The Performance of UK Financial Institutions Over Periods of Market Stability and Volatility: 1980-2015

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ABSTRACT

This thesis is concerned with an empirical investigation of the financial performance of UK financial institutions over the period 1980-2015. This period reflects numerous changes in the development of the UK economy and in the evolution and financial deepening of its financial system including also the deregulation and liberalisation of financial markets that culminated in financial institutions being able to compete actively in markets for financial services where previously they were prohibited; the global financial crisis of 2007-2009 and the Eurozone debt crisis which had a strong negative impact on the UK financial sector and resulted in the move away from an informal regulatory structure toward a more rigorous and formal structure of regulation. These developments make it necessary to investigate empirically important factors that shed light on the performance of UK financial institutions which should be of interest to policy makers and regulatory authorities.

Following the introduction to the thesis in chapter one and a review of the literature which is presented in chapter two, there are four themes which is the primary focus of this thesis. The first theme, which occupies chapter three investigate, using a panel data regression approach, whether a number of the key drivers of performance affect the financial performance of UK financial institutions over crisis and non-crisis periods, and whether, by means of EGARCH, the risk taking behaviour of financial institutions have a decided impact on their financial performance. The findings indicate that the strength of the UK economy underpins the overall profitability of the sectors. Additionally, we provide strong evidence of risk undertaken is a key variable which impacts profitability in all financial sectors, confirming the risk-return hypothesis. The banking sector is also able to exert greater performance through a highly concentrated market. The second theme, taken up in chapter four, investigates the changing risk profile of UK financial institutions using rolling regression, the Kalman filter, DCC-GARCH, bivariate BEKK GARCH and bivariate GJR-GARCH methodologies. The results confirm the literature by determining beta to be a time-varying variable. We also contribute to the literature by demonstrating the insurance and banking sectors possesses greatest systemic risk throughout our sample years, which can be attributed to their central role in financial markets, risk management and their contribution to the economy. The third theme, which is the focus of chapter five examines the impact of macroeconomic news and other announcements on the stock prices of UK financial institutions. We utilise the event study, SUR and GJR-GARCH techniques to determine the impact of macroeconomic news, which we demonstrated investors were able to distinguish the risk levels of UK banks. Moreover, during periods of crisis government announcements are just as effective as the Bank of England to restore confidence in the financial system. We demonstrated how integrated financial markets are in today's economic climate due to globalisation. Whereby, announcements from Western economies had a greater impact on UK non-bank financials than combined Bank of England and Government announcements. The fourth theme, which is contained in chapter six assessed the impact of regulatory changes by the UK authorities and other relevant regulatory bodies towards the security prices of UK financial institutions through event study, EGARCH and VAR GJR-GARCH techniques. The Vickers report sought to implement new standards to create financial stability and avert future crisis periods. This led to negative impacts on equity prices on the financial sectors, demonstrating the risk-return hypothesis, along with higher capital requirement regulations mirroring this result.

The research provides a basis to develop in-depth knowledge of the UK financial system in order to improve risk management, allocation of resources, decision making by financial institutional managers' and aid policy makers future decisions to improve market conditions for financial institutions, which will aid overall economic prosperity.

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DECLARATION

"Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award."

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DISSEMINATION

Presentations

- University of Portsmouth, 2014 – Explaining Financial Institutions Performance and the Effects of Risk: Panel Evidence from the UK Financial Sectors
- EconWorld, 2016 Barcelona - Explaining the Changing Risk Profile of UK Financial Institutions: Non-Crisis and Crisis Related Periods
- ECOBATE, 2016 - Assessing The Effect of Regulation Changes On The Stock Price and Volatility of UK Financial Institutions

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LIST OF ABBREVIATIONS

- ARCH – Auto-regressive conditional heteroskedastic model
- ARMA – Auto-regressive-moving-average model
- BEKK GARCH – Baba-Engle-Kraft-Kroner generalised auto-regressive conditional heteroskedastic model
- BIS – Bank for International Settlements
- BoE – Bank of England
- BOJ – Bank of Japan
- CAARs - Cumulative average abnormal returns
- CAP – Total Capital
- CAPM – Capital Asset Pricing Model
- CAR – Cumulative abnormal returns
- CDS – Credit default swaps
- CEO – Chief Executive Officer
- CIN – Cost-to-Income Ratio
- DCC-GARCH – Dynamic Conditional Correlation generalised auto-regressive conditional heteroskedastic model
- DNR – Do not Reject
- ECB – European Central Bank
- EGARCH – Exponential auto-regressive conditional heteroskedastic model
- EQAS – Equity asset ratio
- ER – Expected Return
- EU – European Union
- EUGOV – European Government announcements
- FCA – Financial Conduct Authority
- FED – Federal Reserve
- FSA – Financial Service Authority
- FTSE – Financial Times Stock Exchange index
- GARCH – Generalised auto-regressive conditional heteroskedastic model
- GDP – Gross domestic product
- GJR-GARCH – Glosten-Jagannathan-Runkle generalised auto-regressive conditional heteroskedastic model
- GLS – Generalised least squares model

- GMM - Generalized method of moments
- GOV – UK Government Announcements
- IC – Independent Committee
- IMF – International Monetary Fund
- Kal – Kalman Filter
- LDEP – Loan-to-Deposit Ratio
- LIBOR – London Interbank Offered Rate
- MAE – Mean absolute error
- MCAP – Market Capitalization
- MCON – Market Concentration
- MS – Market Share
- MSE – Mean squared error
- NARCH - Nonlinear ARCH
- NAV – Net asset value
- NGARCH – Nonlinear GARCH
- NIM – Net interest margin
- NYSE – New York Stock Exchange
- OLS – Ordinary least squares model
- P – Inflation
- PRA – Prudential Regulatory Authority
- QE - Quantitative Easing
- QGARCH – Quadratic GARCH
- REITs – Real estate investment trusts
- REPO – Repurchase Agreement Rate
- RET – Daily/Weekly equity price return
- ROA – Return on assets
- ROE – Return on equity
- Roll – Rolling regression
- SCP – Structure Conduct Performance Hypothesis
- SEC – Securities Exchange Commission
- SUR – Seemingly unrelated regression model
- TARP - Troubled Asset Relief Programme
- TAS – Total Assets
- TINV – Total Investments Portfolio

- TOPIX – Tokyo Stock Price Index
- TUR – Turner's Review
- UK – United Kingdom
- US – United States of America
- USD – US Dollar
- USGOV – United States Government announcements
- VAR – Vector autoregressive model
- VAR GJR-GARCH – Vector auto-regressive Glosten-Jagannathan-Runkle generalised auto-regressive conditional heteroskedastic model
- VECM – Vector error correction model
- WLS – Weighted least squares regression model

CHAPTER 1

Introduction

1.1 Research Background and Motivation

Financial crises since the turn of the 20th century have become a recurring event, propping up across many different economies over time. The most recent major global financial crisis of 2007/8 cost the UK economy an estimated £500 billion once accounting for loans and liquidity guarantees, bringing the UK economy into recession, due to the losses amassed from the financial sectors of the developed world. The problems from the financial sector leaked into the real economy, which caused funding issues to facilitate economic activity and led the UK into a recession. The unfolding events which transpired from the collapse of the US sub-prime market in 2007, led developed governments to implement bailouts/pass laws in order to sustain the financial system. Furthermore, the efforts made by respective central banks within the affected nations exhausted all their powers to restore confidence within the system. Measures taken included coordinated base rate cuts, providing liquidity into the system and launching an unprecedented quantitative easing programme. The significant cost towards respective EU governments paved way for a Eurozone sovereign debt crisis, which materialised in 2010. This follow-on event caused further issues for UK financial institutions, which held an estimated £100bn exposure to certain Eurozone nations' debt such as the Republic of Ireland, Greece, Spain and Portugal. Following these volatile years post 2008 financial crisis, there has been a period of reconciliation within the balance sheets of the UK financial sectors. Whereby, there has been large restructuring of British institutions through closing certain investment businesses, selling assets, stricter lending regimes and holding more capital. Following the interventions from the UK government and Bank of England, stricter regulations have been implemented or in the process of doing so, outlined by the recommendations of the Turner Review in 2009. Further to the Turner Review the government reformed the regulatory bodies which paved way for the creation of the Financial Conduct Authority and the Prudential Regulation Authority (Controlled by the Bank of England). Extra measures were taken in 2010 by the government to create future financial stability which established the independent commission on banking to reform the sector further. The outcome was the Vickers Report in 2011, which witnessed calls for the banking sector to hold additional capital and ring fencing the banking sector, which is to separate banking activities from investment activities. Proposed

reforms directly impacted the business models of the industry. The newly suggested regulations also can negatively influence overall performance of the economy as this would restrict financing in certain financial sectors.

Traditionally, the performance of the financial sector is linked to current economic conditions such as during periods of growth when greater performance levels are expected and vice versa for recessionary conditions as exemplified by Smirlock (1985), Berger (1995), Demirgüç-Kunt and Huizinga (1999) and Abreu and Mendes (2001). Additionally to economic growth, overall bank performance is sensitive to long-term interest rates and inflation as demonstrated by the studies of; Bourke (1998), Molyneaux and Thornton (1992), Demirgüç-Kunt and Huizinga (1999) through reporting positive correlations between inflation and long-term interest rates with bank performance. Furthermore, outside of economic conditions there are other drivers of performance which has been drawn upon in the existing literature. For example, Goddard et al. (2004) report a tenuous relationship between size and profitability, but also report a significant and positive relationship between off-balance sheet business and profitability for the UK banking firms examined. However, these drivers may have evolved over time through technological advances as the industry has dynamically altered over the previous decades till the present day. This began during the Margaret Thatcher government era through deregulating building societies/banks with the introduction of the Buildings Societies Act of 1986 and the Financial Services Act of 1986. These acts enabled building societies to offer a range of services from which they were previously excluded from. Furthermore, this allowed non-depository financial firms and international banks to offer similar products to commercial banks as the regulations reduced barriers to enter into the market. Ultimately, deregulation led to a greater degree of competition and contestability for market share, which led to a period of declining profit margins. As a result, consolidation occurred within building societies as well as banks, which materialised through mergers and acquisitions, reducing the number of institutions operating in the UK. These events in history shaped the UK banking market over time, which has resulted in a very concentrated banking market that is dominated by very few institutions. With a concentrated banking sector and an increase of competition from non-banking firms offering banking services, this has led to an industry that is under constant pressure to innovate and invent new financial products in order to increase profit margins. In order to achieve such returns for shareholders, bank managers increased their roles in off-balance sheet activities, in particular mortgage backed securities which fuelled the risk appetite of the sector. As the sub-prime mortgage crisis developed, the large losses were

sourced from engaging in off-balance sheet activities (through the derivatives market), which eventually led to the demise of the financial sector.

The continued excessive risk appetite demonstrated by the financial sectors in the build-up to the crisis ultimately destabilised the UK economy. This was through a loss of confidence in the financial system when problems of certain banking institutions came to light as a result of high exposure levels to American sub-prime debt defaults. Immediately, this was reflected within the inter-bank markets over fears of the future existence of banking institutions due to the losses incurred, whereby lending between banks halted and a lack of liquidity to the rest of economy emerged leading to financial instability. The risk profile of the UK financial sectors is one that is always evolving, along with the economic cycle. When economic periods are good there is sustained growth present, which is facilitated by the financial sector of the economy through greater lending as credit is widely available. However, as part of the economic cycle, there will be a period of slowed growth as interest rates rise in order to prevent the economy from overheating. As interest rates rise, this is usually followed by increases in default as the economy begins to stagnate and this is usually followed by increased unemployment as there is less money within the system to facilitate further economic expansion. This was mirrored by the UK economy and financial institutions in particular in the build-up to the crisis of 2008. As the turn of the 21st century, there was a low interest rate environment (in comparison to previous regimes) which ultimately led to increased lending from the banking/financial sectors as prosperous economic conditions were present, which reduced fears of credit default among borrowers. In the years that led to the financial crisis, increased performance levels of the financial institutions were present off the back-drop of increased risk-taking behaviour being exhibited. All of which this information is to be reflected within the risk profile of each sector from the markets standpoint, in order to price the risk-return relationship correctly as identified by many academics in their studies of time-varying risk, see Choudhry (2005), Mergner and Bulla (2008), Choudhry and Wu (2009), Zhou (2012) and many others.

Following the turbulent years, which the financial crisis brought to the UK economy as a whole, the government requested an inquiry in 2010 through the independent commission on banking chaired by Sir John Vickers. This was the result of the release of the Turner Review in 2009, which highlighted within its recommendations increased supervision as well as further inquiries of reforming regulation towards the financial sector within the UK. This eventually led to the Vickers Report in 2011, which outlined various recommendations to create financial

stability. In order to protect the deposit-taking institutions from future crisis periods, the policy implications made is to split the institution from ring fencing and non-ring fencing units, which alters banking within the UK. The ring fenced unit is to maintain market integrity and only conduct in traditional banking activities (deposit taking and creating loans) and is excluded from partaking within non-traditional banking activities. These reforms naturally possess high demands towards the UK depository institutions as this requires vast restructuring of their business models, which will be costly to satisfy the regulations. However, with the proposed changes in the Vickers Report this theoretically will produce financial stability as risky activities is solely held within the non-ring fenced units. Thereby carrying out this investigation possesses great importance to understand how the market has received incoming regulation. Whether increased regulation was perceived to be positive, as a result of increased stability encourages more participants to the market. Conversely, a negative reaction from the market would suggest the tightening of regulation would impact the business models of the financial sectors and thereby reduce their risk and return.

The motivation of conducting this research thesis are three fold; (i) The financial crisis of 2008 witnessed in the UK caused ever lasting effects towards the economy, which are still present to this day and has effectively impacted the vast majority of the public in one form or another. Whether this is through unemployment, lack of government spending on public services due to the cuts made by the elected government in 2010 as a result of government bailouts to the financial sector or any other reason that can be linked back to the crisis event. One strongly feels it is pivotal to undertake such research in order for the general public to gain greater knowledge of what occurred within the financial sectors that caused the UK taxpayers dearly. (ii) Once greater knowledge is exhibited through this thesis, policy/law makers are more informed when decisions are to be made when it comes to preserving the health of our financial system. Through understanding the attributes to greater financial performance of the financial sectors, we will be able to optimise their performance, which will inherently benefit the economy. Furthermore, through gaining greater understanding of their risk profile they exhibit we will be able to monitor and effectively be able to improve risk management among the financial institutions. (iii) The existing literature across UK financial institutions is out-dated and there are few studies that consider the recent financial crisis. With this in mind, this gives us further motivation to create a debate within the current strand of literature and make a contribution to knowledge within the field of economics and finance.

1.2 Research Methods

In order to undertake the research within this thesis a wide variety of econometric methodologies will be implemented. The literature on the financial performance of banks has employed a wide range of statistical approaches to examine the profitability of commercial banks. The approaches range from cross-sectional regression technique as implemented by Smirlock (1985), Molyneux and Thornton (1992) and Molyneux and Forbes (1995); panel data regression models as demonstrated by Demirgüç-Kunt and Huizinga (1999), Pasiouras and Kosmidou (2007) and Staikouras and Wood (2011); VAR model as utilised by Goddard et al., (2004). These techniques applied explore related themes in the field of determining financial performance of banks. All of these techniques have their benefits to reach the final goal of explaining financial performance in banks as these studies have demonstrated.

For the second empirical chapter we will attempt to identify the risk profile of UK financial institutions over non-crisis and crisis related periods of the economic cycle. To address this we can incorporate many different methodological approaches to capture the changes in risk profile. These approaches are as follows; rolling regression technique first implemented by Fama and Macbeth (1973), Kalman filter with a random walk as produced by Harvey (1993) and Hamilton (1994), DCC-GARCH methodology as outlined by Engle (2002), Bivariate-BEKK GARCH model from Engle and Kroner (1995), the GJR-GARCH model produced by Glosten et al. (1993), the Schwert-Seguin approach as given by Schwert and Seguin (1990) and the Markov switching process from Hamilton (1989). All of these methods outlined enable us to produce a conditional time-varying series, from which we will discussed at length later in the thesis. The existing literature within this context focuses upon the stability of beta, with Literature from Jacob (1971), Blume (1971) Fabozzi and Francis (1978), Alexander and Chervany (1980), Bos and Newbold (1984) and many more determined the beta variable within the Capital Asset Pricing Model (CAPM) to be time-varying, which is assumed to be stable in the traditional estimation. Hereafter, the literature develops into empirical research regarding the best technique to capture the time-varying beta element of the CAPM. Studies from Brooks *et al.,* (1998) and Faff *et al.,* (2000) and many more examine these techniques extensively most of which come to the conclusion the Kalman Filter with a random walk possesses the greatest accuracy for time-varying beta.

Our next empirical chapter addresses the impact of macroeconomic news held towards the stock price performance of UK financial institutions. This is strand of the literature that is

expanding with research from various authors that we will expand upon later in this thesis includes King (2009), Grammatikos et al. (2015), Aït-Sahalia et al. (2012), Fratianni and Marchionne (2013), Dumontaux and Pop (2013) and Klomp (2013). Within these studies a wide range of techniques have been utilised in order to determine the impact news from the financial crisis held towards respective equity prices. Across the theme of event studies, the relative literature noted before employ a wide range of approaches within their respective studies to achieve similar goals. King (2009), Aït-Sahalia et al. (2012) and Fratianni and Marchionne (2013) apply the traditional event study methodology as set out by MacKinlay (1997) within their studies to determine the impact of news. In addition to this methodology, Fratianni and Marchionne (2013) extended this methodology through Binder (1998) to apply an event parameter approach, whereby the valuation model is estimated over combined estimation periods to determine further results of impacting news on bank valuations. Grammatikos et al. (2015) undertake a differing approach whereby they apply an EGARCH model as given by Nelson (1991). This enables the authors to determine the positive and negative innovations news held towards the equity prices through the leverage effect within the EGARCH model. Dumontaux and Pop (2013) investigated the collapse of Lehman Brothers news impact to the market, whereby they implemented a SUR methodology as given by Zellner (1962). The methodology employed enables them to create a system which accounts for common modelling issues in time series data such as heteroskedasticity and autocorrelation. Klomp (2013) explored a different technique through applying quantile regression methods to achieve a similar goal in determining the market impact of government interventions towards banks.

For the fourth empirical chapter we will assess the effects of regulatory announcements and volatility of UK institutions. Historical/unrelated literature to our study concerning regulation employ similar methodologies as displayed within the third empirical chapter. For example Cornett and Tehranian (1990) employ a multivariate analysis via a SUR regression model, as given by Zellner (1962). Additionally, other literature from Spiegal and Yamori (2003), which concentrated upon the Japanese banking regulation reforms utilised an OLS regression model to determine the impact of the reforms. Furthermore, other literature from Larcker, Ormazabal and Taylor (2011) utilised the event study methodology to consolidate all the regulatory announcements by the Securities Exchange Commission (SEC), state of Delaware and government officials towards limiting executive pay and capture the reaction to such statements/laws passed. When turning our attention the current strand of literature where this

study will feature, there is rather limited existing literature. Schäfer et, al (2015) is the most relevant study which addresses the issue of whether reforms have had any measureable effects towards the market. The study employs a SUR similar to previous studies concerning this strand of the literature.

1.3 Research Objectives

Since our objective is to investigate the performance of UK financial institutions over non-crisis and crisis related periods, this research is aimed at making an original contribution to the literature on financial performance, explaining the risk profile, the impact of macroeconomic news events and assessing regulatory changes. The first aim is to discover the determinants of financial performance within the differing financial institutions. Further to this we wish to understand the risk-shifting behaviour patterns of the UK financial institutions over time. In order to conduct this research we firstly utilise a panel data regression methodology as given by Pasiouras and Kosmidou (2007) and others. This methodology will enable us to account for heteroskedasitcity as well as resolve any limited data issues that may arise when conducting the research. As the level of undertaking risk plays such a significant role within the financial institutions performance level, we will undertake further scrutiny towards this variable in order to understand the risk shifting behaviour among the differing financial sectors. In doing so, we will adopt the Bai-Perron multiple breakpoint test to identify the structural breaks within our dataset, Bai and Perron (1998 and 2003). From applying this test, we derive patterns from the asset pricing of financial sectors and are most suited for our aims within this section. From there onwards we will then apply Nelson's (1991) EGARCH model in order to ascertain the varying changes in risk levels that prevailed over time leading to the financial crisis of 2007/8 and post crisis era.

We wish to then explain the risk profile of UK financial institutions from 2000-2012, in order to illustrate how the build-up of risk was portrayed by the market through examining the beta variable in comparison to general market movements. The goals of this chapter is to determine whether beta is time-varying among UK financial institutions, which techniques are most suited to determine the time-varying nature of beta and also to determine which financial sector possessed the highest level of risk. In order to conduct the research we apply the following methods as given by the existing literature above, which are as follows; the rolling regression technique first implemented by Fama and Macbeth (1973), Kalman filter with a random walk

as produced by Harvey (1993) and Hamilton (1994), DCC-GARCH methodology as outlined by Engle (2002), Bivariate-BEKK GARCH model from Engle and Kroner (1995) and the GJR-GARCH model produced by Glosten et al. (1993). These methodologies will aid us to our final goals of answering our hypotheses set, which we be highlighted at length in the thesis.

Moreover, we outline the necessity to investigate the stock price performance of the UK financial institutions during volatile periods and understand market movements to macroeconomic news. Firstly, we will apply the event study methodology outlined by MacKinlay (1997) as this will identify the cumulative average abnormal returns (CAAR) for each sector combined with the type of announcement, which aided/implicated each sector. In order to improve further the results we implement a Seemingly Unrelated Regression (SUR) model as introduced by Zellner (1962). The SUR model enables us to model data collectively as part of a system, which accounts for data modelling issues such as heteroskedasticity within time series data, which may be present in stock market data. In order to understand the banking sector further we will apply additional variable within a GJR-GARCH model to determine the announcement impacts towards the stock price performance.

Given rise to financial crisis and the significant cost to the government we wish to determine the impact regulation held towards the different financial sectors. In addition to this we lastly aim to detect whether transmission of information was present within the markets surrounding impending regulatory changes. In order to answer these objective we employ the event study methodology similar to the third empirical chapter, whereby we generate the CAARs of each financial sector in response to regulatory changes. We apply the event study methodology to determine the market response of equity prices within the financial sectors. A positive response would indicate greater improved market conditions, which would lead to greater demand in purchasing equities, creating an upward pressure on equity values. However, a negative response in equity prices, suggest there is less risk as a result of increased regulation as this hinders the business model certain financial sectors and therefore the regulation is priced into the equity value. To obtain clearer results, we then apply Nelson's (1991) EGARCH model as it enables us to model positive and negative innovations which will determine the leverage effect of equity prices in response to regulatory announcements. In order to determine whether investors were able to predict in-coming regulation changes beforehand we apply a multivariate vector autoregressive (VAR) GJR-GARCH model as highlighted by Rahim et, al (2009) and . It is a combination of the VAR methodology popularised by Sims (1980) and the GJR-GARCH was introduced by Glosten et al. (1993), which is an extension of Bollerslev (1986). This

methodology will enable us to identify whether there was evidence of the transmission of information in the trading days leading up to regulation changes implemented.

1.4 Research Summary and Structure

In the subsequent chapter I review the related literature on financial institutions performance and as such situate the thesis within the main strand of the literature. By doing so, we were able to understand theoretical concepts that have been applied when conducting such research towards financial institutions during periods of distress. However, more importantly we were able to identify key gaps within the literature concerning studies which collectively study the differing UK financial sectors. From highlighting this key gap we hope to exploit it and contribute to the literature. We reviewed a number of studies that investigate financial crisis literature, the performance of financial institutions, bank risk-taking behaviour, the stability of beta and historical financial crisis event studies. In addition to the review on financial crisis literature, we also provide a brief review of the relevant studies in each of the corresponding chapters that follow.

To summarise the findings in Chapter 3, we demonstrate economic conditions heavily influence the overall financial performance of UK financial institutions. Whereby, during prosperous economic conditions enables greater financial performance of the sectors through the easing of credit worthiness, which is facilitated by the financial sectors of the economy. Furthermore, in the UK there is a concentrated banking sector, with which we confirmed within our results market share and concentration contribute significantly towards determining financial performance. This extensively relates to the historical context of the banking sector within the UK, which has witnessed vast changes over the previous decades. There has been an unprecedented quantity of competition entering the market from international banks as well as market contestability, which led to vast levels of consolidation. Among other financial sectors with respect to market share we demonstrate the same applies to insurance companies, real estate firms and finance companies. Moreover, we exemplify risk has a significant role in determining overall financial performance of each sector. From which we extensively reviewed the variable of risk through identifying risk shifting behaviour and the drivers of risk. The outcome was a mixture of results across the differing financial sector as one would expect.

In reference to Chapter 4 we assessed the risk profile of each financial sector in the UK. The first finding is that we confirm previous literature in terms of beta being a time-varying

variable. Secondly, we find the insurance sector possesses on average the highest level of risk via the beta variable over our sample period. As solely market data was utilised in the chapter, this overall highlights the market has historically priced added a risk premium to the insurance sector against all other sectors. This also contributes to the literature in terms of the sectors role in the build-up to the financial crisis, whereby they underwrite the mortgages being sold by the banking and real estate sectors. We also find the banking sector ranks second in terms of beta variability over time. This highlights their involvement in undertaking risk in the build-up to the financial crisis as well as determining their increasing risk appetite during periods of economic growth. Lastly, our findings also suggest the highest precision of in-sample forecasting is most suited to rolling regression technique in accordance with the Mean Squared Error (MSE) over a long-term window, however the Kalman filter demonstrates its superiority over a shorter term period.

The findings in Chapter 5 highlight the impact macroeconomic news held towards the stock price performance of UK financial institutions. We found investors were able to distinguish risk levels between depository institutions, which illustrates the markets understand of risk exemplified from the banking sector. This was determined through the CDS spreads of each of the banks being highly evident against institutions like Northern Rock. Furthermore, we found government announcements were just as significant as monetary policy actions to the market. For example the nationalisation of Northern Rock was just as significant as the quantitative easing programme launched by the Bank of England. Our results also demonstrate the non-banking institutions are highly integrated into global markets. This occurred as announcements from Western economies and the IMF held a stronger effect within the UK with announcements from the Bank of England and Government combined. Lastly, we also provided some evidence of announcements from the Federal Reserve, ECB and IMF holding a positive impact on UK banking stocks. This suggests they are also integrated into the world banking system, whereby UK banking institutions are exposed to international markets.

When referring to Chapter 6 we concentrated upon regulatory changes. From which we find that announcements surrounding Solvency II and higher capital level requirements resulted in negative equity returns towards the banking and insurance sectors. The overall interpretation from the reaction is founded from the impact these regulatory reforms hold towards the operations of the banking and insurance sectors. With regards towards the banks this inherently controls their risk exposure levels and therefore restricts their performance as the greater risks taking theoretically lead to greater returns. The same can be argued towards the insurance

sector also, as Solvency II has a similar theme to restrict risk taking exposure. These two sectors are seen as the most pivotal to ensuring economic stability and to avert future crisis periods in the future. We also find there is evidence of prior knowledge of regulatory change and highlights market inefficiency. We determined the market priced information of regulatory announcements from every governing body by at least one sector prior to the release of new information.

Chapter 7 outlines the main findings of the research conducted as outlined above. We have enriched the literature by fulfilling a gap upon financial performance of UK financial institutions over stable and unstable market conditions. We indicate policy implications for many respective bodies due to the depth and scope of the research conducted. We outline issues within the research for policy makers to take into consideration when adopting new strategies. For example we have provided evidence of inefficiencies within the market, which need to be addressed by regulators as well as have provided greater specified knowledge on the performance of financial institutions within the UK. Furthermore, we recognise a limitation within our data sample, whereby we were unable to include private financial institutions due to financial restrictions; as private companies are not required to publish their financial data publically. The potential for future research includes including private institutions into the sample as well as applying the concept to other economies.

CHAPTER 2

A Review of the Literature on Financial Crisis and Bank Performance

2.1 Introduction

Historically, countries have encountered financial crisis of various types ranging from currency crisis to the collapse in equity prices and more recently the global economy witnessed its most significant financial crisis since the 1930s which morphed itself into the Eurozone sovereign debt crisis, which had a resounding effect on the financial system and its financial institutions. A financial crisis may be defined as a period of sustained downward adjustment in asset prices, which impairs the liquidity of the financial system. This then produces an inability within financial institutions, namely banks to advance credit in order to facilitate economic development and growth. Kindleberger (2011) points out that a financial crisis and bank failure is usually associated with an implosion of asset prices and sharp depreciations of currencies and or including declines in real estate prices, while Minksy sees financial crisis as being part of the economic cycle, whereby the build-up of confidence among businesses and consumers, as the economy expands, creates a demand for widely available credit which results in a credit bubble. Credit bubbles have been reflected in many crisis events of recent times, such as the Latin American debt crisis (1970s-1980s), the East Asian banking crisis (1997), Japans lost decade/s (1990s-2000s) and the US sub-prime crisis of 2007, which led to the global financial crisis.

The tulip mania bubble of 1637 (in the Netherlands), is often used to illustrate the first price bubble and is considered the birthplace of financial crisis. This event was the result of a speculative craze of tulip bulbs which appreciated in value over time (from 1593 to 1637). Prices peaked in January 1637, which led people to sell simultaneously resulting in a dramatic decline in price, thus ending the speculative bubble (Garber, 1990). In British history, the first bubble was the South Sea bubble of 1720 when a speculative bubble occurred in shares of South Sea which attracted vast investment with the promise of high returns to the public. But after speculative purchases inflated the stock price of the South Sea company, investors sold the stock en mass due to the failure of the stock to deliver the promised high returns, thereby ending the bubble (Malkiel, 2007). Since the turn of the 20th century, financial crises have

become an increasing occurrence, generally coinciding with economic cycle via credit bubbles, an early example of this was the Wall Street crash of 1929 (Santoni, 1987).

Minsky (1977) and Allen and Gale (1998a), along with other economists, have produced theories and models to explain crisis periods. For example, Minsky (1977) put forward the financial instability hypothesis to explain credit bubbles as coinciding with the economic cycle as confidence increases. Minsky (1977) suggests that financing positions will go through three different phases; hedge borrowers, speculative borrowers and Ponzi borrowers, while Allen and Gale (1998a) puts forward a three phase cycle approach, noting agency problems, along with excessive risk-taking which is adopted by financial institutions as financial incentives. The three phases include; financial liberalisation, bubble bursting and credit default.

In this chapter our goal is to situate the research topic of this thesis in its context, with particular emphasis on the connection with different strands of the literature. We review these branches of the literature in order to highlight the main research questions, and the variables of interest. The study of financial crisis and the performance of financial institutions require that we draw on the relevant literature that will help us make sense of the changing environment within which financial institutions function. In this respect, there are a large number of studies that represent this growing literature and our review will highlight these. The chapter is structured as follows. Section 2.2 reviews the financial crisis literature, which is followed in section 2.3 by a review of econometric studies on financial crisis. Section 2.4 reviews the literature on the financial performance of financial institutions, while section 2.5 provides a review of studies undertaken on bank risk-taking behaviour. Section 2.6 reviews event studies on a number of related themes. Section 2.7 summarises and concludes.

2.2 Financial Crisis Literature

2.2.1. The Latin American Debt Crisis

The Latin American debt crisis of the late 1970-1980s inflicted large loan losses to the US financial sector due to high exposure in the region. Manuel Pastor (1989) shared many theories and different perspectives into the causes of the Latin American debt crisis, the origins of which has its root in the 1960s when US financial institutions with a large surplus funds sought new

clients, which resulted in opening up international capital markets to South America. The new availability of credit to Latin America expanded in the 1970s as the supply of loans increased to the region. In 1973-1979 private Western banks experienced an increase in deposits from the oil rich (OPEC) nations as the exogenous shock of increased oil price materialised due to the Gulf war. US banks then opted for asset creation through loans to Latin America in order to strengthen their balance sheets with the new influx of deposits. Net external borrowing from South America grew steadily from 1977-1982, resulting in increased trade deficits in balance of payments.

Debt accumulation in Latin American countries spiralled out of control, resulting in increased interest payments, some as high as 20 per cent. As a result of the mounting debt levels, in 1979 credit availability became a scarce resource within the US, leading the banks to withdraw loans and/or to close access to international capital markets to Latin American countries most affected. Thus, gaining new finances came at higher cost for indebted countries, eventually falling into financial distress as higher interest payments and increased default rate followed. All of these resulted in a deep financial crisis with Mexico, in particular, signalling in 1982 debt repayment problems. The rationalisation that followed from 1977-1982 varies from different economic schools of thought, orthodox, radical, structural, due to conflicting ideologies.

Orthodox Economists and the IMF put this down to domestic policy, partial fiscal expansion and exchange rate overvaluation during this period (Enders and Mattione (1984), Wiesner (1985) and Sachs and Williamson (1985)). Structural economists focus on the impact of external factors such as the decline in industrial growth and changing terms of trade. They suggest that the policies of Latin American countries may have required corrections in order to avert deepening economic conditions (Dell and Lawrence (1980), Diaz-Alejandro (1984) and Taylor (1986)). Unorthodox economists claim that aggressive US banks were responsible for initiating the crisis by over-lending in order to maintain market share, as shift in credit availability shifts shadow, as argued by Minsky (1992) and Kindleberger (2011). As credit became scarce in 1979 the banks collectively withdrew from the market in a panic which, as a result, caused the financial crisis to develop as South American countries required short and medium term funding that were no longer available, giving rise to debt default or debt forgiveness (Felix (1987), and Kindleberger (2011)).

2.2.2. 1997 East Asian Crisis

The 1997 East Asian financial crisis affected many countries including South Korea, Indonesia, Thailand, Singapore, Malaysia and the Philippines. Differing opinions have been shared for the cause of the crisis. Krugman (1999) and Moreno (1999) claim that the root of the crisis was due to the weaknesses of the financial system of these countries, in addition to poor macroeconomic policies in the region which led to the failure of government guarantees on loans, that led to over-lending, thus the loans were "hidden" due to rapid economic growth and influx of foreign capital. The Alternative view lays blame on the high levels of foreign investment and the herding effect from investors to East Asian nations (Radelet and Sachs (1998) and Lane et al. (1999)). The region experienced vast capital inflows with foreign investors benefitting from high interest rates as well as corporations gaining large loans from the U.S. to fund investments in the late 1980s and early 1990s, which led to economic growth in the region. Then ultimately external factors, such as the U.S. recovering from recession in the early 1990s, increasing interest rates transpired resulting in a strong U.S. Dollar (USD) as well as devaluations of the Japanese Yen and Chinese Renminbi. These factors contributed to the declined economic growth of South East Asia as South Korea, Indonesia and Thailand had pegged their exchange rates to the USD. This appreciated their currencies and declined exports as well as asset values within these nations and as a result of reduced competitiveness in the global market. Following this, by 1997 Thailand and surrounding nations suffered speculative currency attacks and herding led their currencies to depreciate (By 1998 Thai Baht depreciated 40%, Indonesia Rupiah 80%, Philippine Peso 37%, Malaysia Ringgit 39% and South Korean Won 34%). As the USD strengthened, this inflated debt levels in the region, leading to increased deficits, defaults and created a financial crisis. Philippines were less affected as macroeconomic conditions were solid through the supervision of the IMF which implemented the economy on a sustainable growth path, however did still accumulate losses through currency depreciation, which inflicted losses to the asset prices to the Philippines. Singapore also recovered very swiftly from this episode due to their banks being more capitalized and able to withstand losses incurred from loans as well having capital to sustain speculative attack on their respective currency, Corsetti et al. (1998). Furthermore other nations such as Japan, Russia and U.S.A also faced the prospect of a global crisis. Japanese banks were already suffering from the 1980s asset bubble combined with a stagnant economy, also had large loan

exposure, deepening the Japanese economy in 1997 as Japanese banks accumulated capital losses.

2.2.3. Japanese Lost Decade

The problem encountered by Japan was as a result of an asset price bubble in 1989 which resulted in economic stagnation for the next 10-20 years. This is commonly referred to as the lost decade(s). The literature highlights three main factors that contributed to the financial crisis; financial deregulation, monetary policy and fiscal policy. The Japanese banks were liberated slowly from the mid-1970s onwards from a tight system of regulatory control. The deregulation of the Japans financial system allowed banks' to raise capital at a time when they were faced with rising costs of capital due to the opening up of international capital markets from which they chose to raise new capital. This was a pivotal factor in the creation of the asset price bubble as most banks looked to expand their business by offering real estate loans. The over-reliance upon the real estate lending meant that banks overlooked the possibility that land prices will not always increase over time and thus should not use such assets as collateral (Hoshi and Kashyap (2004)). Since the monetary policy implemented by the Japanese authorities was too loose, the Bank of Japan (BOJ) focussed on buying USD in order to resist an appreciating yen, as the high trade surplus would only serve to hinder economic growth. This expansionary monetary policy resulted in an overheating of the economy, without much intervention by the BOJ to tighten monetary policy at a time when asset prices began to rise, for the reason that it was more interested in increasing reserves. Fukao (2003) points out that had the BOJ taken the necessary early actions the problems it experienced may have had a lesser impact on the economy in future years. On the fiscal impact on asset price bubble, Japanese tax system favoured debt financed real estate investment up-until the bursting of the asset bubble. For example capital gains on land were not realised until the time of sale with interest payments being tax deductible for corporations, leading to a large number of real estate investments being carried out for tax planning purposes (Fukao (2003)). In addition, the financial crisis also had a long lasting impact on the economy due to slow policy response of the government, as well as the banks being saddled with non-performing loans which became an increasing problem.

Throughout the 1980s, Japanese banks and listed companies experienced exceptional rates of growth as manifested by the Nikkei Index which was valued at 10,000 in 1984 and by 1989 at had reached 40,000. Over the same period, land prices to GDP almost doubled with commercial prices nearly tripling. These asset values floating in Japan enabled institutions and companies to expand their business at unsustainable rates. The levels reached suggest how undercapitalized these institutions became after the asset bubble with unrealised capital gains from stock and real estate markets disappearing. This forced the BOJ to adopt an expansionary monetary policy through a zero percent interest rate to prevent deflation.

2.2.4. 2007/ 8 Sub-prime Crisis

The 2007-2008 US sub-prime mortgage collapse was initiated by rising interest rates following a prolonged period of low interest rates and thus low cost of borrowing. It is important to stress that most economist viewed this as a credit bubble, which grew due to increasing confidence within the financial sector that financial firms could continue to raise new capital through the process of securitization. In the build-up to the financial crisis, real estate prices in the US were inflating at an abnormal rate due to increased demand and available credit. Banks seeking to profit from the favourable conditions lowered their lending criteria for mortgages, resulting in many individuals wishing to purchase real estate, thereby creating assets on their respective balance sheets'. As US base rate would eventually increase, the supply of money and credit diminished, resulting in a slowdown in economic activity, increased unemployment and a rise in borrowing costs which increased default rates leading to a large supply of real estate with falling housing prices (supply was greater than demand). The fall in house prices had serious implications for US banks and investors in mortgage backed securities, as portfolios were collateralized on sub-prime mortgages, resulting in large losses, and with many financial institutions requiring bailouts from the US government. Many financial institutions around the globe, from Western Europe to Asia, were exposed to institutions such as Lehman Brothers and Bear Stearns who had underwritten subprime assets. This resulted in lost capital and the ability to raise finances at lower cost as the financial crisis unfolded.

Many UK banks were also exposed to the US sub-prime market, while UK mortgage banks, such as the Northern Rock Bank and HBOS were affected significantly as the financial crisis unravelled. For example, the Northern Rock Bank experienced a bank run, raising

concerns of possible systemic risk. The events surrounding Northern Rock led to widespread financial distress over the financial viability of other UK banks' exposure to US subprime lending (Shin (2009)). To prevent the collapse of the bank, the UK government announced that it would provide financial assistance to Northern rock. Soon after a number of UK banks made their financial exposure known and, as had been feared, quite a number of these would also require considerable capital injection from the UK government to keep them afloat and, more significantly to prevent a collapse of the UK banking sector. Not too long after the crisis had settled, the Eurozone sovereign debt crisis erupted in 2010, partly as a result of the 2008 collapse as government debt levels increased in order to lessen the impact of the economic recession. However by 2011 a number of Eurozone countries required financial assistance that would allow them to service debt interest payments.

2.2.5. Contained Financial Crisis Periods

Historically, periods of financial crisis have been averted from impacting the real economy (i.e. households and consumption) in countries such as Canada, the U.K, Norway, Sweden and most recently Iceland. The UK experienced a small banking crisis in the early 1990s, which pushed the UK into recession, which was the result of attempts to sustain macro-economic expansion, through monetary policy tightening. Against the declining financial environment small banks en mass experienced frailties, which included the failure of 25 institutions. The prompt response through providing liquidity and extensive monitoring limited spill-over effects to the real economy as confidence was restored and prevented further failures, Logan (2000). The Scandinavian banking crisis of the 1990s witnessed swift policy response from Norway and Sweden resulted in a short-lived recession. Norway's response included brokering mergers of two large savings banks and complete nationalisation of Kreditkassen, Fokus Bank and Christiana Bank (second, third and sixth largest) (Allen and Gale, (1999)). Also provided capital injections to the largest bank (DnB), claiming an 87.5% stake. Sweden's government response was similar, in order to prevent systematic failure through capital injections to keep banks afloat, which cost the government an estimated 2% of GDP, Englund (1999). Sweden and Norway resumed economic growth, with Fokus Bank re-privatised and saw other holdings drop to 50% by 1995. Iceland was one of the first victims of the 2008 global financial crisis as a combination of deregulation, foreign investment and over-inflated asset prices. The

consequences led to a banking collapse, which observed the three largest Icelandic banks nationalised within a week as Lehman Brothers failed, this prevented Iceland to borrow from foreign markets. The consequences led to drastic measures employed by the government as banking reforms were implemented in order to resolve debt forfeiting issues. The policy responses have foreseen Iceland's economy resume positive GDP growth by 2011 and ahead of schedule debt repayments to the IMF (Fridriksson (2009) and Jackson (2010)). Bordo, Redish and Rockoff (2010) highlight Canada's banking system has historically not been heavily implicated by financial crises. This is due to the structure implemented which allows the government to exercise a wrath of intervention when necessary, combined with a tight regulatory system. Canada from this tight regulatory control were not impacted from the sub-prime collapse as their banks' were unable to partake in such high-risk investments, which results in little or no exposure as well as not requiring bailouts as witnessed in US and Europe.

2.3 Econometric Literature

We will now introduce a branch of literature concerning the econometric modelling techniques, which have improved our ability to understand relationships within time series data beginning with Engle (1982).

Engle (1982) transformed econometrics by enabling researchers to model prices, time varying volatility through a new stochastic process known as autoregressive conditional heteroskedasticity (ARCH). This revolutionary model allows the conditional variance to change over time as a function of past errors leaving the unconditional variance a constant. Bollerslev (1986) established the GARCH model (generalized autoregressive conditional heteroskedasticity) progressing Engle's framework. The model enables researchers to capture temporal behaviour of many economic variables or macroeconomic time series accurately. GARCH is obtained by assuming an autoregressive moving average equation on an observable variable (Y), the conditional variance is expressed as a linear function of past squared innovations and of its past values. Sentana (1990) extended GARCH through introducing quadratic GARCH (QGARCH) model, by allowing any positive quadratic form of the past innovations to capture asymmetry in volatility. Nelson (1991) established issues with previous models, firstly finding negative correlation, which GARCH model rules out through assumption. Secondly, GARCH model impose parameter restrictions that are often violated by

estimated coefficients that may disproportionately restrict the dynamics of the conditional variance process. The final issue is interpreting whether shocks to conditional variance persist or not is difficult in GARCH models, because the usual normal measuring persistence often do not agree. Nelson addressed the errors through the exponential GARCH model (EGARCH), via a linear independent variable. This model accounts for positive and negative shocks of equal size to have different impacts on volatility, also EGARCH places no restrictions upon the parameters. This is an important differential in comparison to the traditional GARCH model, as interpreting EGARCH result produces clarity. However Engle and Ng (1993) discredit EGARCH as their study suggests there is evidence that the variability of the conditional variance implied is too high, but does capture most asymmetry. Higgins and Bera (1992) introduced the nonlinear ARCH (NARCH) which can accurately model financial time series data such as exchange rates through a nonlinear functional form for the conditional variance of an ARCH. The NARCH model is a result of research by Hsieh (1989) and Scheinkman and LeBaron (1989) exposed weaknesses of GARCH. As they are not adequate to comprehend exchange rates as well as provided evidence that volatility in stock market data cannot be captured completely by linear ARCH. Engle and Ng (1993) extended NARCH framework by generalising it to nonlinear GARCH (NGARCH) through including Box-Cox transformations of lagged dependent variables. NGARCH can determine how news impacting events are incorporated into volatility estimates. Glosten, Jagannathan and Runkle (1993) created the GJR-GARCH model to sanction seasonal patterns in volatility. The model allows positive and negative fluctuations in returns to impact differing conditional volatility, when applied to the Japanese crash (1987), the model presented a greater impact on volatility in comparison to other models. Zakoian (1994) devised the threshold GARCH (TGARCH) model to accommodate for different reactions of volatility to different signs of lagged errors, achieving stationarity within the data. TGARCH differentiates by offering the conditional standard deviation a piecewise linear function of past values of white noise. This sophisticated approach is effective when modelling the asymmetric relation between volatility and past returns.

2.4 The Performance of Financial Intermediaries

The financial sector is important not only for the allocation of capital, financial intermediation, but crucially the transformation of savings into investments of various kinds. In these respects banking activities, in particular, is seen as being very important in affecting productivity and economic growth. It is perhaps for this reason why the analysis of the performance of financial institutions such as banks has been the subject of much empirical investigation which has resulted in a growing literature. One of the most important studies is the work of Gilbert (1981) who examined the performance and profitability of the banking sector using an approach that takes into account 56 market structures in order to determine the most appropriate method of estimation. In arriving at his conclusion, Gilbert raises questions concerning regression equations in the earlier studies of Whitehead (1977), Harvey (1979), Rhoades (1977) and Savage and Rhoades (1981) where the average interest rate on loans is the dependent variable, and the independent variable include the ratio of loans to deposits, as well as market structure measures. Gilbert note that the inclusion of the ratio of loans to deposits as an independent variable creates an issue of bias in the coefficient of market concentration which tended toward zero, since some of the influence of market structure is captured in the loan to deposit ratio. To overcome this bias within the equation he suggest specifying a demand function of bank customers, and a supply functions of banks and to derive a reduced form equation between a set of performance variables and a measure of market structure. Overall Gilbert conclude that the most accurate studies and estimation procedures find significant influence of market structure on measures of bank performance. Smirlock (1985) sought to investigate the interrelationships between banking profits, market share, and market concentration using simplistic approach that differed from the study of Gilbert (1981). The method applied estimates a cross-sectional profit regression equation that include market share and market concentration as independent variables. The regression Equation is of the following form:

$$\pi = \alpha_0 + \alpha_1 MS + \alpha_2 CR + \alpha_3 MSCR + \sum_{i=4}^{n} a_i Z_i \qquad (2.1)$$

where: π is the profit measure, MS, market share, CR, market concentration, $MSCR$, an interaction term defined as MS multiplied by CR and $a_i Z_i$, a vector of additional control

variables known as Total market deposits (MKTDEP), the percentage of market growth (MKTGROW), the ratio of demand deposits to total deposits (DDTODEP), total bank assets (ASSETS), The effect of holding company affiliation (INDEP) and the law as applied to multibank holding companies with a value of 1 if the bank is located in a state that allows multibank holding companies and zero otherwise (MULTI). Smirlock's (1985) findings indicate that when market share is positively and significantly related to profitability, market concentration does not explain bank profitability.

Bourke (1989) and Molyneux and Thornton (1992) investigated the concentration and determinants of profitability amongst international banks with Molyneux and Thornton (1992) solely focussing on European banks. The methodological approach taken shadows by Molyneux and Thornton mirrors Bourke (1989) through estimating a linear equation, regressing independent variables such as; government ownership; concentration ratio; 10 year bond rate in given country; money supply; capital and reserves per cent of total assets; cash and bank deposits of total assets; CPI of given country and staff expenses as per cent of total assets. Bourke (1989) produced conflicting results to Smirlock (1985) and provide evidence concentration was positively related to profitability and explains this through achieving statistical significance. Bourke (1989) also demonstrates money supply, the 10 year bond rate and inflation are positive influences towards profitability. Results from Molyneux and Thornton (1992) are in line with Bourke (1989) in many respects, such as finding a statistically significant relationship between return on capital and concentration. In addition, capital ratios and nominal interest rates are found to be positively related to profitability, which confirms Bourke's (1989) study. Molyneux and Thornton (1992) discovered two conflicting results from Bourke (1989) which are government ownership and staff expenditure have a positive impact on profitability instead of a negative as found in Bourke (1989).

Molyneux and Forbes (1995) is a closely related study which focuses on structure and performance in European banking by testing the structure-conduct-performance hypothesis and the efficiency for the period 1986-1989. The methodology opted for a cross-sectional profit regression formula as exemplified in the regression below.

$$\pi_i = \alpha_0 + \alpha_1(CR_j) + \alpha_2(MS_{ij}) + \alpha_3(CAPAST_{ij}) + \alpha_4(LOTODEP_{ij}) + \alpha_5(ASSET_{ij}) + \alpha_6(GOVT_j) \quad (2.2)$$

where: π_i, bank i's profits measured as the return on assets, CR_j, concentration ratio in market j, MS_{ij}, market share, $CAPAST_{ij}$, capital-to-asset ratio, $LOTODEP_{ij}$, loans to deposits ratio, $ASSET_{ij}$, total assets of bank i and $GOVT_j$, a binary value equal to 1 if government owned (central or local) or 0 if otherwise.

Molyneux and Forbes (1995) draws upon the market share to yield a negative coefficient and not statistically significant to profitability which conflicts Smirlock's (1985) original finding. However, they provided evidence to support the structure-conduct-performance hypothesis as well as government ownership to have a positive and statistically significant relationships against profitability, which is in line with Bourke (1989) and Molyneux and Thornton (1992). Additionally, Molyneux and Forbes (1995) demonstrate total assets to have a negative relationship towards profitability but also finds capital asset ratio to be positively related to profitability.

The work of Berger (1995) differs from previous studies in that it makes use of variables that have been excluded in previous studies. The method applied takes the following form:

$$\pi_i = f_7(CONC_m, MS_i, X-EFF_i, S-EFF_i, Z_{im}^7) + \epsilon_i^7 \quad (2.3)$$

where π_i, profit, is denoted as return on assets or return on equity, $CONC_m$, concentration from Herfindahl index, MS_i, market share of market deposits, $X-EFF_i$, x-efficiency - ratio of the smallest nine year average multiplicative cost function residual of banks in the same competitive environment to the banks nine year average residual, $S-EFF_i$, scale efficiency – a ratio of predicted unit cost for a scale efficient firm with the same product mix and input prices to the bank's predicted unit cost, Z_{im}^7, a vector denoted for control variables and ϵ_i^7 , an error term. The reported findings highlight market share and x-efficiency as having a positive and statistical association with bank profitability.

Demirgüç-Kunt and Huizinga (1999) examine the determinants of profitability by applying the following regression model:

$$I_{ijt} = \alpha_0 + \alpha_i B_{ijt} + \beta_j X_{jt} + \gamma_t T_t + \delta_j C_j + \varepsilon_{ijt} \quad (2.4)$$

where I_{ijt} denote the profit variable (net interest margin) for bank *i* in country *j* at time *t*, B_{ijt} is a vector for multiple bank characteristics of bank *i* in country *j* at time *t*, X_{jt} a vector of characteristics for country *j* at time *t*, T_t and C_j, a time and country dummy variables and ε_{ijt} is a white noise error term. Demirgüç-Kunt and Huizinga (1999) findings suggest there are many positive and negative relationships towards profitability. For example, concentration ratio, capitalisation, international owner, higher stock market capitalisation to GDP ratio, inflation, GDP and real interest rates are found to have statistically significance. These results suggests banks are able to convert higher market share through concentration and experience greater profitability due to lack of competition. International ownership enables banks to raise capital levels much cost-effective and as a result increase profit margins and profitability. In terms of the macroeconomic factors, banks are able to convert favourable economic conditions into greater profitability as banking sector funds growth through increasing loans as well as manage interest rates and inflation efficiently. The negative aspects towards profitability found within this literature are high non-interest earning assets; banks that rely on deposits for funding; Banks operating in industrial countries are also less profitable which is perceived to be due to lack of technology implementation. The reserve requirements are found to depress profitability as banks are required to hold liabilities and also concludes law variables with higher contractual agreements has a negative impact towards margins and profit. Abreu and Mendes (2001) furthered the research within this field and replicated the methodology of Demirgüç-Kunt and Huizinga (1999). Abreu and Mendes (2001) find as capitalization, interest rates and market share are found to be determinants of profitability, which is consistent with Demirgüç-Kunt and Huizinga (1999). The contradictions raised from Abreu and Mendes (2001) is inflation to be negative, which means banks costs are higher than revenues when inflation occurs. Other conclusions included loan-to-asset ratio has a positive impact on interest margins and profitability. Lastly, Abreu and Mendes (2001) conclude unemployment rate to have a positive influence on bank profitability and the exchange rate has no impact on profitability.

Goddard et al. (2004a) applied a pooled cross-sectional time series model, as well as a dynamic panel model using the generalized methods of moments (GMM) to determine the

profitability of European banks (in a sample that include Denmark, France, Germany, Italy, Spain and the UK) over the period 1992-1998. The model employed is as follows:

$$\pi_{i,t} = f\left(\pi_{i,t-1}, s_{i,t}, o_{i,t}, c_{i,t} d_{1,i}, d_{2,i}\right) \tag{2.5}$$

where $\pi_{i,t}$ is the profit of bank *i* in year *t* measured using return on equity, $s_{i,t}$ the natural logarithm of total assets in €, $o_{i,t}$ the nominal value of off-balance sheet business, $c_{i,t}$ CAR for bank *i*, $d_{1,i}$, a dummy variable taking a value of 1 for savings bank, and 0 otherwise, and $d_{2,i}$ a dummy variable taking a value of 1 for cooperative bank, and 0 otherwise. The reported findings confirm the need for further investigation into the size-profitability relationship as the results are inconclusive and consistent with previous research in this area. Furthermore, their results suggest that off balance sheet activities play a role in the determinant of profitability. Although Goddard et al. (2004a) report a positive relationship between capital-asset ratio and profitability, from the countries examined they found little to no evidence of any systematic relationship between ownership type and profitability as German saving and co-operative banks appear to be significantly less profitable in comparison to German commercial banks.

Goddard et al. (2004b) used the following VAR model to estimate the dynamic panel interactions between firm growth and profitability using 583 banks accounting data from the 5 largest EU countries (e.g., France, Germany, Italy, Spain and the UK) over the time period 1992-1998:

$$\pi_{i,t} = \alpha_{2,0,i} + \alpha_{2,1}\pi_{i,t-1} + \alpha_{2,2} g_{i,t-1} + \beta'_2 x_{i,t} + u_{2,i,t} \tag{2.6}$$

where $\pi_{i,t}$ is the profit rate denoted as return on equity of bank *i* in year *t*, $g_{i,t-1}$ the logarithmic growth of bank *i* between years *t* – 1 and t, $x_{i,t}$, a vector of control variables that include the value of off-balance sheet activities, capital-to-asset ratio, liquidity ratio (liquid assets to total assets), bank *i*'s market share, banking sector Herfindahl index for country *j* and GDP annual growth, $\alpha_{2,0,i}$ individual bank effects and $u_{2,i,t}$, a disturbance term. The findings of Goddard et al. (2004b) confirm the results of Molyneux and Forbes (1995) that there is no cross-sectional

relationship between size and growth, while also reporting a positive relationship between concentration and profitability. The findings also suggest that banks that maintain a high capital-asset ratio or a high liquidity ratio are likely to be more profitable, but report little evidence of a relationship between x-efficiency and profitability.

Pasiouras and Kosmidou (2007) also contribute to the literature by investigating the determinants EU countries bank profitability over the period 1995-2001. Using return-on-assets as the main profit measure, along with variables such as stock market capitalization to GDP, stock market capitalization to assets of deposits and assets of deposits money banks to GDP, they estimate the following balanced panel regression model:

$$Z_{it} = b_{ot} + b_{it}(EQAS_{it} + COST_{it} + LOFUND_{it} + SIZE_{it}) + b_{jt}(INF_{jt} + GDPGGR_{jt} + CONC_{jt} + ASSGDP_{jt} + MACPASS_{jt} + MACGDP_{jt}) \quad (2.7)$$

where; Z_{it} is the dependent variable that represents Return on Assets, EQAS is the equity to assets ratio, a measure of capital adequacy. High capital asset ratios are assumed to be indicators of low leverage and therefore low risk. COST is the cost-to-Income ratio which provides information on the efficiency of bank management regarding expenses relative to the revenues it generates. Higher ratios imply less efficient management. LOFUND is the ratio net loans to customer and short-term funding. Higher figures denote lower liquidity. SIZE is the total assets. INF is the annual inflation rate. GDPGGR is GDP Growth. ASSGDP is the ratio of the total assets of banks divided by the GDP. MACPASS is the ratio of stock market capitalization to total assets and MACGDP is the ratio of stock market capitalization to GDP. The results are broadly in line with the finding of Kosmidou et al. (2005) who report a banks' equity-to-assets ratio has having a positive impact on profitability. The results also reveal that the macroeconomic variables in the model have a positive influence on profitability, though variables such as the cost-to-income ratio and bank size have a negative impact on bank profitability, which supports findings of Kosmidou et al. (2006). We should note that stock market capitalization to GDP and stock market capitalization to assets of deposits have significant and positive impact on profitability, but interestingly assets of deposits money banks to GDP is negatively related to profitability.

Where UK real estate companies are concerned, very little research have been carried out on their performance. Lizieri and Satchell (1997) using a Threshold Autoregressive model (TAR) explored how changes in the rates of interest affect the performance of UK estate companies in order to determine whether the real estate sector is sensitive to the economic cycle of the UK, particularly at the peak of economic activity when property prices are expected to rise as a result of demand pressures. The estimated model is as follows:

$$\Delta Y_t = a_i + b_i Y_{t-1} + \sigma_i e_t \text{ if } Z_{t-1} \varepsilon R_i \quad (2.8)$$

where ΔY_t measures the change in price of the property index, i = 1, 2, a_i, b_i and σ_i are the parameters associated with regimes R_i and Z_t, and e_t is as an error term. The findings suggest that property company prices are sensitive to interest rate fluctuations, as well as being non-linear. Furthermore, the impact of high interest rates tends to correspond to lower prices and vice versa for lower interest rates. However, when interest rates are low the upward pressure on prices is far greater and result in greater volatility in comparison to a high interest rate regime.

In his investigation of the determinants of UK real estate returns, Kohlert (2010) applied a Vector Error Correction Model (VECM) in order to identify the long-run relationships among returns and economic variables as well as short-term corrective behaviour. The model is expressed as follows:

$$\Delta y_{it} = \delta_i d_i + \alpha_i \beta'_i y_{i,t-1} + \sum_{j=1}^{p-1} \tau_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad (2.9)$$

When; i = 1,… N; $t = p_i + 1, p_i + 2,\ldots,$ T. Which becomes cross-sectionally estimated as follows:

$$\Delta y_{it} = \delta_i d_i + \alpha_i \beta'_i y_{i,t-1} + \sum_{j=1}^{p-1} \tau_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \text{ for t = 1, 2, …, T.} \quad (2.10)$$

where; Δy_{it} is the changes in each dependent variable (Total return, GDP, total investments and unemployment growth) *i* at time *t*. δ_i is a parameter, d_i illustrates a vector of deterministic components and p_i is the lag order for the VAR process. α_i and β'_i are both matrices of full column rank, with τ_{ij} accounting for unknown matrices and ε_{it} is defined as an error term. Kohlert (2010) showed that the observed economic variables have a strong long-run relationship with total return, and further that the relationships are casual and running from the economic variables to total return. The results also reveal the existence of a short-term causal relationship between total investment, total returns and total returns adjusting to long-term disparities resulting from changes in the variables.

In his study of corporate governance mechanisms within the UK real estate sector, Ke (2015) sought to identify the determinants of the discount to net asset value, with the net asset value chosen as the dependent variable so as to capture the underlying value of the property portfolio, which is Ke (2015) definition for performance. The panel regression model implemented is as follows:

$$DIS_{i,t} = \frac{NAV_{i,t} - P_{i,t}}{NAV_{i,t}} \times 100\%$$

$$DIS_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 DEBT/ASSET_{i,t} + \beta_3 TRADING_{i,t} + \beta_4 TAX_{i,t} + \beta_5 REIT_{i,t} + \beta_6 HTYPE_{i,t} + \beta_7 INTER_{i,t} + \beta_8 MARKETDIS_{i,t} + \beta_9 RISK_{i,t} + \beta_{10} RETURN_{i,t} + \beta_{11} A - BSPREAD_{i,t} + \beta_m \sum_{m=1}^{4} CGM_{mi,t} + \beta_{16} YEAR_{i,t} + e_t \quad (2.11)$$

where $DIS_{i,t}$ is the discount or premium of a listed property company *i* at time *t*. NAV is the net asset value per share of the company and P is the share price of property company. β_n is a parameter coefficient, $SIZE$ the natural logarithm of total assets value, $DEBT/ASSET$ is the ratio of total debt to total assets, $TRADING$ is the properties held for sale as a percentage of total assets. TAX is the contingent liability to pay tax on capital gains as a percentage of total assets, $REIT$ is a dummy variable used to capture if the company is a real estate investment trust with a value of 1, and 0 otherwise. $HTYPE$ is explained by the Herfindahl Index, $INTER$ is a dummy variable if the company invests across border. $MARKETDIS$ is a property sector average discount, $RISK$ is measured by the standard deviation of stock prices, $RETURN$ is computed as the average daily stock return over the preceding three years. $A - BSPREAD$ is

the difference between the ask price and bid price. CGM is a measure of corporate governance variables, $YEAR$ is a dummy variable for 2008-2013 which equal 1, and 0 for other years, and e_t is an error term. The findings indicate that debt-to-asset ratio, tax, risk, market sentiment, the ask-bid spread and internal ownership contribute positively to the NAV, and that there is also a negative correlation between NAV and the size of real estate firms, share price and focused property portfolio.

Studies that examine the performance of UK investment trusts define performance from a market perspective with much emphasis on portfolio performances. Fletcher (1995) examined the selectivity and market timing performance of UK investment trusts, using the CAPM with additional terms to capture selectivity of portfolio performances. The findings indicate a divergence between timing and selectivity performances. Leger (1997) also examined the issue of performance and timing selectivity of UK investment trusts portfolios using the CAPM model to capture selectivity and the predictability of returns. The model is as follows:

$$r_{pt} = n_0 + n_1 r_{mt} + n_2 r_{mt}^2 + \omega_{pt} \tag{2.12}$$

where; r_{pt} and r_{mt} measures the returns of the portfolio and the market in excess of a risk-free rate while n_0 measures selectivity. When a manager is able to predict fluctuations in the market, the implied systematic risk is correlated with r_{mt}, entailing a positive value of n_2 and ω_{pt} is an error term. The result of abnormal performances is found to be weak indicators of selectivity and timing with very little persistence. Bangassa (1999) also investigate the selectivity and timing performance of investment trusts companies in the UK. The approaches follows the work of Jensen (1968), Treynor and Mazuy (1966), Henriksson (1984), Connor and Korajczyk (1991) and Fama and French (1992). The results indicate that investment trust managers are non-existent within their market timing positions, with evidence of unfavourable perverse timing. Elyasiani and Jia (2011) also examine the persistence of portfolio performance of closed-end funds using 1, 3 and 4 factor models in order to discover the determinants of performance. The model adopted for this purpose is as follows:

$$RAP_j = \delta_0 + \delta_1 SPREAD_j + \delta_2 MT_j + \delta_3 LAGRAP_j + \delta_4 LAGDY_j + n_j \tag{2.13}$$

where RAP_j is the risk-adjusted performance, δ denotes a coefficient parameter, $SPREAD$ is the bid-ask spread, MT defines momentum, $LAGRAP_j$ is defined as the lagged risk-adjusted performance, $LAGDY$ captures the lagged dividend yield and n is an error term. Their results demonstrate that closed end funds cannot beat the market persistently under all methods. In terms of the determinants of performance, Elyasiani and Jia (2011) note that the lagged dividend yields as a main driver of performance.

We should also add that our review of the literature has uncovered only a few studies that that examine the performance of insurance companies and to the best of our knowledge there is no literature that has to date examined the financial performance of finance companies.

2.5 Bank Risk-Taking Behaviour

In seeking to maximise profit, financial institutions are invariably exposed to various types of risk, some of which if not properly hedged will result in financial losses. Thus it is necessary to examine the extent to which the risk-taking of financial institutions over time affects their performance. In regard to risk, Koehn and Santomero (1980) examined the relationship between capital and risk by measuring the impact of regulation on portfolio risk-taking. The model used in this study presents capital regulations as serving to restrict a banks opportunity sets and shows why the ratio regulation fails to reduce risk taking. The model, which borrows from the quadratic programming insights of Merton (1972) is as follows:

$$1/2 \sum_{t=1}^{n} \sum_{j=1}^{n} x_i x_j \sigma_{ij} - \lambda_0 E_p \text{ for all } \lambda_0,\ 0 \leq \lambda_0 \leq \infty \qquad (2.14)$$

Subject to:

$$1 = \sum_{t=0}^{n} x_i$$

$$x_0 \geq 1 - \frac{1}{c}$$

With:

$$E_p = x_0 R + \sum_{t=1}^{n} x_i E_i$$

where E_i is the expected return on the *i*th asset, x_i is the percentage of equity value calculated from the total portfolio value invested in the *i*th asset i = 1, 2, ...,n. σ_{ij} is the covariance of returns between the *i*th and the *j*th assets and the variance of return on the *i*th asset is $\sigma_{ij} = \sigma_i^2$.

Kim and Santomero (1988) assumed that the variance-covariance matrix is positive-definite. E_p and σ_p^2 are the expected returns and variance of return per unit of capital on the bank portfolio. x_0 is the percentage of capital held in the negative asset (deposits) paying the risk free rate *R*, and λ_0 is the real trade-off between variance and expected return at any point on the efficient investment frontier i.e. $\lambda_0 = d\sigma_i^2/dE_p$. The leverage of the bank is constrained by *c*. The results show that it is possible that regulatory efforts to control risk taking through capital ratio regulation may increase the probability of failure for some institutions. Kim and Santomero (1988) also distinguish between bank capital regulation and risk using a utility maximizing mean-variance approach. In fact, the study presents a new risk-related capital model which builds on the earlier framework of Koehn and Santomero (1980) by placing bank assets into several risk categories and assigning a risk weight to each category to determine the minimum equity capital that should be maintained against it. The findings show that capital ratio regulation is an ineffective approach to control the banking system, primarily because it ignores individual bank preference structures, while at the same time allowing risky banks to evade restriction through leveraging. The results also suggest that bank risk weights depend on three factors; the expected returns, their variance-covariance structure and the upper bound on the allowable insolvency risk regulators require.

Saunders et al. (1990) investigate the relationship between bank ownership and risk-taking by hypothesising that stockholder controlled banks are riskier than managerially control banks during times of deregulation. The model used is as follows:

$$RISK_{it} = \alpha_0 + \alpha_1 PROP_{it} + \alpha_2 KA_{it} + \alpha_3 FAA_{it} + \alpha_4 TA_{it} + u_{it} \qquad (2.15)$$

where $RISK_{it}$, which is one of seven different capital market risk measures ($\sigma_s, \sigma_\varepsilon^S, \beta_m^S, \beta_I^S, \sigma_\varepsilon^L, \beta_m^L$ and $\beta_{\mathrm{I}}^{\mathrm{L}}$.) for bank *i* in year *t*. $PROP_{it}$ the percentage of stock owned by officers and directors in bank *i* in year *t*. KA_{it} the book value of capital-assets ratio of bank *i* in year *t*. FAA_{it} the ratio of fixed assets to total assets (operating leverage) of bank *i* in year *t*. TA_{it} the total assets of bank *i* in year *t*, and u_{it} an error term. Their findings conclude that stockholder controlled banks exhibit significantly higher risk-taking behaviour than managerially controlled banks for a given sample period of deregulation. Shrieves and Dahl (1992) also examined empirically bank behaviours with respect to observed changes in capital and risk to determine whether theoretical arguments support changes within these variables.

The approach used the changes in both capital and risk with endogenous and exogenous components and with clear focus on the determination of discretionary changes in risk as follows:

$$\Delta RISK_{j,t} = c_0 + c_1 LNSIZE_{j,t} + c_2 BHC_{j,t} + c_3 REG_{j,t} + c_4 \Delta CAP_{j,t} + c_5 \Delta NON_{j,t} + \beta_2 RISK_{j,t-1} + U_{2,j,t}, \quad (2.16)$$

where: ΔRisk is a change composite risk index calculated by weighted sum of assets divided by total assets. LNSIZE, the natural log of total assets to capture size, REG, regulatory cost, is a binary variable that reflects the degree of regulatory pressure. CAP, the capital ratio, NON, non-performing loans which is captured by loan loss provision. BHC, bank holding company which captures potential organizational effects, a binary variable, Risk, a composite risk index calculated by weighted sum of assets divided by total assets, and j,t – j identifies bank, and t the time period. The findings indicate the statistical significance between all variables in at least 1 of the 3 models tested. The results also suggests that multibank holding company affiliation status significantly negatively impacted target capital levels, while also influencing target risk levels positively. Shrieves and Dahl (1992) conclude that risk exposure and capital levels are simultaneously related to one another and that the majority of banks in their sample mitigate the effects of increases in capital levels by increasing risk and vice versa. The findings also show that theoretical models that include leverage and risk-related cost avoidance and managerial risk aversion of capital structure and risk-taking behaviour in commercial banks are consistent. In contrast, Angbazo (1997) show that bank size had no effect on overall target capital levels, though this was inversely related to target capital levels for banks with total capital ratios less than 7 per cent. Although this finding report a positive association between capital and risk, it also reveals that banks with low capital levels will increase capital levels as risk increases. Iannotta et al. (2007) also shed light on ownership affecting banks asset quality and risk-taking behaviour by making use of two models to identify profitability and risk as follows (profitability):

$$P_{jt} = \alpha + \beta OS_{jt} + \delta Year_t + \lambda Country_j + \tau GDP_{jt} + \gamma C_{jt} + \varepsilon_{jt} \quad (2.17)$$

where P_{jt} is the observed performance for the *j*th bank at year *t*, OS_{jt} a vector of ownership structure variables, $Year_t$ a vector of time specific dummy variables, $Country_j$ a vector of country specific dummy variable, GDP_{jt} the annual growth rate, C_{jt} a vector of control variables, $\alpha, \beta, \delta, \lambda, \tau, \gamma,$ are the regression coefficients, and ε_{jt} an error term (risk):

$$LOANLOSS_{jt} = \alpha + \beta + \delta Year_t + \lambda Country_j + \tau GDP_{jt} + \gamma C_{jt} + \varepsilon_{jt} \quad (2.18)$$

where $LOANLOSS_{jt}$ – the observed value for the variables LOANLOSS for the *j*th bank at year t

The findings of Iannotta et al. (2007) showed that public sector banks have poorer loan quality and higher insolvency risk than other types of banking institutions, which is consistent with the existence of government guarantees which allows public sector banks to avoid the indirect costs. However, the study shows that Mutual banks have superior loan quality and lower classified asset risk than both private and public sector banks, which supports the finding of Saunders et al. (1990) as managerial ownership banks are found to benefit from better customer relations. Laeven and Levine (2009) also examined the issue of bank risk-taking behaviour and ownership structure by applying a regression model with clustering at country level. The formulated model differentiates itself from previous studies by including multiple independent variables while quantifying bank risk through their z-score. The model is expressed as follows:

$$Z_{b,c} = \alpha * X_{b,c} + \beta * CF_{b,c} + \gamma * R_c + \delta * CF_{b,c} * R_c + u_{b,c} \quad (2.19)$$

where $Z_{b,c}$ is the Z-score of bank *b* in country *c*, $X_{b,c}$ a matrix of bank level control variables, $CF_{b,c}$ the cash flow rights of bank *b* in country *c*, R_c country level bank regulations, $u_{b,c}$ the error term, and α, β, γ and δ are vectors of the estimated coefficients. Once the regression is performed, a simultaneous equation system was derived to allow for the joint determination of

risk and valuation. Although issues of biasness within the model could arise as high risk banks might form concentrated ownership structures if diffuse shareholders have difficulty monitoring risky investments. The problem of biasness was addressed by using a variety of strategies to minimise biasness with all strategies yielding the same conclusion. Results from the study suggest that banks with more powerful owners tend to take greater risks which supports Saunders, Strock and Travlos (1990). Laeven and Levine (2009) conclude that shareholders have stronger incentives to increase risk than non-shareholding managers and debt holders, while large owners with substantial cash flows have the power and incentives to induce the bank's managers to increase risk-taking behaviour. These results support also the findings of Koehn and Santomero (1980) who note that capital ratio regulation may actually increase the probability of failure for some institutions.

Fortin et al. (2010) examine three factors which they consider influence risk-taking by bank managers; ownership structures, executive compensation and governance. Their study differs from previous studies in that they combine these influences into a model that accounts for risk-taking prior to the global financial crisis of 2007. The model developed accounts for 83 depository institutions with share return as risk (dependent variable), which is estimated as the standard deviation of daily share return. The independent variables account for CEO salary, options granted to the CEO, institution size, corporate governance index, equity-to-total assets ratio, ownership, regular shareholders and bonus payment to CEO. The model is represented as follows:

$$Risk_{it+1} = f\left(Size_{i,t}, Charter_{i,t}, Capital_{i,t}, Gov_{i,t}, Own_{i,t}, Block_{i,t}, Salary_{i,t}, Option_{i,t}, Bonus_{i,t}\right) \quad (2.20)$$

where $Risk_{i,t+1}$ is the standard deviation of daily share returns for firm i at time $t + 1$, $Size_{i,t}$ the natural logarithm of total assets, $Charter_{i,t}$ the market-book ratio, $Capital_{i,t}$ the equity-assets ratio (which is a measure of bank capitalization), $Gov_{i,t}$ the corporate governance index, $Own_{i,t}$ the percentage of common shares owned by inside directors, $Block_{i,t}$ the percentage of common shares owned by outside block-holders, $Salary_{i,t}$ the base salary paid to the CEO scaled by the natural log of total assets, $Option_{i,t}$ the total value of options granted to the CEO scaled by the natural log of total assets and $Bonus_{i,t}$ the total value of bonuses paid to the CEO

scaled by the natural log of total assets. The findings from this study show that bank CEOs with greater power (through share ownership or other corporate governance) take less risk, while bank CEOs, who are paid higher base salaries also take less risk. However bank CEOs who are paid more in bonuses or in stock options take more risk. The study also finds that weak capitalized banks (where ownership is by outside investors) are associated with greater risk-taking activities, which is consistent with Sullivan and Spong (2007) in the sense that bank managers are generally more risk adverse than outside shareholders.

2.6 Time-Varying Risk

The issue of time-varying risk has received much attention in the finance literature, with the majority of empirical research utilising the Capital Asset Pricing Model (CAPM). Within the framework of the CAPM Beta is assumed to be constant through time, which has been reputed by Blume (1971), Fabozzi and Francis (1978), Alexander and Chervany (1980), Bos and Newbold (1984) and Faff et al. (1992) all of conclude that beta is time-varying. The empirical insights of the approaches used are flexible enough to lend themselves to various applications. One such approach which lends itself to our investigation is the rolling regression method utilised by Fama and Macbeth (1973), which utilises the market model with adjustments to the length of the window when computing the desired beta series. The rolling regression window is then estimated as follows:

$$[t - w + 1\ t] \text{ When } \beta_i = \text{COV}(R_i, R_M)/\text{VAR}(R_M) \tag{2.21}$$

where *w* is the length of the window and *t* is simply time. The process is continued until the series one desires for is reached. Schwert and Seguin (1990) study demonstrates the ease by which a time-varying beta model can be created by incorporating the market model which accounts for heteroskedasticity, through obtaining a conditional time-varying beta series as follows:

$$R_{it} = \alpha_i + \beta_1 R_{mt} + \beta_2 \left(\frac{R_{mt}}{\sigma^2_{mt}}\right) + \varepsilon_{it} \quad ; \beta_t = b_0 + \frac{b_1}{\sigma^2_{mt}} \tag{2.22}$$

where R_{it} is the return on security *i* and time *t*, $\beta_1 R_{mt}$ is a constant beta multiplied by the return on the market. $\beta_2 \left(\frac{R_{mt}}{\sigma^2_{mt}}\right)$ is defined as the conditional time-varying beta as obtained via the GARCH(1,1) estimation. ε_{it} is denoted as the error term.

State space models otherwise known as Kalman Filters were proposed by Harvey (1993) and Hamilton (1994). The Kalman filter procedure is a powerful recursive algorithm that generates a time-varying beta series. The state space model is able to create the series through two equations. Firstly the observation equation which is the market model, and second, via a transition equation. These two equations are then able to create a dynamic system which produces a conditional beta which can be characterised in three forms. First a mean reversion model:

$$\beta_{it}^{MR} = \tau\left(\beta_{it-1} - \hat{\beta}\right) + \hat{\beta} + v_{it-1} \tag{2.23}$$

Random Coefficient:

$$\beta_{it}^{RC} = \hat{\beta} + v_{it-1} \tag{2.24}$$

Random Walk:

$$\beta_{it}^{RW} = \beta_{it-1} + v_{it-1} \tag{2.25}$$

where τ is a parameter, $\hat{\beta}$ is the constant mean of beta and v_{it-1} is a disturbance term.

There emerge in the literature a collection of models from the multivariate GARCH family that are suitable for our investigation. One such model is the bivariate BEKK GARCH model which has been applied in numerous finance settings; see for example Brooks et al. (1998) and Choudhry (2005) amongst others. The model, as introduced by Engle and Kroner (1995), allows us to generate a time-varying beta series through a parameterised Bivariate BEKK GARCH framework as follows:

$$y_t = \mu + \varepsilon_t \tag{2.26}$$

$\frac{\varepsilon_t}{\Omega_{t-1}} \sim N(0, H_t)$

$$vech(H_t) = C'C + \sum_{K=1}^{K} + \sum_{i=1}^{q} A'_{K_i} \varepsilon'_{t-i} A_{ki} + \sum_{K=1}^{K} + \sum_{i=1}^{p} B'_{Kj} H_{t-j} B_{kj} \quad (2.27)$$

where y_t is a 2×1 vector containing the natural logged returns of the stock index and market index and μ is a 2×1 vector of a constant. H_t specifies the multivariate GARCH conditional variance of both variables, returns on stock index and the returns of market index, which is a function of the information set in Ω_{t-1}.A'_{K_i}, $i = 1, q, K = 1, K$ and $B'_{Kj}, J = 1, p, K = 1$ and K, are all matrices of $N \times N$.

Following the approach of Engle and Kroner (1995), the BEKK bivariate GARCH(1,1) allows us to make use of less parameters as there is a diagonal restriction to the model, where *K*=1.

where:

$$H_t = C'C + A'^{\varepsilon_{t-1}\varepsilon'_{t-1}} A + B' H_{t-1} B \quad (2.28)$$

$C$is a 2×2 lower triangular matrix with intercept parameters, *A* and *B* are 2×2 square matrices of parameters. More specifically, *A* highlights the volatility linkages element, whilst *B* illustrates the extent to which the conditional variances and covariance are correlated with past innovations. Thus then leads us to compute the time varying beta which, is calculated as follows:

$$\beta_{i,t} = H_{12,t} / H_{22,t} \quad (2.29)$$

where $H_{12,t}$ is the estimated conditional covariance between the returns on stock sector index and market index and $H_{22,t}$ is denoted as the conditional variance of the return on the market both given by the BEKK GARCH (1,1) model.

Another useful approach is the GJR-GARCH model introduced by Glosten et al. (1993), which allows for positive and negative innovations of returns that ultimately impact the conditional variance. Faff et al. (2000) demonstrates how to capture the asymmetry or leverage effect through the use of a dummy variable attached to the original GARCH model.

For are purpose, we are able to capture the conditional variance and covariance of two variables as follows:

$$h = \alpha_0 + \alpha b_{t-1}^2 + \alpha b_{t-1}^2 b_{t-1<0} + \alpha \delta_{t-1} \tag{2.30}$$

where α represents a constant parameter, b holds a residual value and δ denotes the GARCH element within the model and $\alpha b_{t-1}^2 b_{t-1<0}$ captures the leverage effect, which is the conditional variance. To obtain the time varying beta, it is necessary to apply $\beta_{i,t} = H_{12,t}/H_{22,t}$.

In addition to the approaches outlined above, the DCC-GARCH can also be used capture the time-varying beta as demonstrated by Engle (2002). The models design structure allows a researcher to estimate the conditional correlation matrix of the returns on the security as well as the market. The model is parameterised as follows:

$$H_t = D_t R_t D_t \tag{2.31}$$

where H_t is a matrix of (2×1) containing the natural logged returns of the stock index and market index.

$$D_t = diagonal(\sqrt{h_{1,t}}, \sqrt{h_{2,t}}, \ldots \sqrt{h_{n,t}}) \tag{2.32}$$

$$R_t = (diagonal(Q_t))^{-1/2} Q_t (diagonal(Q_t))^{-1/2} \tag{2.33}$$

$$Q_t = (1 - \psi - \zeta)\bar{Q} + \zeta Q_{t-1} + \psi \delta_{i,t-1} \delta_{j,t-1} \tag{2.34}$$

where D_t is the diagonal matrix of conditional standard deviations for return series, which is obtained from the estimation of the GARCH (1,1) model, where $\sqrt{h_{n,t}}$ on the diagonal *i*th term. $R_t$is defined as the conditional correlation matrix of the standardised returns, where Q_t is the positive definite matrix containing the conditional variances and covariance of ε_t. $(Q_t))^{-1/2}$is

defined as the inverted diagonal matrix with the square root of the diagonal elements of Q_t. $\bar{Q}$is the unconditional correlations of $\delta_{i,t-1}, \delta_{j,t-1}$, ψ and ζ are nonnegative scalar parameters as followed by Engle (2002). Where the log-likelihood of the estimators are given as:

$$L = -\frac{1}{2}\sum_{t=1}^{T}[(n\log(2\pi) + \log|D_t|^2 + \varepsilon_t' D_t^{-1} D_t^{-1}\varepsilon_t) + (\log|R_t| + \delta_t' R_t^{-1}\delta_t - \delta_t'\delta_t)] \tag{2.35}$$

The dynamic conditional correlations are produced by the following:

$$\rho_{ab,t} = \frac{(1-\psi-\zeta)\bar{q_i}+\psi\delta_{i,t-1}\delta_{j,t-1}+\zeta q_{ij,t-1}}{[(1-\psi-\zeta)\overline{q_{ii}}+\psi\delta_{i,t-1}^2+\zeta q_{ii,t-1}]^{\frac{1}{2}}[(1-\psi-\zeta)\overline{q_{jj}}+\psi\delta_{j,t-1}^2+\zeta q_{jj,t-1}]^{\frac{1}{2}}} \tag{2.36}$$

where the time varying beta is capturing by $\rho_{ab,t}$, as β_i can also be defined as the correlation between the two series; returns of the stock index and market index.

2.7 Event Studies

2.7.1 South American Debt Crisis

The empirical literature on bank stock price behaviour following the Latin American debt crisis is filled with studies that make of event study analysis to explain the crisis. One of the earlier studies is the work of Cornell and Shapiro (1986) and Schoder and Vankudre (1986). In order to explain the impact of the crisis, Cornell and Shapiro (1986) used daily, monthly, biannual and annual cross-sectional regressions owing to difficulties associated with determining when opinions of key investors changed. The cross-sectional regression model integrated three types of returns: raw returns; excess returns using the method of Dimson (1979) and a third set of excess returns using Bayesian procedure for adjustments in beta estimates. The model utilised is as follows:

$$r_{it} = \alpha_{0i} + b_{it}L_i + b_{2t}E_i + b_{3t}P_i + b_{4t}R_i + b_{5t}F_i + b_{6t}N_i + b_{7t}S_i + U_{it} \quad (2.37)$$

where r_{it} is the return for bank *i* over the interval *t*, measured as either the raw return or the excess return, L_i the total Latin American exposure for bank *i* as a fraction of total assets, E_i the reported energy loans for bank *i* as a fraction of total assets, P_i Penn Square loans purchased by bank *i* as a fraction of total assets, R_i real estate loans for bank *i* as a fraction of total assets, F_i non-Latin American foreign loans for bank *i* as a fraction of total assets, N_i net purchased liabilities for bank *i* as a fraction of total assets, S_i the size of bank *i* measured by its market capitalization (in billions of dollars) and U_{it} an error term with mean 0.

The study of Schoder and Vankudre (1986) relied on vast data testing to determine whether an abnormal event occurred on 19 August 1982. Schoder and Vankudre used a two-factor market model for daily returns based on a weighted least squares (WLS) method to account for heteroskedasticity of residuals across bank stocks, as well as the use of a dummy to code for whether a bank is a money centre or Texas based bank. Returns and exposures in terms of book value were regressed to correlate the events that occurred 29 trading days prior to 19 August, 1982, as:

$$\epsilon_{2i} = a + bE_i + \epsilon_{3i}\,, b < 0 \quad (2.38)$$

where E_i denotes the exposure to Mexico of ith bank, ϵ_{3i} a normally distributed error terms with zero mean and uncorrelated across securities $E_i = \frac{BVM_{it}}{N_{it-1}} \times P_{it-1}$ .Where BVM_{it} is book value in USD of the ith bank Mexican cross border exposure on August 18, 1982, N_{it-1} the number of shares outstanding on August 18, 1982 and P_{it-1} the price per share on August 18, 1982.

The study of Cornell and Shapiro (1986) and Schoder and Vankudre (1986) offer similar conclusions which found little effects on the stock prices of US banks on the event day. For example, Schoder and Vankudre (1986) note that stock prices did not correctly reflect exposure to Latin debt on 19 August, 1982, which differs from Cornell and Shapiro (1986).

However Cornell and Shapiro (1986) considered numerous event dates which revealed that exposure adjust over a two year period but not initially. Lamy et al. (1986) examined the Mexican debt problem by isolating 19 August, 1982 and drawing on the insights of Cornell and Shapiro (1986). The testing procedure applied the market model based on the work of Jaffe (1974) and Mandelker (1974) with cumulative excess returns of the portfolio to remove biasness from the outcome as follows:

$ER_{jt} = R_{jt} - E(R_{jt})$, where R_{jt} the actual return and $E(R_{jt})$ the expected return

$$ER_{pt} = \sum_{j=1}^{n} ER_{pt}/n \tag{2.39}$$

where; ER_{pt} – Excess returns for portfolio. Cumulative excess returns:

$$CER = \sum_{t=-r}^{s} ER_{pt} \tag{2.40}$$

$$ER_{J0} = y_o + y_1 Expose_J + \varepsilon_0,$$

Where ER_{J0} denotes the excess returns for bank J on day zero taken from the CRSP excess returns, $Expose_J$ bank j exposure to Mexican loans where exposure is defined as total Mexican loans/(Total owner equity + Total loan loss reserves) and ε_0 an error term. A cross-sectional sensitivity regression of the excess return of each bank in relation to exposure was applied on August 19, 1982.

Lamy et al. (1986) suggests that the announcement had a significant and negative impact on exposed banks and thus investors were aware of the exposure before the announcement which contradicts the conclusions reached by Cornell and Shapiro (1986) and Schoder and Vankudre (1986). Bruner and Simms (1987) and Smirlock and Kaufold (1987) builds on the literature by empirically examining whether bank shareholder returns reflect new information on exposure levels, to which they find markets react rapidly to surprising events. Smirlock and Kaufold (1987) incorporate a cross-sectional regression similar to Cornell and Shapiro (1986) and Lamy et al. (1986) using the SUR approach, which was replicated by Unal, et al. (1993) as follows:

$$R_{it} = \alpha_1 + \beta_1 R_{mt} + \gamma_i D_1 + \varepsilon_{1t} \quad (2.41)$$

where R_{it} is the return on stock, R_m the return on NYSE on day t, D_1 a dummy variable coded 1 for the event day and zero otherwise, γ_i captures the effect of the Mexican default on bank i and $\alpha_1 + \beta_1 R_{mt}$. The model is as follows:

$$R_{it} = \alpha_1 + \beta_1 R_{mt} + \lambda_1 D_t EXP_1 + \mu_{it} \, , \quad (2.42)$$

where λ is the event parameter which measures the firm's response to default announcement and EXP_1 the exposure denoted as Mexican loan to equity ratio of bank.

Bruner and Simms (1987) examined issues concerning the duration of response which was overlooked by Cornell and Shapiro (1986), Schoder and Vankudre (1986) and Smirlock and Kaufold (1987). According to Bruner and Simms (1987), duration is an essential element within the empirical testing as the efficiency to new information response can lead to alternative outcomes. As such they compute excess returns from a data sample consisting of 100 trading days before 19 August to 57 trading days after across 48 banks using the market model. Cumulative abnormal returns (CAR) were calculated, followed by t-tests to determine whether daily returns were abnormal. The CAR was then standardized to adjust for the auto-covariance of returns. Bruner and Simms (1987) then regressed the individual exposures of banks as a percentage of market value in equity as follows:

$$e_i = R_{it} - (a_i + b_i(R_{mt}))$$

Where e_i is the residual or excess return on stock *i*, R_{it} – return on stock *i* for day *t*, and R_{mt} – return on the value-weighted market portfolio for day *t*. The parameters a_i and b_i were estimated over the period -160 to -101 days before the announcement. The average residuals were calculated as follows:

$$AR_t = \frac{1}{N} \sum_{i=1}^{N} e_{it} \quad (2.43)$$

$$CAR_{KL} = \sum_{t=k}^{L} AR_t \quad (2.44)$$

Bruner and Simms (1987) also critique the findings of Cornell and Shapiro (1986) by labelling the hypothesis as "dribs and drabs" and argued that the August 19 report was not a material event relevant to other events regarding the Latin American debt crisis. The findings of Bruner and Simms (1987) and Smirlock and Kaufold (1987) conflict with the results of Cornell and Shapiro (1986), as they find a negative return upon the arrival of rumour and new information as Schoder and Vankudre (1986) found for the announcement day. However the results of Smirlock and Kaufold (1987) and Bruner and Simms (1987) are in line with the findings of Cornell and Shapiro (1986) with respect to exposure to Mexico which was initially positively related to returns, which suggests a temporary investor contagion. The finding of Smirlock and Kaufold (1987) are in line with results of Lamy et al. (1986) who note that investors distinguished bank exposure levels in the absence of public knowledge.

Kyle and Wirick (1990) contributed to the debate by providing a study that addressed the impact the Latin American debt crisis held towards the required returns of US bank equities. The resulting study from Kyle and Wirick (1990) led to a variety of approaches being undertaken with a two-factor linear returns-generating function with a pooled cross-sectional methodology being adopted. The Estimation procedures opt for OLS and GLS methods to permit heteroskedastic variables and non-constant covariances for contemporaneous disturbances across banks, as the model illustrates below:

$$R_{jt} = \sum_{j=1}^{n}(\alpha_j Z_{jt} + \beta_{1j} Z_{jt} R_{mt} + \beta_{2j} Z_{jt} R_{bt}) + \sum_{t=t_0}^{t1}(\Phi_t W_{jt} + \Delta\tau_t W_{jt} EXP_{jt} + \lambda_1 X_{jt} R_{mt} EXP_{jt} + \lambda_2 X_{jt} R_{bt} EXP_{jt} + u_{jt} \quad (2.45)$$

where Z_{jt} is coded 1 for the j bank, 0 otherwise, W_{jt} is coded 1 for the t month, 0 otherwise, X_{jt} is coded 1 for t>0, 0 otherwise, Φ_t a coefficient for time shift effects common to all banks, τ_t a market value of $1 of LDC debt, λ_1 a coefficient for time shifts in market return sensitivity, λ_2 a coefficient for time shifts in interest rate sensitivity, t_0 a August 1982, t_1 December 1983 and u_{jt} an error term.

The model makes use of dummy variables to represent other macro-economic events in order to isolate the unfolding crisis events. The conclusions of Kyle and Wirick (1990) are in line with Cornell and Shapiro (1986), Smirlock and Kaufold (1987) and Bruner and Simms (1987) as participants were able to penetrate accounting complexities and discover exposure levels had shifted markedly. Therefore investors were able to position themselves accordingly,

resulting in significant negative returns for bank stock prices. Slovin and Jayanti (1990) and Karafiath et al. (1991) reinforce the findings of Cornell and Shapiro (1986), Smirlock and Kaufold (1987), Bruner and Simms (1987) and Kyle and Wirick (1990) with respect to the reaction of equity value in relation to exposure to Latin American debt.

In applying a SUR model, Slovin and Jayanti (1990) examined 39 banks from the American stock exchange including exposure levels to Latin American debt. The model integrates dummy variables to isolate event dates, and for capital deficient and capital sufficient banks, whilst integrating daily returns and exposure to the model as follows:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \lambda_d D_d EXP_i + \lambda_s D_s EXP_i + u_{it} \quad (2.46)$$

where R_{it} is the return on stock, R_m the return on NYSE on day t, D_1 a dummy variable coded 1 for the event day and zero otherwise, $\alpha_1 + \beta_1 R_{mt}$ the market model, λ the event parameter to measure firm response to default announcement and EXP_i – exposure denoted as Mexican loan to equity ratio of bank *i*.

Slovin and Jayanti (1990) conclude that bank capital regulation and examination procedures can induce financial markets to alter assessments as to whether regulators will enforce policies such as reducing dividends, which implies that investors react accordingly to increased regulatory pressures. Karafiath et al. (1991) examine Brazil's exposure by focusing on the reaction of stock prices to default announcements. They differentiate their study using a Generalized Least Square (GLS) approach to examine the cross-sectional regression relationship between prediction errors and Brazilian debt due to cross-sectional correlation and heteroskedasticity in market model prediction errors. The model utilised is as follow:

$$EXP_{J,sm} = 0.023 + 0.664EXP_J + e_j,\ R^2 = 0.91, F = 197.67 \quad (2.47)$$

where $EXP_{J,sm}$ is the exposure variable: Brazilian debt divided by primary capital as defined by Musumeci and Sinkey Jr (1990) and EXP_J the exposure variable as defined previously.

$$R_{Jt} = \alpha_J + \beta_J R_{mt} + \sum_{n=-45}^{45} \tau_{Js} D_{St} + e_{Jt}\,, t = -345, +45 \quad (2.48)$$

where R_{Jt} is return on security or portfolio, α_J the OLS estimate of the intercept, β_J the OLS estimate of the slope coefficient, R_{mt} the return to the value-weighted market on day t, τ_{Js} the OLS estimate of coefficient on the dummy variable D, D_{St} a dummy variable coded 1 on day s and e_{Jt} a residual for security or portfolio j on day t. Karafiath et al. (1991) examine over an event window from 45 days prior to 45 days after following event and test for possible size effect. They are able to illustrate banks with low exposure, security prediction errors, which are negatively correlated with asset size. Karafiath et al. (1991) overall found that the market was able to adjust share prices of US bank equities to level of exposure to Brazilian debt default.

2.7.2 Event Studies – East Asian Debt Crisis

The East Asian crisis of the late 1990's resulted in numerous research that sought to explain the origins and effects of the crisis. Tan (1998), for example, highlights the contagion affects by investigating the extent to which stock price movements in one country offset the stock price fluctuations in other countries. Overall this study discovered Hong Kong, Singapore and Taiwan would not have experienced a decline in real stock prices had there been no contagion effects or herding. However fundamental issues characterized Thailand and Korea, since their real index prices would still have experienced significant decline even with absence of contagion effects, with the lesser extent applied Malaysia and the Philippines. Finally the crisis stretching to Indonesia would have been sustainable had investors not acted irrationally through western investors pulling investments. Pan et al. (2007) examined linkages through the exchange rates and index values for the same countries nations using the VAR and Granger causality methodology. Their conclusions offer a different and unexpected perception during the crisis, as pre-crisis results establish exchange rates and stock prices indicate significant relationship with Hong Kong, Japan, Malaysia and Thailand. However during the crisis no country demonstrates a significant causal relationship from stock prices to exchange rates. Choe et al. (1999), Stulz et al. (2000) and Kho and Stulz (2000) concentrate on bank stock

returns as the Far East crisis emerged. Choe et al. (1999) studied Korean effects in depth by examining whether herding was evident during the crisis using a binomial distribution methodology which computes portfolios based on size and past returns equally, taking an average across stock for each portfolio. The model implemented in their study is as follows:

$$|P_{it} - E(p_{it})| - E|p_{it} - E(p_{it})| \tag{2.49}$$

where P_{it} denoted the proportion of foreign investors buying stock *i* on day *t* among all investors trading that stock on that day, $E(p_{it})$ the expected proportion of foreign investors buying on day *t* relative to all foreign investors and $E|p_{it} - E(p_{it})|$ an adjustment factor computed assuming that in the absence of herding the number of foreign investors with net purchases follows a binomial distribution. Choe et al. (1999) found no evidence that trades from foreign investors had a destabilizing effect on the Korean stock exchange over the sample period and that the market-adjusted efficiently to large sales. This was not followed by negative abnormal returns.

Kho and Stulz (2000) investigate the impact of the Asian crisis on bank stocks through applying the SUR technique. Their sample incorporated four Western and six East Asian countries from July 1997 to January 1998 with the main goal of understanding differing market reactions to the East Asian crisis. Their SUR methodology is demonstrated as follows;

$$R_{pt} = \alpha_0 + \beta_0 R_{mt} + \sum_{k=1}^{K} \gamma_{0,k} X_{k,t} + \sum_{j=1}^{J} D_j \emptyset_{jt} + \varepsilon_t \tag{2.50}$$

where R_{pt} is the logarithmic daily dollar return on the banking industry indices for each of the 10 countries, R_{mt} the corresponding stock market index returns, $X_{k,t}$ the daily dollar excess returns on the currency holdings (BP, DM, FF and JY), $\emptyset_{jt}$ a dummy variable taking a value of 1/n for the *j*th event days or zero otherwise, D_j represents CAR for the *j*th event days, α, β and γ are coefficients and ε_t an error term. Kho and Stulz (2000) concluded East Asian banks performed poorly, banks in Korea, Indonesia and Thailand do not experience AR's bank indices to exchange rate fluctuations. In addition the IMF announcements did not reduce systematic risk as the share price values would have increased as a result of news however Western banks were unaffected by this event. Other findings included banks in East Asian

indices incurred losses in excess of 60% in each of the crisis countries in contrast to Western banks outperforming the counterparts. Stulz et al. (2000) delved into the issue of the East Asian crisis to examine the impact of the crisis and bailouts in relation to U.S. bank stock prices. Stulz et al. (2000) conducted this which is illustrated as follows:

$$R_{pt} = \alpha_0 + \beta_0 R_{mt} + \gamma_0 X_t + \sum_{j=1}^{J} D_j \emptyset_{jt} + \varepsilon_t \quad (2.56)$$

Where R_{pt} - Logarithmic daily returns on one of the U.S bank portfolios, R_{mt} - U.S. stock market index return, X_t – Change in the seven-day Eurodollar rate, $\emptyset_{jt}$ - Dummy variable taking a value of 1 for the j-th event day shown below, or zero otherwise and D_j – Represents an abnormal return for the j-th event day. Stulz et al. (2000) findings include exposed banks are affected by such events whereas non-exposed banks are not, thus meaning investors are capable of distinguishing banks that possess exposure. Furthermore, Stulz et al. (2000) found banks with exposure to country debt, benefitted from country bailout through increased returns, whereas banks with no exposure had no impact on equity returns. Djankov et al. (2005) focussed on East Asian crisis and examined the valuation effect of resolutions of insolvent banks from Korea, Indonesia and Thailand to commercial clients. To achieve this Djankov et al. (2005) applied a multivariate WLS estimate approach which is as follows;

$$CAR = \alpha_0 + CLOSURE + FORSAL + DOMMER + NAT + INTCOV + MKTVAL + MKTBK + BANKTA + BANKNI + MULTBANKDUM + MULTBANKDUM/CLOSURE \quad (2.57)$$

Where; CAR - Cumulative abnormal returns for time period t = -1 to 0, where the event date t=0 is the date of the announcement of the type of resolution of distress of the firm's related bank, $CLOSURE$ - A dummy variable indicating that the related bank would be closed, $FORSAL$ - A dummy variable indicating the bank would be sold foreigners, $DOMMER$ – A dummy variable indicating that the related bank would be merged domestically, NAT - A dummy variable indicating the bank would be nationalized, $INTCOV$ - Is the interest coverage, $MKTVAL$ – The natural log of the market value, $MKTBK$ - The ratio of the market value to book value of the firm, $BANKTA$ – Total assets of the bank, $BANKNI$ - Net income of the bank, $MULTBANKDUM$ - A dummy variable indicating that the firm has multiple banking

relationships and $MULTBANKDUM/CLOSURE$ - The interaction between the two dummies. Djankov et al. (2005) concluded that banks add value to a firm with the value depending on solvency of the bank. Additionally, Djankov et al. (2005) discover significant CAR for 50 days following event announcement, multivariate regressions interpret the announcement of closures and nationalisations of banks endure a significant effect on the performance of related firms.

2.7.3 Event Studies – Japanese Lost Decade

As a result of the Japanese lost decade as described previously, vast literature has been produced within this strand. We first introduce Yamori (1999), which examined whether market participants do not distinguish between solvent from insolvent banks, the study being based upon the liquidation of Hyogo bank. To undertake this investigation Yamori (1999) cross-sectionally regressed the abnormal returns of the Japanese bank stocks relating to the materialising events of the Hyogo bank failure from August 29-31, 1995, which was modelled as follows;

$$AR_{i,t} = DUMMYLOW + BADFUKU + INVEPER + LTOASS \quad (2.58)$$

Where $AR_{i,t}$ - Abnormal returns for bank *i* during time period *t*, $DUMMYLOW$ - A dummy variable that equals 1 when dividend payments per share of a bank are less than ¥5 and 0 zero otherwise, $BADFUKU$ - The ratio of the BADLOAN to the FUKUMI, where the BADLOAN is the amount that a bank has loaned insolvent debtors and FUKUMI is the unrealized capital gain on banks' securities portfolios, $INVEPER$ - Denoted as the ratio of earnings per share to stock prices and $LTOASS$ - The natural log of total assets. Yamori (1999) concluded stock market reactions reflect the financial conditions of banks and market participants have the ability to distinguish troubled banks more negatively, which supports the Efficient market hypothesis (EMH) within Japan. Saporoschenko (2002) commenced further event study regarding unanticipated changes or shocks to the systems, which offered a different perspective

to existing literature. Saporoschenko undertook a GARCH (1,1) volatility model, which is as follows:

$$R_{jt} = \beta_{01} + \beta_{11} INMKT_t + \beta_{21} IN71R_t + \beta_{31} DSPD_t + \beta_{41} INYW_t + \varepsilon_{1t} - \theta_{1\varepsilon 1jt-1} \quad (2.59)$$

Where: R_{jt} – Weekly returns of Japanese banks, $INMKT_t$– Japanese stock market return, $IN71R_t$– Long term Japanese Government bond return, $INYW_t$– Yen trade-weighted exchange rate return and $DSPD_t$– Interest rate spread, difference between short term prime rate and 3-month bank deposit rate.

Results from the investigation provide evidence that many Japanese banks had asset/liability structures over the period 1986-1992 that resulted in significant negative sensitivity to long-term interest rate measure increases. Evidence also suggests Japanese banks that served in the main role undertook more market and interest rate risk than most other Japanese banks. The impact of bank stock returns are thus found to be significantly and usually negatively in relation to long-term interest rate, with market Beta's always highly significant. Japanese banks are generally found to assume more risk as based on market betas. Brewer et al. (2003) investigated the ability of the Japanese stock market to appropriately price risk of financial firms, similar to Saporoschenko (2002). Brewer et al. (2003) concentrated upon 6 failures (four banks and two securities firms) by adopting an event study methodology similar to MacKinlay (1997) and Binder (1998). Whereby, they examine the ability of stock market participants to price risk of banks and digest new information. Their study integrated a multivariate model which used GLS regression to estimate the impact of events and variance of residuals across banks individually, sampling 115 Japanese banks and the TOPIX index. The model implemented by Brewer et. al (2003) is exemplified by the following:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \alpha_i P + \beta_i P R_{mt} + \sum_e \gamma'_{ke} D_{ke} + \sum_e \emptyset_e D_{ke} COND_i + \sum_e \theta_e D_{ke} SH_i + \sum_e \lambda_e D_{ke} TA_i + \mu_{it} \quad (2.60)$$

where R_{it} - Return of bank i on day t, α_i – the intercept for bank i, β_i – the market risk coefficient for day t, R_{mt} – Return of market index for day t, P – Binary variable that identifies

post event periods, γ'_{ke} – Captures any daily intercept shifts on event day k and provide an estimate of abnormal returns associated with failure announcement, D_{ke} – Binary variable that equals 1 if day t is equal to the event day or window k, $COND_i$ - Variable to describe the condition of bank, SH_i – Controls for the exposure of bank i to the failed institution and TA_i – Natural log of total assets to capture size of bank. Brewer et al. (2003) empirical results suggest that market participants were able to incorporate new information and offer similar findings to Yamori (1999) and Brewer and Pettway (2002), which investors were able to discriminate among the banks through the levels of risk they possessed. However, in addition to this not all banks were adversely impacted by the failure announcements of banks and thus any contagion effects that resulted from the crisis, was based on rational evidence.

Spiegel and Yamori (2003), examined regulation, laws and policies effect upon the share prices of banks. Spiegel and Yamori (2003) examined the pricing of portfolios of bank stocks of common regulatory class on the dates of significant events concerning the passage of Stabilization Laws – The Rapid Recapitalization Act and The Financial Reconstruction Act. Spiegel and Yamori (2003) also examine disparities between pricing of portfolios from strong and weak banks as well as cross-sectional studies of differentiating bank equities by financial strength in sensitivity to announcement of laws. Spiegel and Yamori (2003) similar to Spiegel and Yamori (2000) and Aharony and Swary (1996) performed a cross-sectional regression which was as follows:

$$R_{pt} = \alpha_p + \beta_{mp}R_{mt} + \beta_{ip}\Delta_{it} + \sum_{e=1}^{8}\gamma_{pe}D_e + \varepsilon_{pt} \quad (2.61)$$

where R_{pt} - Represents the return on the bank portfolio on day *t*, α_p - The constant term, β_{mp} – The bank portfolio's market beta, R_{mt} – The market return on day *t* as the daily return on the TOPIX index, β_{ip} – The portfolio's sensitivity to changes in the interest rate, Δ_{it} – Denotes the changes in the overnight call rate, γ_{pe} - The sensitivity of the bank stock portfolio to event *e*, D_e – A dummy variable for event *e*, equal to 1 when *t* = *e* and 0 otherwise and ε_{pt} - A random disturbance term. The differences are a different dummy variable in terms of bank regulatory classes and the total capital ratio to account for leverage of an institution. Spiegel and Yamori (2003) found that large banks regulatory advantages were diminished by Financial Reconstruction Act, which affected large banks and trust bank groups portfolios significantly

negatively priced on announcements studied. However following these announcements, it benefited smaller regional banks as abnormal returns on these events proved to be significantly negatively related to bank size, as measured by total assets. As well as the Rapid Recapitalisation Act was perceived by investors to benefit the weaker banks within the Japanese system and thus improved their performance as a result of regulation implemented.

An extended study from Kobayashi, Spiegel and Yamori (2006) investigated monetary policy effects upon the stock markets through quantitative easing (QE) programme implemented by the Bank of Japan as a measure to reignite their economy. The study sampled 87 Japanese banks, which used CAPM to compute the bank portfolio excess returns during the specific dates of QE announcements. Furthermore the study was followed by a cross-sectional event study to examine whether QE was perceived to disproportionately benefit weaker Japanese banks than large banks upon introduction of QE programme. The cross-sectional model is illustrated below as follows;

$$BANK_t = \alpha + \beta R_{mt} + \sum_{e=1}^{10} \gamma_e D_e + \sum_{e=1}^{10} \beta_e (R_{mt} \times D_{et}) + \sum_{r=1}^{2} \beta_r (R_{mt} \times D_{rt}) + \beta_{FX} FX_t + \varepsilon_t$$

Where: $BANK_t$ – Represents the daily stock return of the TOPIX bank index, R_{mt} – Market portfolio return for day *t*, γ_e – Represents the sensitivity of the bank portfolio to the BOJ announcement represented by the by the dummy variable D_e, which takes the value 1 on the event date *t* and zero otherwise, D_{rt} and D_{et} – Dummy variables equal to 0 prior to the date of events *e* and *r* respectively and 1 afterwards, β_r and β_e - Represent coefficient estimate on the foreign exchange intervention measure FX_t and ε_t – Disturbance term. Two of the ten event dates examined, proved the overall banking portfolio yielding significant positive excess returns, which also coincides with the financial revitalisation programme, which was expected to aggressively clean-up Japan's banking problem. However after robustness examination, deposit growth was indicated to be negatively statistically significant bank excess returns, supporting the hypothesis that weak banks were expected to disproportionately benefit from such monetary policy actions. As depositors were removing time deposits from problematic banks at this time due to the anticipated partial reduction in deposit insurance guarantee.

Furthermore to information impacting Japanese stocks, Miyajima and Yafeh (2007) concentrated on events surrounding the Japanese banking sector stock prices that surprised investors (1995-2000). Miyajima and Yafeh (2007) conducted the investigation through

sampling 800 listed firms whilst computing the CARs of the stock price fluctuation upon a surprising news event emerging to the market. The model utilised within the study is as follows;

$$CAR_{it} = \alpha_0 + ASSETS + TOBINSQ + LEVERAGE + HIGHRD + BONDRTG + MBLOANSTOTOTASSTS + MBSHAREHLDNG$$

Where: CAR_{it} - Cumulative abnormal returns on bank *i* during time period *t*, $ASSETS$ – Total assets in ¥m, $TOBINSQ$ - Ratio of market value to book value, $LEVERAGE$ - Ratio of total liabilities (borrowing and bonds) to assets, $HIGHRD$ – Dummy variable to capture chemicals, pharmaceuticals, machinery, electronics, transportation equipment and precision instruments, $BONDRTG$ - Bond rating of firm on a scale of 4 (lowest, no rating) to 1(rated A or higher), $MBLOANSTOTOTASSTS$ - Main bank loans total to total assets and $MBSHAREHLDNG$ - Main bank shareholding. Results illustrate the banking crisis was far more homogenous as not all companies were equally affected by the unfolding events. Companies within sample are sensitive to macroeconomic credit crunches for example have limited access to bond market and undertake high levels of leveraging. However Miyajima and Yafeh (2007) offer a different perspective as little evidence in stock price responses to suggest that the banking crisis led to a substantial misallocation of credit from good to bad firms.

2.8 Conclusion

The purpose of the literature review outlined and discussed above was to identify the relevant research that lends itself to the empirical work contained in this thesis relating to bank performance and financial crisis. The approach is historical in context owing to the nature of the origins of financial crisis which occurred at various points in the economic cycle. In so doing, we highlight the most relevant theoretical framework that have been applied, as well as the empirical approaches that have been adopted to investigate a range of issues relating to the financial performance of institutions, specifically banks, against the background of various financial crisis that have occurred. Our purpose in this respect is to identify possible gaps within the literature that can be explored and hopefully may result in meaningful empirical research which makes a direct contribution to the existing literature. From the sections above, we highlight the first gap whereby, there is no study which considers the performance of all financial sectors within the UK during periods of volatility and stability. This gap within the literature will enable us to make a contribution to the literature through utilising similar

methods as explored above. We identify further within the literature, whereby to the best our knowledge there are no studies, which concentrate on the entire UK financial system. The second gap we identify is explaining the risk profile of UK financial institutions over good and bad times. This will enable us to compare and contrast the changes in risk across all financial sectors in the wake of the recent global financial crisis in 2007/8. The third gap we highlight is the effect of macroeconomic news events during crisis periods towards the equity price performance of UK financial institutions. Lastly, in wake of the financial crisis, respective governing bodies have taken vast measures in order to avert future crisis periods from materialising again. Considering these actions being implemented, this gives rise to a gap in the literature, whereby we can focus on the impact regulatory changes have incurred towards the UK financial sectors asset prices.

The empirical literature on financial crisis and the performance of financial institutions, especially banks is voluminous and offers mixed results on the impact of financial crisis and on the performance of banks. To a large extent this is a result of the existence of a variety of ways in which investigation into these issues is empirically examined, as well as the choice of variables selected are particularly sensitive to other important determinants. We find the literature progresses through differing modelling techniques, which account for econometric issues such as heteroskedasticity or multicollinearity through panel data regression and GMM, respectfully through the research of Pasiouras and Kosmidou (2007) and Goddard et al. (2004a). Our research in Chapter 3 will take the insights and findings into account and incorporate a measure of these variables into the estimating regression equation. We believe that this is the most prudent way of approaching the study of the performance of financial institutions and its determinants.

Chapter 4 will address explaining the risk profile of UK financial institutions, which will hopefully enrich the literature. Given the literature covered within this chapter we will proceed by adopting a mixture of the methodological approaches from relevant papers such as Fama and Macbeth (1973). Harvey (1993), Hamilton (1994), Brooks et al. (1998), Faff et al. (2000), Engle (2002) and many more.

Chapters 5 and 6 will predominately be event studies, which will focus upon the impact of macroeconomic news and regulatory announcements on equity prices of UK financial institutions, respectively. When recalling the event studies covered within this Chapter we note the progression of the modelling techniques over time. When referring back to the Latin

American debt crisis, the main regression techniques utilised were OLS/SUR/GLS as well as event study methodologies utilised from many studies such as Schoder and Vankudre (1986), Smirlock and Kaufold (1987), Bruner and Simms (1987), Kyle and Wirick (1990) and many others. These are the more traditional regression techniques as opposed to modern econometric models. As we progressed to the East Asian crisis, the literature became more focussed towards cointegration/VAR/Error correction techniques, in order to understand the relationship of key variables in a different light from authors such as Choe et al. (1999), Pan et al. (2007) and others. Following the East Asian crisis, we focussed the event study literature upon the Japanese banking crisis. From undertaking this we gained new methods of undertaking such research, whereby the GARCH methodology from Saparoschenko (2002) was utilised.

CHAPTER 3

Explaining Financial Institutions Performance and the Effects of Risk: Panel Evidence from the UK Financial Sectors

3.1. Introduction

It is widely recognized that banks and other financial institutions are an integral part of the financial system owing to the specialized role they play in the process of intermediation. The financial crisis of the late 2000s demonstrated quite vividly just how important financial institutions are to the real economy when the UK government moved fairly swiftly to implement measures to rescue failing financial institutions whose very existence was threatened as a consequence of their prior risk-taking behaviour, combined with the introduction of more robust structures of regulation to impose greater discipline on the behaviour of financial institutions – one with the explicit objective of limiting systemic risk and in securing the future of the financial system, so as to recapture confidence in the financial system. Indubitably, the financial crisis had important consequences on UK financial institutions, not least on their performance. For a number of banks, in particular, that incurred substantial financial losses were bailed out or nationalized, resulting in a contagion in equity prices as investors fled to high quality assets. To limit such contagion, as well as to stabilize the financial system, the UK government introduced a number of measures that included capital injections, the strengthening of deposit insurance guarantees, asset purchase scheme (whereby bad loans were purchased from banks), and quantitative easing. Since most banks suffered from a loss of liquidity, owing to the seizing up of credit markets, they in turn found it increasingly difficult to extend finance to the household and corporate sectors. In result, banks reduced lending while at the same imposing tighter credit conditions. Consequently, stock market values and real investments declined, and the economy entered a period of recession.

To date, very little research has examined the financial performance of UK financial institutions following the financial crisis of the late 2000s. Given the importance of financial institutions to the UK economy, understandably their performance has increasingly come under the scrutiny of the financial press, shareholders, analysts and regulators. This we suspect is because the performance of financial institutions is a crucial part of changes in the process of

designing effective structures of regulation to mitigate future transgressions, and because the evaluation of their performance serves as a basis for firm specific improvements, as well as a benchmark for detecting profound problems. Furthermore, the financial performance of nonbank financial institutions has been under researched, save for a selection of studies which examine various traits of managers of investment funds, including the impact of managerial dexterity on performance, selectivity and market timing, among other pertinent issues; see for examples Ward, and Saunders (1976), Black, et al. (1992), Fletcher, (1995), Brown, et al. (1997), Leger (1997), Blake and Timmermann (1998), Cuthbertson et al. (2008) and Jans and Otten (2008). On balance the studies of Fletcher (1995) and Leger (1997) report mixed results on positive average selectivity performance and negative timing performance, while Blake and Timmermann (1998) report evidence of risk-adjusted underperformance and persistence of performance. What specific research that exist on financial institutions performance has primarily focused on the profitability of UK banking firms, often included as part of a wider study examining the determinants of European bank profitability using a variety of statistical approaches; see for examples Molyneaux and Thornton (1992), Staikouras and Wood (2003), and Godard et al. (2004). Of the studies just mentioned, the findings of Molyneaux and Thornton (1992) reveal that liquidity is negatively related to bank profitability, while Staikouras and Wood (2003), in examining the determinants of profitability in the EU context, report that the profitability of European Union banking firms may be influenced by factors related to changes in the external macroeconomic environment. In a similar direction, Godard et al. (2004) report a tenuous relationship between size and profitability, but also report a significant and positive relationship between off-balance sheet business and profitability for the UK banking firms examined.

As background we note that in the run up to the financial crisis of 2007 that the macroeconomic conditions exerted a sustained and positive impact on financial institutions profitability which only began to tail off in 2008 as the impact of the global financial crisis took hold. One consequence of this was the deleveraging of financial institutions, especially the deleveraging of banking firms, which culminated in the deep sell-off of assets in order to pay down obligations that could not be financed in closed credit markets. There is no doubting that other sectors of the financial industry were affected. For example, the insurance sector suffered because the attainment of insurance in highly integrated global markets meant that with insurance takers claiming at the same time that insurance firms would experience reduced levels of profitability. In the real estate sector, the failure of rising home values and mortgage

payments of homeowners forced banks to acknowledge substantial write-downs and write-offs, which resulted in banks themselves having liquidity problems and as a direct consequence the reluctance to advance new mortgages at anything but at exorbitant fixed or variable rates which ultimately affected the real estate sector. At the same time, the seizing up of credit markets limited an important source of finance for finance companies, while investment trust firms suffered from the volatility that impacted financial markets.

Above all, the financial crisis inflicted a very high adjustment costs on the financial sector, with the banking sector generally experiencing the highest cost of adjustment. During this period of adjustment and uncertainty for the financial sector, not only did the banking sector have to adjust to a changing regulatory environment but they also encountered a sharp downturn in economic activity which affected balance sheets more generally. The profitability of the banking sector and its ability to assume risk were also affected by various other developments, such as on-going policy uncertainty about the intended regulatory changes, and the dramatic change in the willingness of the corporate and household sectors to increase their debt burden. More specifically, the banking sector appears not to have coped very well with the challenges cast by this new operating environment. Thus a study of the performance of the banking sector and other financial sectors will tell us how well they coped with the changing economic conditions prior to, during, and following the financial crisis. The financial institutions included in our sample consist of banking firms, insurance companies, unit trust companies, finance companies, and real estate firms. We concentrate on these financial institutions owing to the availability of historic data and because many of the measures introduced impacted the financial sectors included in our sample in different ways.

Analysing the financial performance of these sectors is particularly interesting, mainly due to the following reasons: (i) from a policy perspective, if financial institutions are more profitable one might expect lower prices and improved quality of service for consumers, as well as greater safety and soundness if some proportion of profits is channelled towards strengthening capital buffers that absorb risk; (ii) the performance of financial institutions is particularly important for the recovery of the UK economy in light of the financial crisis of 2007-2009; (iii) the performance of financial institutions is important for the stability of the UK economy and for employment in the financial sector more generally; (iv) considering that at present the UK economy has been experiencing its third year of economic growth, adequate historical data exists in order to investigate the issue of UK financial institutions performance in relation to the post crisis period 2010-2013, which to our knowledge has not been studied.

In addition, we attempt to explain why changes in the condition of risk are more pronounced for some financial institutions than others. This panel analysis is designed to determine how characteristics unique to the corresponding institutions influence performance. From a broader perspective, the study should be of interest to investors and policymakers as the financial sectors studied are pivotal to the UK economy and have been widely influenced by government economic policy over the period represented by the data. In addition, they have been subject to increased competition as a result of the globalization of financial markets and to economic shocks to the domestic economy. In this process, it would be interesting to observe how these financial institutions manage performance when challenged by varying market conditions, which thus allows us to make conclusion about how they responded, and whether they responded differently to the changing environment.

This study contributes to the relevant literature in three ways: (a) it covers a period which includes some of the most innovative approaches to financial crisis management leading to a reshaping of the UK financial environment. Furthermore, and in view of the severity of the economic recession, it is important to investigate, at the micro level, the financial indicators in an effort to trace possible changes in financial institutions performance measures; (b) it allows for the first time a financial sector assessment to be made on the performance of UK financial institutions during the same time period; (c) the validity of the findings is enhanced by considering specific time periods which are characterized as good and bad times over the economic cycle of the UK economy. Thus, the investigation of the performance of UK financial institutions during the period of the financial crisis and the post crisis periods offers many implications. The results are also useful for developing investment decisions, as these sectors are considered to be relatively attractive to international portfolio investors.

The chapter is organized as follows. Section 2 outlines the empirical method to be implemented. Section 3 discusses the data and presents descriptive statistics of the datasets. Section 4 provides a brief discussion of the role of the UK financial system. Section 5 reports and discusses the empirical results from the performance analysis. Section 6 concludes the chapter.

3.2 Econometric method

It is well established that the performance of a firm, be they financial institutions or otherwise, may be evaluated on the basis of its return on assets (ROA) or its return on equity (ROE). In the context of the performance of financial institutions, finance theory instructs us that profitability measures should account for the risk and return associated with the financial institutions portfolio which therefore suggests that we should adopt the following formulation:

$$\pi_{it} = \alpha_0 + \alpha_1 IN + \alpha_2 EX + \varepsilon \tag{3.1}$$

where π is a profit measure, *IN* a measure of firm specific internal variables, *EX* a measure of market specific external variables and ε the stochastic term with the usual classical properties. The subscript *i* denotes the individual sector (*i* = 1, 2,…, N) and *t* denotes the year (t = 1, 2,…, T). Eq. (1) is similar to the standard specification that is used in the empirical literature to evaluate financial performance. Following Demirguc-Kunt (1999), and Goddard et al. (2004), we expand Eq. (3.1) to obtaining a measure of the financial performance of banking firms as follows:

$$\pi_{it} = \alpha_0 + \alpha_1 MS + \alpha_2 MCON + \alpha_3 LDEP + \alpha_4 TAS + \alpha_5 EQAS + \alpha_6 MCAP$$
$$+\alpha_7 FTSE + \alpha_8 GDP + \alpha_9 P + \alpha_{10} NIM + \alpha_{11} CIN + \varepsilon_t \tag{3.2}$$

where the natural logarithm of π_{it} is as previously defined. The two profitability measures used in our analysis as the dependent variable in Eq. (3.2) are return on asset (ROA) and return on equity (ROE). ROA is defined as the net profit of a financial institution divided by the average total assets and thus provides us with a measure of the ability of the management to transform an institution's assets into net earnings, and therefore indicates the efficiency of managers in generating net income from all assets or resources committed to realizing the institutions objectives. Overall, ROA indicates the relationship between net income and total assets, and our decision to utilize this measure is informed by our understanding that using net income for funding purposes within the financial structure constitutes an incentive and target for financial institutions to augment their return on investment. At the same time, the capital structure policy involves returns trade-offs, for extensive use of debt is more likely than not to enhance the risk faced by financial institutions while also amplifying total invested funds and expected returns.

As a supplement to the purpose of the present study, we also employ ROE as a measure of performance, since it reflects the net return of capital invested by shareholders and thus the proficiency of a financial institutions management in utilizing equity in profitable ways. Thus ROE approximates the net benefit that shareholders obtain from investing in a financial institution. The independent variables in Eq. (3.2) include both firm and market specific variables similar to those used in other studies such as Demirguc-Kunt (1999), and Goddard et al. (2004) among others. The firm or micro specific independent variables that we include represents information about market share (MS), loans to deposit ratio (LDEP), total assets (TAS), equity to asset (EQAS), market capitalization (MCAP), net interest margin (NIM), and cost to income ratio (CIN), while the market specific variables include concentration ratio (MCON), annual percentage change of the FTSE 100 index (FTSE), gross domestic product (GDP), and the rate of inflation (P).

The variable MS is used to measure market share, while the measure for concentration (MCON) is calculated as the total assets held by the five largest commercial banks operating in the banking sector divided by the total assets of all commercial banks operating in the banking sector. According to the SCP hypothesis, banks in highly concentrated markets tend to collude and therefore earn monopoly profits (e.g. Short, 1979; Molyneux et al., 1996). However, not all studies, have found evidence to support the SCP hypothesis. From the 45 studies reviewed by Gilbert (1984) only 27 provide evidence that the SCP paradigm hold. Berger (1995a) note that the relationship between bank concentration and performance in the U.S.A. critically depend on what other factors are held constant. An important decision that managers of commercial banks, in particular, must take refers to the liquidity management and specifically to the measurement of their needs related to the process of deposits and loans. For that reason the ratio of bank's loans divided by customers plus short-term funding (LDEP) is used as a measure of liquidity. Higher figures denote lower liquidity. Without the required liquidity and funding to meet obligations, a bank or for that matter a non-bank financial institution may fail. Thus, in order to avoid insolvency problems, banking firms and non-bank financial institutions often hold liquid assets, mainly money market securities, which can be easily converted to cash. However, liquid assets are usually associated with lower rates of return. And so it would be expected that higher liquidity would be associated with lower profitability. The size of a financial institution is measured as total asset (TAS). In the literature, the size of a financial institution is considered to be an important determinant of its performance. The reason being that large size may result in economies of scale that will, in the

process, reduce the cost of gathering and processing information (Boyd and Runkle, 1993). Moreover, large asset size can add financial stability, investment flexibility and thus can reduce the cost of financial institution specific activity such as lending promoting overall efficiency. In general, large financial institutions, in terms of asset size, have an advantage of providing a wider set of financial options to their customers, which translate in more competitive rates, fees, and premiums. On this issue, the empirical results are mixed, since some studies found economies of scale for large banks (European Commission, 1997; Berger and Humphrey, 1997; Altunbas et al., 2001) and other economies of scale for small banks or diseconomies for larger banks (e.g. Vander Vennet, 1998; Pallage, 1991). The ratio of equity to total assets (EQAS) is used in this study as a measure of capital adequacy which essentially gauges the ability of financial institutions to withstand losses. Thus stated, capital adequacy merely refers to the sufficiency of the amount of equity capital to absorb any shocks that a financial institution may experience. Financial institutions with substantial equity ratios may be deemed over-cautious, overlooking profitable investment opportunities as and when they present themselves, while a declining ratio may signal capital adequacy problems. Hence the sign of the coefficient could be either positive or negative. It is expected that the higher the equity to assets ratio, the lower the need for external funding and therefore the higher the financial institutions profitability. As this suggests, capital is an important variable in determining financial institutions profitability, but it may also proxy risk and regulatory costs. On this issue, the literature instructs us that in imperfect capital markets, financial institutions that are adequately capitalized will tend to borrow less in order to finance a given level of assets, and thus tend to confront much lower cost of funding due to lower prospective bankruptcy costs. Nonetheless, we are mindful that in the presence of asymmetric information, a financial institutions that is well capitalized may be signalling to the capital markets that a better than average performance can be expected. And when viewed from this perspective, a financial institution that is adequately capitalized is likely to face much lower risk of encountering financial distress which reduces its costs of funding. Such an outcome should translate in lower profits, since the financial institutions would be considered to be more secure. And as such, we would expect to see a negative relation between capital and profits. However, we are mindful that for some financial institutions, namely banking firms, that regulatory capital represents a binding restriction, and is considered as a cost. Thus we would expect a positive association to the extent that banking firms will in some way seek to pass some of the regulatory costs onto bank customers. Berger (1995), for example, finds a positive relation in both direction between capital and profitability. Net interest margin (NIM) is a measure of a financial institutions interest spread and thus focus on the profit earned

on lending, investing and funding activities. The study utilizes cost-to-income ratio (CIN) as a measure of the costs of running a financial institution – the major element of which is salaries. The higher the operating costs are relative to a financial institution's generated incomes, the lower the institution's financial performance. Although the relationship between expenditure and income might appear, prima facia, straightforward suggesting therefore that higher expenses mean lower profits and the opposite, this may not always be the case. This is because higher amounts of expenses may be associated with higher volume of activities (e.g., increase in insurance cover, car loans, etc.) and therefore higher revenues. It is expected that this variable will have a negative impact on performance because a financial institutions that operate its business efficiently can be expected to operate at lower costs.

The literature tells us that the environment in which financial institutions operate will have a large bearing on performance. We take this to include not only the financial market structure, but also the prevailing economic condition, as well as the impact of the legal and political environment. A change in the FTSE 100 index (FTSE) is expected to be positively related to the financial performance of financial institutions, for in a well-developed stock market financial institutions can be expected to increase their income(s), which allows them to generate higher levels of revenue. A measure of macroeconomic conditions is Gross domestic product (GDP) which is calculated as the annual change in GDP for the change in economic growth. Thus as GDP growth increase during an upward trend in economic activity, financial institutions can be expected to experience a greater demand for services and, in turn, to increase borrowing as they expand their activities accordingly and with a lower risk of default more generally. From the perspective of banking firms, GDP growth can be expected to have an effect on numerous factors related to the supply and demand for bank assets, namely loans and deposits, while for insurance companies it may result in a rise in demand for insurance related premiums, and for estate companies an increase in the demand for commercial property as business firms expand their business, as well as an increase in the demand for houses from the household sector as their income increases, all of which of course puts upward pressure on prices. Thus a positive relationship is expected between the performance of these financial institutions and GDP in periods of real GDP growth. We should also note that when the rate of GDP growth slows, particularly during periods of recession, credit quality can be expected to deteriorate, and defaults increase (on the payments of loans of various kinds, and on premiums), thereby reducing returns to financial institutions. Demirguc-Kunt and Huizinga (1998) and Bikker and Hu (2002) find a positive correlation between bank profitability and the business

cycle. The study accounts for macroeconomic risk by controlling for inflation, as measured by the retail price index, since a rise in the price level, P, may impact the costs and profitability of financial institutions in direct and indirect ways. For instance inflation may impact costs and revenue directly by virtue of a rise in the price of factor inputs, i.e., labour, and indirectly as a result of changes in interest rates and asset prices. While we expect a positive effect of the price level on the profitability of financial institutions, its impact on financial institutions performance does rather depend on whether future movements in inflation are fully anticipated or unanticipated, which also depends on how accurately financial institutions are able to forecast future movements in the most applicable control variables. If, for example, inflation is anticipated, then interest rates will be adjusted accordingly resulting in revenues, which accrue faster than costs, with a positive impact on profitability. If on the other hand inflation is unanticipated financial institutions may be slow in adjusting their interest rates which may raise financing costs than revenues and, in the process, thus have a negative impact on profitability. In their study bank on performance, Bourke (1998), Molyneaux and Thornton (1992), Dermiguc-Kunt and Hiuizinga (1998) report a positive relation between inflation and long-term interest rates with bank performance. It is perhaps worth noting that the Bank of England uses interest rates to target inflation. And if the bank anticipates an increase in the price level, P, it will raise interest rates so as to restrict expenditure and borrowing by firms and households, which, all things considered, could also increase the rate of default. But ultimately, these will affect the financial performance of institutions.

With regard to nonbank financial institutions, that is: insurance companies, finance firms, investment trusts and real estate firms, we modify Eq. (3.2) in order to capture more closely the economic conditions pertinent to these sectors by including a measure for total investment portfolio (TINV) which is a common variable shared within their respective balance sheet. The empirical model is formulated as follows:

$$\pi_{it} = \alpha_0 + \alpha_1 MS + \alpha_2 MCON + \alpha_3 TINV + \alpha_4 TAS + \alpha_5 EQAS + \alpha_6 MCAP$$
$$+\alpha_7 FTSE + \alpha_8 GDP + \alpha_9 P + \varepsilon_t \qquad (3.3)$$

where π_{it} is as previously defined. From the models outlined above, four different estimation periods will be examined thoroughly for the UK financial sector in order to obtain better understanding of the determinants of profitability. Equation (3.2) and (3.3) is estimated for each performance indicator by pooling the data covering four periods.

We chose to utilize a panel data approach, since an advantage of panel data analysis is the likely reduction of multicollinearity and, in our case, it will allow us to control for unobserved heterogeneity for the time-invariant effects. The independent variables outlined in regression equations (3.2) and (3.3), and their hypothesized relationships with profitability are outlined in Table 1.

3.3 Data and Summary Statistics

Our data base is compiled from Companies House, Bloomberg and DataStream and covers the period 1980 to 2012. The data includes both firm specific and market specific data as earlier noted. The analysis is broken down into four sub-periods: 1980-2012, 2002-2007, 2007-2010 and 2010-2012. These periods will enable us to understand not just how the financial performance of financial institutions changed but also to identify what were the most influential drivers of profitability over periods marked by favourable macroeconomic conditions (2002-2007) and periods of instability as reflected by the impact of the financial crisis (2007-2019), while the period 2010-2012 may be described as the "post-crisis" era which was underpinned by the deep recession.

To estimate the regression models outlined above, we used balanced panel data on a sample of FTSE 250 listed financial institutions operating in the UK financial sector with an historical listing since 1990. These include: banking firms (6), finance companies (6), insurance companies (6), investment trusts (24), and real estate companies (9). We exclude financial institution listed on the UK stock exchanges after 1990 due to the paucity of firm level data and because it would result not only in fewer observations, but in non-representative results also. The main reason for the inclusion of the institutions in our sample has much to do with the availability of data, and because privately owned institutions are not required by UK law to publicly disclose the financial information required to progress our study. These financial institutions provide an excellent sample for a study of the financial performance of UK financial institutions for several reasons. First, they share a number of similarities concerning key macroeconomic and financial system features. To begin with, all the financial institutions in our sample were affected in some way by the financial crisis of 2008-2009 and by the uncertainty surrounding the protracted Eurozone sovereign debt crisis. Further, the UK financial sector suffered substantially due to the financial distress of banking firms as a result of the lack of liquidity and weakening economic conditions in the real economy as the financial crisis deepened. Prior to the financial crisis, when the UK macroeconomic conditions appear

to exert a positive impact on the financial performance of institutions, banking firms, in particular, targeted growth rather than short-term profits by investing in high risk sectors, in increasing the size of loans and deposits, and asset size. However, once the impact of the financial crisis had been normalized, the focus of banking firms shifted towards profitability in an effort to repair enfeeble balance sheets and blemished reputation for financial stewardship. Six micro variables are employed as internal determinants of bank performance, and 5 micro variables as internal determinants of the non-bank financial institutions performance. These variables and there hypothesized signs are set out in Table 1.

Table 1: Variables Description

Variables	**Remarks**	**Hypothesized direction**
Dependent		
ROA	Return on assets - used as a proxy of the profitability of financial institutions. A positive relationship with profitability is expected	+
ROE	Return on equity - used as a proxy of the profitability of financial institutions. A positive relationship with profitability is expected	+
Independent		
MS	Market share – calculated through the net revenue of financial institution divided by the sum of sector sample, then converted to a percentage.	§
MCON	Market concentration ratio - used as a proxy to capture market share	+/-
TAS	Total assets - used as a proxy to capture institutional size	+
LDEP	Loans/deposits - used as a proxy to capture bank behaviour towards lending within its operations and is seen to be a measure of riskiness	+/-
TINV	Total investment portfolio within the financial markets - used as a proxy to capture market risk exposure	+
NIM	Net interest margin - used as a proxy to capture fluctuating cost of borrowed funds	§
CIN	Cost to income ratio	-
EQAS	Equity Asset Ratio – used as a proxy for solvency	+
External Factors		
FTSE	FTSE100 Index – used as a proxy to capture the UK stock index valuation	+
MCAP	Market capitalization - used as a proxy to capture the relationship between market financing and profitability	§
GDP	Gross Domestic Product - used as a proxy for macroeconomic conditions	+
P	Retail Price Index - used as a proxy for the price level, i.e., inflation	+/-

Notes: Concentration ratio was measured by the Herfindahl Index obtained by summing the squared totals of the four largest institutions market share. +- denotes positive and negative effect; § denotes no indication.

Table 2 reports the summary statistics for the variables used in this study for the five financial sectors included in our sample. These include the mean and standard deviation, the measures for skewness and kurtosis, and the Jarque-Bera statistic. First, we should mention that the unit root test results, not reported, using the approach of Levin et al. (2002), indicate the presence of a unit root in log difference level for all variables across the financial sectors.

It is observed that for the banking sector, the profitability measures, ROA and ROE, have respective mean return of 7.9336 and 2.6207 and standard deviation of 3.75369 and 0.3969, while the mean value of total assets (TAS) is 19.5189 and standard deviation of 1.3689. The concentration of the banking sector has a mean of 7.6885 and a standard deviation of 0.1410. Equity is, on average -3.0494 of total assets but with a standard deviation of 0.2908. Worth mentioning is the market share GDP has a mean 13.7839 and a standard deviation of 0.5217, while the mean value of inflation (P) is 0.9900 with a variability of 0.6355. Moreover we find; ROE, MS, MCON, LDEP, MCAP, FTSE, GDP and CIN experience a leptokurtic distribution which suggests a sharper than normal distribution with values namely concentrated towards the mean within these variables, which have a high probability for extreme values to prevail. Among the previously stated variables the CIN is found to experience the highest kurtosis with a value of 5.5620. The following variables; ROA, MCON, TAS, EQAS, P and NIM are found to have a platykurtic distribution which have a flatter than normal distribution with shorter tails as well as a smaller possibility for extreme outcomes. Among these variables total assets has the smallest kurtosis with a value of 2.2279. Following the kurtosis statistics, we find interesting features through the skewness whereby ROA, MCON, LDEP and CIN are found to be positively skewed, which infers a long right tail with extremely bad scenarios are not as likely. All other variables in the banking sector are negatively skewed, which infers a long left tail with a greater chance of extremely negative outcomes. Lastly, it worth mentioning the Jarque-Bera statistics of the banking sector which reveals the ROA, LDEP, TAS, EQAS, P and NIM are found to be normally distributed with all other variables in the sector experiencing non-normality.

Panel B presents the insurance sectors' descriptive statistics in Table 2, which reveals the mean values for ROA and ROE are 2.9684 and 3.5694 with a standard deviation of 0.8665 and 4.2194, respectively. This suggests the ROE is a more volatile variable in comparison to ROA given the higher value of standard deviation. We find; ROE, ROA, MCON, FTSE and P experience a leptokurtic distribution which suggests a sharper than normal distributions with values namely concentrated towards the mean, which these variables also have a higher probability for extreme values to prevail. The following variables; MS, INV, TAS, EQAS, MCAP, and GDP are found to have a platykurtic distribution which have a flatter than normal distribution with shorter tails as well as a smaller possibility for extreme outcomes. In terms of skewness we find the positively skewed variables endure a long right tail with extremely bad scenarios are not as likely among the following variables; ROE, MCON and EQAS.

Furthermore, a negative skewness is found upon the remaining variables in Panel B, which suggests a long left tail with a greater chance of extremely negative outcomes. Further to this, we highlight overall the most volatile variables within the insurance sector are the; ROE, MS, TAS and TINV with the following values; 4.2194, 2.0653, 2.0478 and 2.9314. We find MCON, GDP and P to be the least volatile variables as they experience the smallest standard deviation values. It is also worth mentioning that all variables within Panel B are not normally distributed via the Jarque-Bera test.

Panel C reveals the descriptive statistics for the investment trust sector within the UK. Firstly, we examine the means of the dependent variables ROA and ROE which indicate values of 2.0672 and 0.9612. The descriptive statistics also tells us that all variables bar inflation experience a leptokurtic distribution in accordance to their kurtosis value being greater than 3. This suggests a sharper than normal distributions with values namely concentrated towards the mean are found with these variables and have a higher probability for extreme values to prevail. Only the inflation variable experiences a platykurtic distribution which has a flatter than normal distribution with shorter tails as well as a smaller possibility for extreme outcomes. Furthermore, when we concentrate upon the skewness of the variables we see the only positively skewed variable is MCON with a value of 3.9161, which alludes to a long right tail with extremely bad scenarios are not as likely. All other variables are found to be negatively skewed, which infers a long left tail with a greater chance of extremely negative outcomes. Furthermore, we Table 2 demonstrate that ROA is the most volatile variable within this sector with a standard deviation value of 6.9265, followed by TINV, TAS and MCAP holding a value greater than 1. Lastly, we find that all variables within Panel C experience a non-normality distribution.

Panel D represents the finance company sector in Table 2. The descriptive statistics of the sector reveals the means of the ROA and ROE are 2.6526 and 0.7015, respectively. The descriptive statistics reveal that ROE, ROA, TAS, EQAS, MCAP, FTSE and P experience a leptokurtic distribution which suggests a sharper than normal distributions with values namely concentrated towards the mean, which these variables also have a higher probability for extreme values to prevail. The following variables; MS, MCON, TINV and GDP are found to have a platykurtic distribution which have a flatter than normal distribution with shorter tails as well as a smaller possibility for extreme outcomes. In terms of skewness we find the only positively skewed variable is concentration, which endures a long right tail with extremely bad scenario not as likely outcome. All of other variables in Panel D are found to have negative

skewness, which suggests a long left tail with a greater chance of extremely negative outcomes. We can also comment on the variables with the highest degree of variance is fond within the TINV (2.2275), TAS (2.0258) and MCAP (1.9526). Lastly, we demonstrate all variables bar ROE are not normally distributed via the Jarque-Bera test.

Panel E presents the summary statistics for the real estate sector within Table 2. Beginning with the mean values of the ROA and ROE are found to be 2.3939 and 1.4725, respectively. The highest mean values are unsurprisingly found within the GDP (13.4753), MCAP (13.5284) and TAS (13.7172). The following variables ROA, ROE, EQAS and P experience a leptokurtic distribution in accordance to their kurtosis value being greater than 3. This suggests a sharper than normal distributions with values namely concentrated towards the mean are found with these variables and have a higher probability for extreme values to prevail. All the remaining variables in Panel E experience a platykurtic distribution which has a flatter than normal distribution with shorter tails as well as a smaller possibility for extreme outcomes. Following this we find only the ROA is positively skewed, which endures a long right tail with extremely bad scenario not as likely outcome. All of other variables in Panel E are found to have negative skewness, which suggests a long left tail with a greater chance of extremely negative outcomes. In terms of volatility within the variables we find TINV (2.8473), MCAP (1.5124) and TAS (1.7216) are most volatile as well as ROE and MS experiencing standard deviation values of greater than 1. Lastly, we see all variables experience non-normality distribution as found the Jarque-Bera test.

Table 3 presents the correlation coefficients of variables employed in the regression model. As can be seen, the correlation coefficients among the regressors generally reveal, on average, low to moderate correlation, the exception being between and as can be seen, the correlation n coefficients among the variables for all financial institutions are not high. Among the independent variables, are significantly and positively associated with ROA and ROE. The independent variable, FTSE is significantly and negatively associated with ROA and ROE. Overall, we found no problem with multicollinearity among the independent variables and can therefore conclude that the correlations are not likely to bias our results. Panel B presents the immediate correlation results for all selected independent variables. As can be seen, the statistics indicate that significant and negative correlation exist between ROA and Loans to deposits, since the correlation is equal to -0.0231 at a significance level, since it is less than 0.05 (0.034). Moreover, a positive (0.995) and strongly significant (0.002) correlation exists between NIM and ROA at 1% significance, while no significant correlation is reported for the

case of Bank size (TAS) as efficiency indicator of return on assets. Therefore the relevant correlation is verified only for GDP and P and not for MCON as predictors of ROA. In addition, it is evident from Table 1 that significant and negative correlation exists between FTSE and NIM; the correlation is equal to -0.998 at 1% significance level (0.001). However, for the case of RPI no significant correlation relationship is traced with NIM (0.448) at any accepted significance level. Similar results are reported for GDP, since no significant correlations are reported with NIM and therefore the relevant correlation is rejected for this case also, since the relevant significance level is greater than 0.05 (.429). Evidence show that significant and negative correlation also exists between ROE and the independent variables considered. In general, the distribution properties of the data series appear to be normal. This is also confirmed by the Jarque-Bera statistic that rejects the null hypothesis of zero skewness and excess kurtosis for all financial institutions.

Table 2: Summary statistics

Panel A: Banking firms

Variable	Mean	Max	Min	St. Dev.	Skewness	Kurtosis	JB statistics
ROA	7.9336	17.824	0.2675	3.7536	0.05143	2.5481	1.7625
ROE	2.6207	3.3478	1.5933	0.3969	-0.8933	3.8391	5.8442
MS	2.8571	3.7620	1.4791	0.5765	-1.2158	3.5376	9.3025
MCON	7.6885	8.0219	7.5464	0.1410	1.0962	2.7937	7.2734
LDEP	4.8016	5.5977	4.1737	0.3280	0.7920	3.6820	4.4616
TAS	19.5189	21.597	16.526	1.3689	-0.4982	2.2279	2.3832
EQAS	-3.0494	-2.6278	-3.6624	0.2908	-0.5128	2.3218	2.2675
MCAP	16.7814	18.631	13.031	1.5574	-1.2567	3.3858	9.6984
FTSE	8.1033	8.8436	6.1524	0.7000	-1.0623	3.3823	6.9902
GDP	13.7839	14.265	12.547	0.5217	-1.3014	3.5293	10.582
P	0.9900	2.0412	-0.3567	0.6355	-0.7316	2.7675	3.2928
NIM	0.7124	1.2119	-0.1165	0.3521	-0.6976	2.8144	2.9715
CIN	4.0264	4.3438	3.8658	0.0975	1.2428	5.5620	19.113

Panel B: Insurance companies

Variable	Mean	Max	Min	St. Dev.	Skewness	Kurtosis	JB statistics
ROA	2.9684	4.4897	-2.2839	0.8665	-1.7399	10.0748	463.62
ROE	3.5694	14.5685	-4.1709	4.2194	1.2652	4.6740	68.65
MS	1.7174	4.3673	-2.6832	2.0653	-0.7513	1.8707	29.15
MCON	7.9832	8.8824	7.8242	0.1656	3.2547	18.0315	2213.64
TINV	15.2248	19.1738	8.7948	2.9314	-0.5308	1.9131	19.04
TAS	16.4185	19.6562	11.3129	2.0478	-0.4566	2.5681	8.42
EQAS	-2.9459	-0.0841	-4.6471	0.9976	0.5545	2.7541	9.62
MCAP	14.1583	17.0083	10.1887	1.6738	-0.1976	1.9976	9.58
FTSE	7.9572	8.8436	6.1524	0.7668	-1.0350	3.0588	35.38
GDP	13.5547	14.2648	12.3596	0.5507	-0.5765	2.2364	15.78
P	1.2579	2.7147	-0.3567	0.5861	-0.2376	4.0829	11.54

Panel C: Investment trust firms

Variable	Mean	Max	Min	St. Dev.	Skewness	Kurtosis	JB statistics
ROA	2.0672	51.0412	-85.9462	6.9265	-3.4829	49.8453	71496
ROE	0.9612	3.8265	-3.2189	0.7900	-0.2201	7.2066	590.4
MS	1.3336	4.5299	-2.8731	0.8116	-0.6179	6.1171	371.0
MCON	6.1330	9.8671	5.6740	0.7692	3.9161	18.6153	10071.0
TINV	12.9109	14.9717	8.1699	1.0685	-0.9056	4.6809	201.5
TAS	12.9730	14.9952	8.1920	1.0522	-1.0558	5.3976	336.8
EQAS	-0.1711	0.0439	-1.2103	0.1357	-2.7779	16.0216	6355.2
MCAP	12.6030	14.7859	6.2003	1.2712	-1.4286	6.0326	572.9
FTSE	7.9572	8.8436	6.1524	0.7654	-1.0350	3.0588	141.5
GDP	13.4976	14.2648	12.3596	0.5850	-0.3931	1.9060	59.9
P	1.2787	2.7147	-0.3567	0.6043	-0.2493	3.9917	40.7

Table 2 (Continued)

Panel D: Finance companies

Variable	Mean	Max	Min	St. Dev.	Skewness	Kurtosis	JB statistics
ROA	2.6526	3.9096	0.5128	0.6948	-0.6735	3.5145	17.152
ROE	0.7015	3.6800	-2.3954	1.0048	-0.3566	3.2841	4.371
MS	2.0529	4.5686	-1.4911	1.6316	-0.4485	2.1224	12.991
MCON	8.2215	9.1395	7.5308	0.4613	0.6058	2.4165	14.921
TINV	12.1964	16.2228	6.0591	2.2275	-0.3163	2.4513	5.786
TAS	13.5410	16.4984	7.2152	2.0258	-0.8683	3.4255	26.372
EQAS	-1.8348	-0.0135	-4.8354	0.7344	-0.5667	4.2717	21.278
MCAP	12.4230	15.4325	5.4797	1.9526	-1.0367	4.5225	54.589
FTSE	7.9572	8.8436	6.1524	0.7668	-1.0350	3.0588	35.378
GDP	13.5708	14.2648	12.3596	0.5338	-0.6153	2.2998	16.538
P	1.2441	2.7147	-0.3567	0.5579	-0.3365	4.5304	23.059

Panel E: Real estate firms

Variable	Mean	Max	Min	St. Dev.	Skewness	Kurtosis	JB statistics
ROA	2.3939	5.0424	-0.2926	0.9578	1.2597	4.6284	101.62
ROE	1.4725	3.5216	-4.5995	1.4479	-2.1348	8.7027	570.94
MS	2.1267	4.0235	-1.3284	1.2006	-0.4640	2.3705	13.36
MCON	7.8895	8.3476	7.3079	0.2775	-0.3153	2.3874	9.56
TINV	9.4379	14.9491	2.4849	2.8473	-0.1206	2.3076	6.65
TAS	13.7172	16.7569	7.3809	1.7216	-0.5572	2.8869	14.17
EQAS	-0.6208	-0.1815	-4.0608	0.4167	-6.1471	47.5955	24074
MCAP	13.5284	16.1220	9.8498	1.5124	-0.4292	2.4732	12.55
FTSE	7.9548	8.8436	6.1524	0.7741	-1.0162	2.9780	51.12
GDP	13.4753	14.2648	12.3596	0.6056	-0.4021	1.8409	24.63
P	1.1617	2.7147	-0.3567	0.5753	-0.6707	4.1223	37.85

Table 3: Correlation coefficients of independent variables in the empirical model

Panel A: Banking firms

	ROE	MS	MCON	LDEP	TAS	EQAS	CIN	NIM	MCAP	FTSE	GDP
ROE	**1.000**										
MS	-0.121										
MCON	0.473	-0.024									
LDEP	0.094	0.262	0.070								
TAS	-0.433	0.621	-0.415	0.126							
EQAS	-0.333	-0.089	-0.195	-0.296	-0.213						
CIN	-0.209	0.024	-0.013	0.237	0.007	-0.261					
NIM	0.254	-0.148	0.288	-0.125	-0.714	0.560	-0.198				
MCAP	-0.320	0.705	-0.321	-0.042	0.689	0.280	-0.288	-0.148			
FTSE	0.105	0.015	-0.124	-0.023	-0.001	0.009	-0.159	-0.058	0.150		
GDP	-0.493	0.002	-0.512	0.062	0.722	-0.024	-0.109	-0.606	0.366	-0.006	
P	-0.105	0.005	-0.006	-0.023	0.075	0.089	-0.161	-0.083	0.147	0.245	0.170

	ROA	MS	MCON	LDEP	TAS	EQAS	CIN	NIM	MCAP	FTSE	GDP
ROA	**1.000**										
MS	0.339										
MCON	0.099	-0.028									
LDEP	-0.462	0.265	0.065								
TAS	0.026	0.592	-0.460	0.116							
EQAS	0.431	-0.090	-0.195	-0.297	-0.194						
CIN	-0.425	0.044	-0.058	0.242	0.048	-0.250					
NIM	0.362	-0.136	0.363	-0.104	-0.741	0.488	-0.228				
MCAP	0.480	0.697	-0.297	-0.048	0.645	0.278	-0.283	-0.122			
FTSE	-0.013	0.014	-0.137	-0.027	0.022	0.013	-0.143	-0.083	0.150		
GDP	-0.138	0.005	-0.545	0.055	0.743	-0.013	-0.058	-0.640	0.335	0.020	
P	0.013	0.004	-0.050	-0.018	0.116	0.094	-0.123	-0.131	0.131	0.253	0.208

Panel B: Insurance companies

	ROE	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROE	**1.000**								
MS	-0.561								
MCON	0.050	-0.011							
TINV	-0.690	0.910	0.010						
TAS	-0.344	0.774	0.126	0.851					
EQAS	0.128	-0.369	0.001	-0.439	-0.572				
MCAP	-0.521	0.712	0.078	0.869	0.851	-0.363			
FTSE	-0.039	0.045	0.088	0.041	0.014	0.074	0.054		
GDP	0.124	-0.215	0.343	0.063	0.348	-0.031	0.393	0.013	
P	-0.063	0.127	-0.210	-0.031	-0.184	-0.012	-0.230	-0.106	-0.539

	ROA	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROA	**1.000**								
MS	-0.692								
MCON	0.084	-0.011							
TINV	-0.746	0.910	0.010						
TAS	-0.570	0.774	0.126	0.851					
EQAS	0.502	-0.369	0.001	-0.439	-0.572				
MCAP	-0.543	0.712	0.078	0.869	0.851	-0.363			
FTSE	0.015	0.045	0.088	0.041	0.014	0.074	0.054		
GDP	0.152	-0.215	0.343	0.063	0.348	-0.031	0.393	0.013	
P	-0.075	0.127	-0.210	-0.031	-0.184	-0.012	-0.230	-0.106	-0.539

Table 3 continued

Panel C: Investment trust firms

	ROA	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROA	**1.000**								
MS	0.164								
MCON	0.268	0.277							
TINV	0.080	0.505	0.164						
TAS	0.084	0.530	0.167	0.990					
EQAS	-0.026	-0.085	0.013	0.078	0.068				
MCAP	0.072	0.468	0.167	0.962	0.970	0.125			
FTSE	-0.056	0.016	0.003	0.045	0.043	-0.027	0.044		
GDP	0.240	0.025	0.271	0.697	0.702	0.127	0.722	0.047	
P	0.004	-0.086	-0.389	-0.455	-0.467	-0.042	-0.496	-0.096	-0.554

	ROE	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROE	**1.000**								
MS	0.269								
MCON	0.110	0.229							
TINV	-0.036	0.513	0.154						
TAS	-0.033	0.541	0.158	0.990					
EQAS	-0.137	-0.108	-0.001	0.073	0.066				
MCAP	-0.044	0.474	0.154	0.960	0.969	0.120			
FTSE	-0.012	0.035	0.051	0.065	0.062	-0.022	0.062		
GDP	0.060	-0.005	0.235	0.696	0.700	0.134	0.721	0.075	
P	0.148	-0.073	-0.374	-0.469	-0.480	-0.060	-0.509	-0.112	-0.560

Panel D: Finance companies

	ROA	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROA	**1.000**								
MS	0.245								
MCON	0.004	-0.207							
TINV	0.071	0.426	-0.324						
TAS	-0.016	0.717	-0.385	0.701					
EQAS	0.489	-0.109	0.005	-0.288	-0.265				
MCAP	0.081	0.627	-0.477	0.416	0.730	-0.101			
FTSE	0.010	-0.041	0.057	0.020	-0.007	0.084	-0.007		
GDP	0.011	0.248	-0.779	0.404	0.523	-0.008	0.704	-0.013	
P	-0.110	-0.104	0.349	-0.170	-0.219	-0.039	-0.367	-0.070	-0.500

	ROE	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROE	**1.000**								
MS	0.206								
MCON	-0.029	-0.205							
TINV	0.230	0.424	-0.338						
TAS	0.015	0.719	-0.382	0.717					
EQAS	-0.184	-0.116	0.011	-0.290	-0.272				
MCAP	-0.006	0.650	-0.485	0.449	0.749	-0.111			
FTSE	-0.072	-0.040	0.058	0.011	-0.010	0.106	-0.051		
GDP	0.000	0.248	-0.777	0.427	0.522	-0.017	0.710	-0.008	
P	-0.181	-0.109	0.354	-0.175	-0.220	-0.044	-0.392	-0.067	-0.513

Table 3 continued

Panel E: Real Estate Companies

	ROA	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROA	**1.00**								
MS	-0.072								
MCON	0.321	0.048							
TINV	-0.261	0.341	-0.190						
TAS	-0.286	0.672	0.408	0.272					
EQAS	0.030	-0.061	-0.127	-0.093	-0.041				
MCAP	-0.170	0.680	0.430	0.216	0.958	0.080			
FTSE	0.051	-0.036	0.071	-0.050	-0.040	-0.014	-0.053		
GDP	0.459	-0.067	0.831	-0.339	0.344	0.042	0.381	0.062	
P	-0.137	0.082	-0.264	0.314	-0.098	-0.028	-0.067	-0.202	-0.438

	ROE	MS	MCON	TINV	TAS	EQAS	MCAP	FTSE	GDP
ROE	**1.000**								
MS	-0.075								
MCON	0.026	0.048							
TINV	-0.126	0.341	-0.190						
TAS	-0.156	0.672	0.408	0.272					
EQAS	-0.009	-0.061	-0.127	-0.093	-0.041				
MCAP	-0.129	0.680	0.430	0.216	0.958	0.080			
FTSE	0.224	-0.036	0.071	-0.050	-0.040	-0.014	-0.053		
GDP	-0.090	-0.067	0.831	-0.339	0.344	0.042	0.381	0.062	
P	0.050	0.082	-0.264	0.314	-0.098	-0.028	-0.067	-0.202	-0.438

3.4 The UK Financial System

The UK financial system serves an important function in the efficient operation of the economy. The financial system is the medium that channels funds from saving units to investing units and thus when the financial system is disrupted by a shock which severely restrict the flow of funds, as occurred during the financial crisis of 2007-2009, this can severely affect the savings-investment cycle and, as a consequence, constrain the rate of growth of the real economy if financial institutions are unable to provide funds to individuals and corporate borrowers in a timely manner. A variety of different financial institutions operate in the U.K. financial system to facilitate the flow of funds between savers and users of funds. These include commercial banks, investment companies, insurance companies, pension funds, finance companies, and real estate firms, amongst others, all of which specialize in the types of deposits they accept and the types of investments they secure. As is well known, commercial banks accept deposits and lend these funds to individuals, businesses, and governments, while investment companies invest funds in debt and equity securities and in money market instruments. Pension funds pool the contributions of employees and invest these funds in various types of financial assets, and insurance companies receive premiums from individuals

which they invest in various financial assets. Finance companies obtain funds by issuing their own securities and loans from commercial banks, and then use these sources of funds to make loans to individuals and businesses. For these reasons and, more, it is important to have a continued understanding of the financial performance of financial institutions.

3.5 Analysis

3.5.1 Empirical results and Analysis of the UK financial sector's performance

Table 4 reports the regression estimates from fitting the balanced fixed-effects panel regression model (1) for the financial institutions in our sample. The results are classified under four separate periods. First, we describe the estimates of bank performance over the period defined by the data (1980-2012), followed by the pre-crisis period leading up to the financial crisis (2002-2007), the period marked by the financial crisis (2007-2010), and the post financial crisis period (2010-2012). In the second part of our analysis, we utilise regression Eq. (3) to investigate the profitability of nonbank financial institutions for the aforementioned designated periods. To offer further related insights on financial institutions performance we evaluate the effects of their risk-taking behaviour by including a measure of risk to a set of specific traits in the regression specification. The motivation for looking at the risk-taking of banks, in particular, is due to the widely held view that the bailout expectations in the banking industry create moral hazard and cause banks to engage in more aggressive risk-taking behavior (Cordella and Yeyati, 2003; Gorton and Huang, 2004; Dam and Koetter, 2012). Therefore, the results will allow us to draw an inference about the effect of UK bank risk-taking behaviour on financial performance over the aforementioned periods.

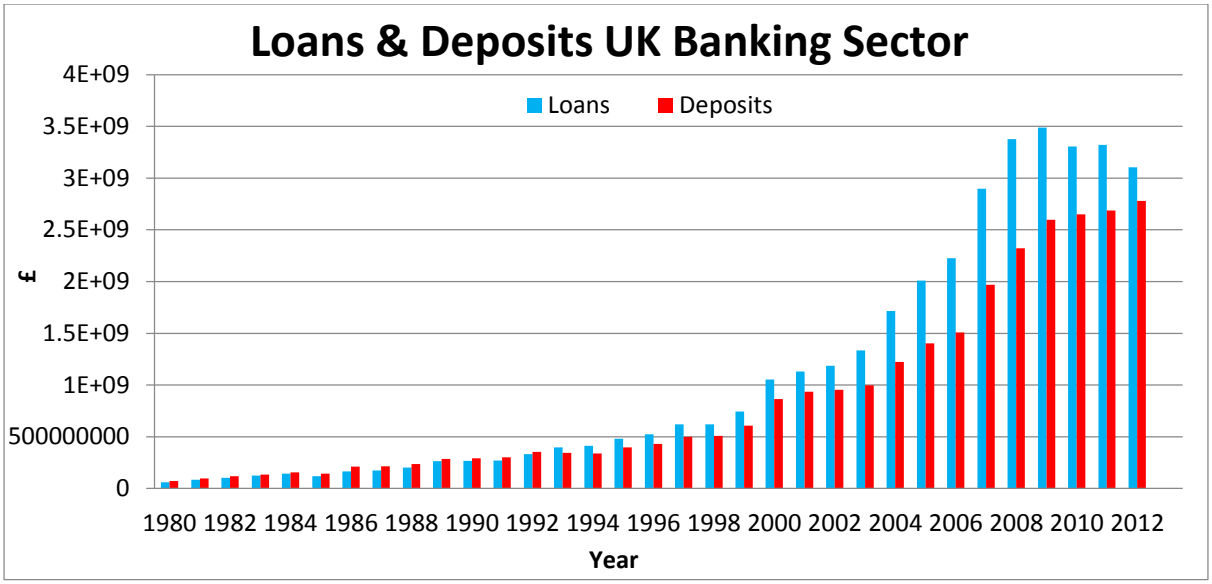
The summary results of the panel regression analysis for the performance of the banking sector under the four periods are disclosed in Table 4 for our profit rates return on assets (ROA) and return equity (ROE). Our discussion indicates when the 1980 to 2012 results differ from those of subsequent years. Several observations deserve mention. First, the adjusted R^2 for the regression suggests a reasonably good fit. Second, it is apparent that market share has a positive and significant (5% and 1% level) relationship with our profit rate, ROE, particularly in the period of stable growth (2002-2007) and post crisis (2010-2012), suggesting that banks' benefitted from their dominance in loan and deposit markets in profitable ways, but only under favourable market conditions when the UK economy experienced a rapid increase in credit, namely to households and to small and medium sized enterprises, which saw many bank

customers choosing to borrow to purchases houses or cars, to expand their business or to engage in new start-ups. This association argument has been reported by Smirlock (1985), Berger (1995), Demirgüç-Kunt and Huizinga (1999), and Abreu and Mendes (2001). Tellingly, loans-to-deposit ratio is statistically significant, which is not surprising, since the growing strength and competitiveness of mortgage banks and foreign banks in banking markets created pressure on banks to became more aggressive in loan markets and, in doing so, to relax their lending criteria when evaluating and arriving at decisions on loan requests, in preference to holding deposits. This result not only supports the risk-return hypothesis but it also demonstrates that during normal economic conditions bank managers are motivated to achieve higher returns through a declined loan loss rate.

Although the banking sector is especially dominant in the area of business borrowing and lending, it should be taken into account that the sector competes for much of this business with non-bank financial-services firms such as insurance companies, investment trust companies, finance companies, and real estate companies. In addition to these financial institutions, the banking sector is also faced with increased competition from supermarket firms and football clubs in some of its product areas such as, for example, the credit card market. Thus it is reasonable to assume that increased competition in retail financial markets offering financial services is likely to impact bank profitability over time. Operationally, the objective of a bank is to maximize shareholder wealth, which implies maximizing the margin, and minimizing costs. The main constraints to this endeavour are the need to incur costs to improve the quality of bank services, and to generate sufficient revenue in order to accommodate increased capital requirements, required for prudential reasons to support asset growth. A bank's asset includes loans which require twice as much capital support than mortgages. Profits are available to bank shareholders via dividends and higher share prices, and one way of boosting profits has been through increases in bank assets in the form of various types of loans, and mortgages. Here, the influence of LDEP is seen in Table 4. An examination of the estimate with our profit rate, ROA, indicates that the coefficient of LDEP has a negative association, which is statistically significant over the 32-year period, 1980- 2012. This implies that the banking sector were more conservative in their lending practices, at least up until the mid-1990s, as Figure 1 shows. As might be inferred from Figure 1, there was a continuous increase in total loans, this tends to correspond with the period of stable growth up until the crisis of 2007-2009 when, owing to the inability of banks' to obtain the necessary short-term liquidity to fund new loans as well as the necessity to repair balance sheets affected from the deep sell-

off of securities declined. It is also clear that the improving trend in deposit taking was not enough to prevent banks from needing to bridge the gap between loan advance and deposit taking by raising much of what they would need to fund new consumer loans in the wholesale money markets, albeit at a higher rate, or from liquidity assistance from the Bank of England.

Figure 1: Total Loans and Total Deposits UK Banking Sector 1980-2012



Regarding the influence of total assets or bank size, the coefficient of α_4 indicates a negative association with our profit rates (ROE/ROA) during the period of growth, indicating a statistically significant association at the 10 per cent level. This is consistent with the reported findings of Smirlock (1985), Molyneux and Forbes (1995), Kosmidou et al. (2005), and Pasiouras and Kosmidou (2007), which found total assets to be negatively correlated with profitability. Moreover, since α_4 provides an estimate of the impact of size, it appears that banks were unable to profitably exploit their size advantage through their reliance on improved bank technology in branches, increased online presence, and or mobile banking services doing more business. This may be attributable partly to the banks earning lower margins and thus reduced profitability at a time when they diversified their product range and grew more rapidly than in the previous period. It may also be due to the banking sector being more highly concentrated owing to the progressive reduction in the number of banks and bank branches, and an increase in contestability in the banking sector. This finding can be explained by the market concentration coefficient α_2 which seems to validate the Structure Conduct Performance (SCP) hypothesis and indicates, moreover, a statistically significant and positive

relationship with the Herfindahl index with our profit rate (ROA). This finding is in line with the results reported by Molyneux and Thornton (1992), Demirgüç-Kunt and Huizinga (1999), Goddard et al. (2004 and 2004b), Pasiouras and Kosmidou (2007) which report the limited contestability of the UK banking sector where a few major banks are known to have dominant presence in bank credit markets.

Interestingly, the net interest margin coefficient α_{10} reveals a statistically significant and positive relationship during the period of stable growth, which is not surprising since the banking sector would be expected to see an increase in the rate of growth in the demand for new loans and other banking products, and thus increased profitability. We also recognize that increased profitability may also reflect the effect of sound capital management practices, in addition to rising income from interest bearing assets than the cost of interest paid to depositors. In general, banks tend to have substantially higher net interest margins, and our results suggest a statistically significant negative relationship with NIM during volatile years. The variable would appear to be a key driver of bank performance as it defines the traditional operation of a bank and of a banks capacity to manage deposits and loans. Figure 1 also suggests a divergence in loans and deposits during the years 2005-2008, after which loan advance and deposit taking begins to narrow, which explains the negative association with our profit rates during the crisis and post-crisis period.

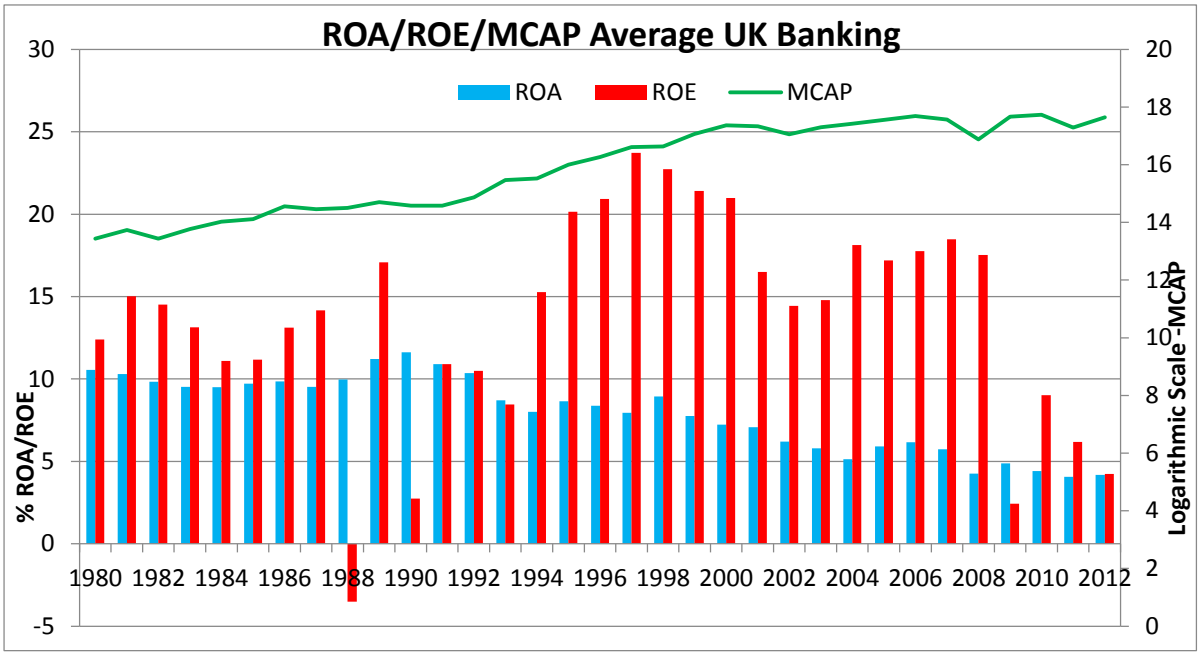
Looking at the effects of capital strength (EQAS), which is one of the main determinants of financial performance. The estimate reported in Table 4 indicate that the coefficient, α_5, is statistically significant. In particular, there is a positive association of EQAS with our profit rate during the 32-year period, the period of growth, as well as during the 2002-2007, 2007-2010, and 2010-2012 periods when bank capital came under pressure. This finding also suggests that well capitalised UK banks have the capacity to reduce the risk of bankruptcy, or were confident in the belief they could rely on the Bank of England, as the lender of last resort, for funding support in the event of severe financial distress which, in turn, allowed them to take advantage of their position – one that allowed them to keep funding costs low, while at the same time maintaining higher margins and higher levels of profitability. Previous research reports a positive relationship between equity asset ratio and profitability. For example, Berger (1995), Demirguc-Kunt and Huizinga (1999), Staikouras and Wood (2003), Goddard et al., (2004), Kosmidou et al., (2005) and Pasiouras and Kosmidou (2007) examine the financial performance of banks in different markets and report a positive relationship between equity asset ratio and profitability.

Looking at bank cost to income ratio (CIN), indicates the extent to which improvements have been achieved in operational efficiency through reductions in operating costs: personnel, information technology and other costs. Our estimation reveals that the coefficient α_{11} is negative and significantly different from zero during the pre-crisis period, which is consistent with the reported findings of Pasiouras and Kosmidou (2007). This decline in bank CIN reflects a number of factors. Namely the adoption of new technologies which allowed the banking sector to focus on reducing high-cost, low-value operation which resulted in the contraction of bank branches, combined with the focus of on online and mobile banking. In addition, the restructuring of operations and the gradual upgrading of bank technology more generally, allowed the banking sector to provide more time saving banking services to customers, while improved back-office processes such as loan approvals, and information processing and management, enabled the sector to counteract the effects of increased competition on profitability. A further potential explanation for the decline in CIN is that mortgage lending represents a high share of a banks' total lending, and because housing mortgages are more homogenous than business loans, the cost of distributing them is likely to have benefited more from technological advances than business lending or relationship-based financial services. This also suggests that there may be diseconomies of scope for the banks – that is, average costs increase as they diversify outside of commercial banking services.

Concerning the impact of stock market capitalization (MCAP) on bank profitability, it is observed that the coefficient is negative over the 32-year period. During the period under study it is observed that the impact of stock market capitalization is also negative with bank sector profitability during the pre-crisis period, implying that during the pre-crisis period the UK stock market provided substitution possibilities to potential borrowers. Figure 2 shows that MCAP increased over time. For instance, from 2002-2007 (a period of stable growth without a banking crisis), market capitalization increased steadily, before declining during the crisis, and rising during the post-crisis period. An important element to take into account also is the coefficient of the stock market (FTSE) which has a positive and significant impact on profitability over all periods. One interpretation of this is that since banks are listed on the stock market, a rise in the FTSE index is likely to strengthen not only their financial position but also the financial sector of the economy. Moreover, the increase in banking activities contributes to enhance profitability, and this is reflected in the stock price of banks. As we can see from our estimation results, the coefficient of this variable is statistically negative and significant with

our profit rate, ROE, during the 32-year period, and during the post crisis period. It seems, from the estimates, that shareholders were seeking to maximize value.

Figure 2: ROA ROE MCAP Average UK Banking Sector 1980-2012



Another factor, which may explain the profitability of the UK banking sector, are the rate of growth of national income as reflected by the coefficient GDP, which exhibit a positive relationship over the 32-year period and during the pre-crisis period with our profit rates ROA/ROE, when the UK economy experienced a period of stable growth. During this period, demand for financial services can be expected to grow as the UK economy expands and society at large becomes more prosperous. Thus the finding is not unexpected since the positive association between GDP and profitability suggests that higher rates of growth provides an incentive for banks to relax their lending criteria so as to be able to profit from the increased demand for loanable funds from the business sector in their quest to seize new investment opportunities or plant expansion, as well as to be able to offer more reasonable loan rates for the household sector to satisfy their demand for loans of various types, the largest of which is residential mortgage loans, as competition increase. Such demand, to the extent that they provide banks with the opportunity to increase profits, may actually strengthen incentives to expand credit at a time when business and consumer confidence is high in the UK economy. Furthermore, GDP growth can be expected to reduce the probability of default owing to lower

rates of bankruptcies and unemployment, which increase the willingness on the part of banks to advance newer business and consumer loans. This finding is consistent with the findings of previous studies examining the financial performance of banks such as, for example, Goddard, et al. (2004a), Kosmidou, et al. (2005) and Pasiouras and Kosmidou (2007). However, we should note that the coefficient indicates a negative relationship with our profit rate during the crisis and post crisis period when the UK economy slowed, but most noticeably the coefficient exhibits a positive and significant relationship with ROE during the periods under study.

The inflation coefficient (P), α_{10}, has a positive and significant effect on our profit rate during the 32 year period and during the post-crisis period, suggesting that the level of inflation was anticipated over the period. It also indicates that during the post crisis period, a 1 per cent increase in the price level result in an increase in profitability by 0.014 per cent, because when inflation is anticipated it therefore offers the banking sector the scope to adjust their interest rates, resulting in revenues that increases at a much faster rate than costs, and thus a positive effect on profitability. However, the inflation coefficient is negatively related to profitability during the pre-crisis and economic and financial crisis period, implying that the levels of inflation were unanticipated by the UK banking sector. This implies that banks were slow in adjusting their interest rates, which resulted in a faster increase in bank costs than bank revenues, with a negative impact on profitability. The negative sign of our inflation coefficient, α_9, also confirms Abreu and Mendes (2001) observation as there is a negative relationship with our profit rate. This would seem to suggest that inflation was unanticipated by the UK banking sector and, as result, may have led to bank costs being in excess of revenue's due to rates offered being unadjusted for and thus having a negative effect on profitability.

Table 4: Balanced fixed-effects panel regression – Empirical estimates for banking firms

$$\pi_{it} = \alpha_0 + \alpha_1 MS + \alpha_2 MCON + \alpha_3 LDEP + \alpha_4 TAS + \alpha_5 EQAS + \alpha_6 MCAP + \alpha_7 FTSE + \alpha_8 GDP + \alpha_9 P + \alpha_{10} NIM + \alpha_{11} CIN + \varepsilon_t$$

Dependent Variable	ROA 2002-2007	ROA 2007-2010	ROA 2010-2012	ROE 2002-2007	ROE 2007-2010	ROE 2010-2012
MS	0.9519	0.4195	-0.3630	0.2950	0.0259	0.3120
	(1.9458)*	(1.1153)	(-0.8153)	(1.2231)	(0.2631)	(1.9212)
MCON	2.9034	-0.8720	2.1976	-0.5808	-0.1433	0.5337
	(3.1556)***	(-0.5698)	(0.7950)	(-1.2802)	(-0.3577)	(0.5294)
LDEP	-0.6249	-0.7247	-0.0556	0.3530	0.4636	1.1241
	(-1.0844)	(-0.6928)	(-0.0340)	(1.2426)	(1.6939)	(1.8874)
TAS	-0.7826	-0.9494	0.1666	-0.3811	-0.2886	-0.9133
	(-2.2284)**	(-1.5361)	(0.1692)	(-2.2006)**	(-1.7842)*	(-2.5436)
EQAS	0.6026	0.1788	2.2474	-0.0194	-0.1287	0.0871
	(1.2324)	(0.2353)	(1.4985)	(-0.0802)	(-0.6473)	(0.1592)
CIN	-1.6135	-0.4776	-2.4970	-1.1442	0.0121	-0.4819
	(-1.2954)	(-0.4388)	(-0.6363)	(-1.8631)*	(0.0425)	(-0.3367)
NIM	0.7449	0.7000	-0.0950	-0.2920	-0.6706	-0.4288
	(1.8698)*	(1.1373)	(-0.1147)	(-1.4865)	(-4.1636)***	(-1.4194)
MCAP	0.6337	1.1439	0.7993	-0.0634	-0.3627	0.3587
	(2.7040)**	(1.7843)*	(1.0294)	(-0.5486)	(-2.1622)*	(1.2667)
FTSE	0.5318	0.1406	0.0776	-0.0819	0.0629	-0.1562
	(2.8794)***	(0.5093)	(0.1760)	(-0.8995)	(0.8710)	(-0.9717)
GDP	0.6860	-0.7242	-2.9635	0.7172	1.3877	1.0667
	(0.5264)	(-0.4522)	(-1.2710)	(1.1163)	(3.3120)***	(1.2545)
P	-0.1730	0.5805	-0.7092	-0.1430	0.1876	0.8059
	(-0.8084)	(0.8247)	(-0.6143)	(-1.3556)	(1.0186)	(1.9141)
R^2	0.673	0.504	0.715	0.541	0.851	0.785

t-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level.

Table 4 Continued: Balanced fixed-effects panel regression – Empirical estimates for banking firms

Dependent Variable	ROA 1980-2012	ROE 1980-2012
MS	-0.1769	0.1064
	(-1.6971)*	(2.2758)**
MCON	0.6212	0.0220
	(1.6563)*	(0.1309)
LDEP	-0.9674	0.3356
	(-3.5235)***	(2.7431)***
TAS	0.1142	-0.2590
	(0.9017)	(-4.5583)***
EQAS	0.2777	-0.1416
	(1.8146)*	(-2.0617)**
MCAP	0.3367	0.1160
	(3.4222)***	(2.6274)***
FTSE	0.1949	0.0349
	(2.3424)**	(0.9466)
GDP	-0.8312	0.2407
	(-2.4378)**	(1.5729)
P	-0.1163	-0.0169
	(-0.9171)	(-0.2978)
R^2	0.238	0.219

t-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level. We were unable to obtain consistent data from 1980-2012 for variables Cost-to-income ratio and Net interest margin.

The results of the estimation of Equation (3) are illustrated in Table 5 for non-bank financial institutions: insurance companies (Panel A), investment trust companies (Panel B), finance companies (Panel C), and real estate companies (Panel D). First, the insurance sector plays an important and specialized intermediary role in the UK economy. Therefore, their financial performance is very critical to the health and growth of the general economy. Given the importance of the insurance sector to the wellbeing of the economy, knowledge of the underlying factors that influence the insurance sector's performance is essential not only for the managers of the insurance companies, but for numerous stakeholders such as the central banks, the British Association of Insurance Brokers (BAIB), governments, and other financial

authorities. Knowledge of these factors would also be helpful to help the regulatory authorities and insurance managers formulate going forward policies for improved performance of the insurance sector.

It is observed from Table 5, Panel A, which shows the regression estimates for the insurance sector, that the model applied, given the values of R^2, was a good fit. If we focus on the overall period 1980-2012, it is observed that the coefficient of market share (MS), α_1, is statistically insignificant. This means that over the 32-year period the insurance sector experienced a decline in its share of the insurance market which influenced our profit rate, ROA, and thus the insurance sector's profitability. The negative t-value (-0.5707) means that the sector's declining market share impacted profitability negatively. This is due to the increased presence of UK commercial banks and other depository institutions in the household and motor insurance markets, as well as from the entry of foreign-owned insurers in life business, pensions, health, annuities, and other products as the insurance market opened up in the wake of deregulation and liberalisation. Regarding the pre-crisis period 2002-2007 when, in particular, the UK economy benefitted from stable rates of growth, we find that market share is statistically significant and positively related to ROA. This implies that during the 5-year period the insurance sector benefited from the expansion of the UK economy, which saw a rise in the level of business activity and employment, leading to an increase in the demand for business, mortgage, car loans, loans for other high priced ticket items, increased travel, and the purchase of insurance cover linked to these products. In addition to employment insurance cover. Consequently, these will have contributed to a higher profitability. For the period represented by the economic and financial crisis, 2007-2010, which saw the UK economy recoiled from its growth path, we see that the coefficient on our profit rate is statistically insignificant and negatively related to ROA. This means that the decline in demand for the main business lines of commercial banks and other depository institutions and, in turn, a reduced demand for insurance products in the insurance markets, as well as the rise in claims, on for example, employment protection insurance, payment protection insurance (PPI) and for other insured risks; as a result profitability decreased. Further, according to the sign of the coefficient for the period following the economic and financial crisis, 2010-2012, market share is positively related to our profit rate, ROA, indicating improving UK economic conditions and insurance markets from which the insurance sector benefitted profitably., the MS coefficient is statistically significant and positive for our profit rate, ROE, during all sample periods.

It is interesting to note that the effects of the market concentration (MCON) coefficient, α_2, for the period 1980-2012 is significant in explaining the insurance sectors profitability and thus does not support the Structure Conduct Performance (SCP) hypothesis. This is evidence that the insurance sector became less concentrated and more competitive over the 32-year period as the insurance market opened up, and as the global economy shift towards an ever increasing globalized financial market environment. This also demonstrates that the competitive pressures from the UK commercial banks that diversified their business by establishing their own insurance companies affected the sector in some market segments (e.g. household and car insurance markets) in which the increased competitiveness of these business organizations brought about an erosion of profitability. It is also worth noting that according to the *SCP* hypothesis, insurance companies in highly concentrated markets tend to collude and therefore earn monopoly profits, which is not supported. We also find that the coefficient has a negative and significant relationship with our profit rate during the pre and post crisis periods. In terms of the impact on ROE, α_2, is observed to have a positive and significant effect on profitability during the 32-year period, the period 2007-2010, and 2010-2012, except for the period 2002-2007 where the coefficient has a significant and negative impact on profitability. The interaction with the investment (TINV) coefficient, α_3, reveals a negative and significant relationship with profitability. One possible interpretation of this result is that the investment portfolio did not yield sufficient investment income to offset the insurance sectors pay-out obligations on claims over the period under study, as both ROA and ROE is consistently negative. We should also note the low interest rate environment also helped to contribute to the low return on investment and thus profitability. Another interesting and significant observation is that the sign of the TAS coefficient, α_4, is positively correlated with profitability over all periods, except for the period of stable growth where TAS has a negative and significant impact on our profit rate, ROA. This suggests that over the 5 year period a 1 per cent increase in company size decreased profitability by 0.07 per cent, mainly for two reasons. First, assets yielded increasingly low returns, and secondly, the increasing longevity of policy holders. The estimates also shows that the relationship between the equity to asset (EQAS) coefficient, α_5, and profitability is positive and statistically significant during all periods. In this vein, it could be argued that the insurance sector remained in sound financial condition mainly by reducing the drain on capital and by managing their business more efficiently. Moreover, since a strong capital structure is essential for the insurance sector, it provides additional strength to underwrite risk, and the ability to withstand increased claims as and when unexpected events

occur. The coefficient of EQUAS does however indicate a negative and positive consistency with ROE during the period of stable growth, as well as during the economic and financial crisis, and the post crisis period.

The statistics also show that market capitalization (MCAP) has a positive and significant effect on the insurance sector's profitability over all periods. The coefficient, α_6, indicate that over the 32-year period a 1 per cent increase in MCAP increased the profitability of the sector by 0.03 per cent. It implies that for the period under study it is observed that the impact of stock market capitalization is also negative with profitability, implying that during the pre-crisis period the London stock market offers substitution possibilities to potential buyers of premium. We also find that although the coefficient, α_6, is highly significant and positively related to ROA during the period of stable growth, and during the post-crisis period, it was negative and positively related to ROA during the economic and financial crisis. The negative and significant relationship between MCAP and ROE during the 32-year period, and during the period of growth implies that the insurance sector did not utilise its equity fully. MCAP does however show a positive and significant relationship with ROE during the economic and financial crisis, and post crisis period. In addition, the sign of the FTSE coefficient, α_7, is negative and significant during the 32-year period, and the period of stable growth indicating there is a negative relationship between stock market strength and insurance sector profitability, while the variable is positive and significant with ROA during the period of economic and financial crisis, and in the post-crisis period. The positive relationship between the UK stock market and insurance sector profitability rather suggests that there are complementarities between the recovery of the stock market and the insurance sector's recovery as the stock market and the insurance sector recovered from the impact of the economic and financial crisis. According to the sign of the variable our profit rate, ROE, there is a negative and positive relationship with ROE during the period under study.

Referring to the impact of GDP, α_8, is positively related to the financial performance of the insurance sector during the 32-year period and during the period of stable growth, while the variable shows a negative and positive relationship with ROA during the crisis and post-crisis period. We also find that the coefficient of GDP has a positive sign with ROE during all periods which suggests the sector was able to expand and maintain its competitive position in bank markets where it became increasingly harder to increase profitability. Finally, the evidence for the impact of inflation on our profit rate ROA/ROE is irregular and not persistent.

For example, the variable indicates a negative and positive consistency with ROA during the period of stable growth and during the economic and financial crisis, before returning to be positive and significantly related to ROA during the post-crisis period. The results also indicate that the price variable has a negative and significant relationship with our profit rate ROE during the 32-year period, and during the period of stable growth, positive during the crisis-period, and positive during the post-crisis period.

The results of the estimation of the fixed-effects specification for the investment trust sector are reported in Table 5, Panel B. Investment trusts are an important medium for enabling small UK investors that want to channel their savings into capital market investments, so as to benefit from portfolio diversification to reduce risk. It is clear from the low R^2 that the model constructed is not a perfect fit and that the variables selected are perhaps not the most important drivers of investment trust sectors financial performance. The market share coefficient, α_1, has a negative sign with our profit rate over the 32-year period, as well as during the period of stable growth and the crisis period, but is found to be positive related to profitability during the post-crisis period. There are several reasons for this finding. First, growth returned to the UK economy and with it higher rates of employment. Second, the low interest rate on savings product offered by the commercial banks and other depository institutions, induced bank customers to place their savings in the hands of money managers rather than to deposit them in bank saving products. Third, the capital markets were increasingly regarded as a much better performing alternative to bank savings account with the potential for investors to earn higher rates of return. Investment trusts are able to offer small investors the opportunity to benefit from portfolio diversification and the professional expertise of fund managers was another key factor. We also find that the coefficient is negatively associated with ROE for the 32-year period, and for the growth period, but is positively correlated with our profit rate during the crisis and post-crisis period. As we can see from our estimation results, this variable is negative and significant for all periods, indicating that there is a negative relationship between market concentration and profitability, which supports the structure conduct performance hypothesis. On the other hand, it is plane that the coefficient, α_2, is positively related to ROE for the 32-year period, and for the period of growth, but there is a negative and positive relationship during the crisis and the post-crisis period.

The return on investments, α_3, has a positive and significant effect on investment trusts performance for all designated periods. In particular, the estimates indicate that during the

period of growth a 1 per cent increase in investment caused investment trusts performance to increase by 0.16 per cent. The possible reason for this positive effect is that the investment strategies adopted by fund managers during periods of stable growth, as well as during the time of turmoil and the post-crisis period delivered stellar returns in an environment of increasing volatility and uncertainty in global markets. For example, during the period 2002-2007 UK shares priced in quite a lot of good news about the strength of economic growth and, as a result, the London stock market witnessed a continued rise not only in the price of stocks traded, but also in the market's indexes. Over this period the FTSE 100 index powered ahead, ending 2002 at 3940, 2004 at 4814, and 2005 at 5619. These highs were surpassed in 2006, when the index ended the year at 6221 and, after hitting its highest level of almost 7000 in 2007, it ended the year at 6457. As a consequence of the global financial and Eurozone debt crisis which created downward pressure on economic growth and resulted in declines in various stock market indexes, the market ended 2008 at 4434. This was bettered when it ended 2009 at 5413, and 2010 at 5900. As a result of the infusion of liquidity into the UK banking system and other economic stimulus measures applied by the UK government and the Bank of England, which led to an improving economy – with low interest rates and low inflation - which provided a positive outlook for UK companies, the market ended 2012 at 5898. Therefore, the relationship between investment returns and investment trust performance is positive. The investment variable is also positively associated with our profit rate ROE for all periods, except for the crisis-period, where the coefficient has a significant and negative effect on performance. This result might be driven by the steep fall in global stock markets, and the market capitalization recession that followed, which ultimately affected the financial performance of investment trusts.

The coefficient of total assets, our size variable, is positive and significantly related to our profit rate, ROA, for all periods, except for the post-crisis period. This result shows that investment trusts were able to benefit not only from the sizeable fund under management but also from diversification possibilities and the gradual strengthening of the economy. For the larger the size of the investment portfolio, the more profitable the investment trust sector, which supports the risk-return hypothesis. On the other hand, the coefficient is negatively and positively related to ROE for all periods, except for the post-crisis period. We also see the effect of EQAS on investment trust performance, which indicates a negative and significant relationship during the 32-year period with our profit rate, ROA, but is positive and significant for all other periods. We interpret this to indicate that since capital is a measure of investment

trust risk, which may have a questionable effect on investment trust financial performance, it seems that well-capitalized investment trusts are perceived by small investors to be much safer havens for their savings, and thus were incline to entrust their savings to managers of funds with a strong capital base. In contrast to the estimates for ROA, differences exist related to ROE. The coefficient, α_5, has a positive and significant effect on profitability for the 32-year period, but reveals a negative and significant relationship with ROE for all remaining periods. Our estimates show that the coefficient of market capitalization has a positive and significant effect on investment trust performance for all periods, except for the crisis-period for ROA, but indicates a negative and significant relationship with ROE for all periods, except for the post- crisis period.

The sign of strong stock market growth and strength is positive and significant for all periods for our profit rate ROA/ROE, except for the period 2002-2007 for ROA, indicating a positive relationship between stronger stock market growth and investment trust performance. This results in an increase in savers putting their savings under the management of investment trusts which, as a result, contributed to higher financial performance. The positive relationship between strong stock market growth and investment trust performance would seem to suggest that there are interrelating benefits between the growth and strength of the stock market and investment trust performance.

On the macroeconomic front which helps to explain how successful the investment strategies adopted by fund managers interact with the environment. It is observed that GDP is negatively related to the performance of investment trusts over all periods, except for the crisis-period for ROE. This result is surprising, particularly in view of the strong GDP growth experienced by the UK economy during the periods under study, which would be expected to have resulted in investment trust seeing an increase in demand for their services, and thus improving financial performance. It is observed that inflation is positively related to investment trusts performance during the periods under study, except for the 32 year period, with our profit rate ROA, implying that during the period of stable growth, the crisis-period, and the post crisis-period, the levels of inflation was anticipated by investment trusts.

Concerning the financial performance of finance companies which also play an important role not only in business and household lending and credit, but also in the higher purchase market, the market for the leasing of machinery, motor vehicles and various types of equipment, their financial performance is of vital importance to the real economy and to policy

makers. The empirical results from the fixed effects model are presented in Table 5, Panel C. It is evident from the R^2 that the model is a good fit overall. The results show that market share is significant and positively related to finance company performance for our profit rate, ROA, for all periods, suggesting that finance companies benefitted from efficiency gains, particularly with regard to the evolution of performance. For example, the economic conditions in credit markets and the period over the crisis and post crisis-period created pressure on finance companies to drive down cost, and to invest more in IT technologies, which made their products more attractive to customers. This trend is also reflected in ROE, except for the post crisis period, which indicates a negative and significant relationship with performance. We interpret this to indicate a decrease in the share of finance companies in business and household loans and credit as a result of the feverish UK economic conditions following the deep recession, the indebtedness of UK households, the slow recovery of the UK housing market, in addition to tougher market conditions which impacted market share and thus dampened finance companies profitability. The positive and significant impact of MCON on ROA during the periods examined, except for the post-crisis period, suggest that the sector experienced some change from the point of view of concentration with a decrease in the number of finance companies. As is evident from the sign of the coefficient, α_2, there was a clear concentration of business and household loans and credits during the post-crisis period, which reflected the credit crunch in the UK during this period. Further, the sign of MCON indicates a positive and significant relationship with ROE during the 32-year period, and the period of growth, but indicates a negative and significant relationship with ROE during the crisis and post-crisis periods.

Regarding the impact of investment, it is positively related to the profitability of finance companies, indicating a positive relationship between ROA and the returns from investments in stocks, fixed income securities, and other investments, except for the post-crisis period which shows a negative and significant relationship with ROA. One explanation of this result is that the decline in economic growth, the low interest rate environment, and lower dividend receipts, resulted in the portfolios of insurance companies yielding much lower return. The trend reflected in the impact of investment on ROA is also reflected in ROE during the periods under study, except for the post-crisis period and reflects the uncertainties concerning whether the economic recovery will be sustainable and whether the continued speculation surrounding the Eurozone debt crisis will disappear.

The relation between the size variable, α_4, and finance company performance is negative and significant for all sample periods, while it becomes positive and significant during the post-crisis period. It should be mentioned that the effect of size follows a similar trend for ROE. Unsurprisingly, the ratio equity to total assets contributes to the performance of finance companies as the relatively positive and significant coefficient shows during all period for ROA. Probably, the main reason is that well capitalized finance companies were able to signal their capital strength, which enabled them to face lower risks of financial distress and, in doing so, to reduce their funding costs. It is notable that the EQAS coefficient, α_5, is positive and significant for our profit rate ROE during all periods, except for the 32-year period. The coefficient of market capitalization, α_6, is found to have negative and significant effect on finance company performance for the periods under study, except for the period of stable growth. The estimate shows that a 1 per cent increase in market value will increase profitability by 0.12 per cent due to the aggressive expansion of business activity in its main niche markets and which helps to enhance firm value. We find that the stock market coefficient, α_7, has a negative and significant impact on ROA during the periods examined, while having a positive impact on ROE for all periods, except for the post crisis period.

We further observe that GDP has a negative and significant impact on finance company performance during the 32-year and post-crisis period, but the coefficient, α_8, is positive and significant during the period of stable growth and during the crisis period. The reason for this result is that the demand for business and consumer loans, higher purchase agreements and other credit contracts increased during the period of economic growth, as well as during the period of the financial crisis, which resulted in an improvement in the financial performance of finance companies. With regard to inflation, the sign of the coefficient, α_9, is negative and significant for the 32-year and crisis-period, but shows a positive and significant relationship with ROA during the period of growth and the post-crisis period. This result indicates that during these periods inflation was fully anticipated by finance companies managers who, in turn, adjusted lending and credit rates, and rates on higher purchase agreements to reflect conditions in these markets.

We now turn to the performance of real estate firms which, over the period of the present study, has been spurred by the stable growth of the UK economy and by the favourable conditions in financial markets prior to the onset of the global financial crisis. Before we

evaluate the financial performance of real estate firms, a definition of the activities of real estate firms is necessary. Broadly speaking, real estate firms are real estate investment trusts that allow individual and institutional investors to invest in portfolios of large scale properties. The main categories of real estate investment are in industrial, office, and retail properties, although funds are sometimes allocated in other categories of the market such as leisure and residential properties. The performance of real estate firms is of particular interest to fund managers, particularly insurance and pension funds with considerable allocations in commercial real estate, as it is to the UK government and the regulatory authorities who closely monitor the sector, especially given the sensitivity of participants to changes in interest rates.

The analysis of real estate firm's financial performance is reported in Table 5, Panel D, which confirms a number of findings with our profit rates ROA/ROE. First we note the explanatory power of the model's R^2 is weak. Second in evaluating the estimates of the fixed effects model, we find that the relationship between market share, α_1, and real estate firm's performance is positive and significant during the periods studied for our profit rate ROA/ROE. The relationship between real estate company financial performance and market concentration, α_2, is negative and significant for all designated periods, except for the crisis period, which shows a positive and significant relationship with ROA. The coefficient also shows a negative and significant impact on real estate performance during the period of growth and the crisis period, except for the 32-year and post crisis period. One of the striking results is the negative relationship between investment and our profit rate, ROA, during the periods examined, except for the crisis period. For example, we would expect investment to a have positive impact on performance during the period of growth, one that was accompanied by a rising equity market. Thus a higher share of equity investments coupled with increasing returns on the market would be expected to impact performance. Compared to ROA, we find that the coefficient, α_3, is negative and significant for the 32-year period and the crisis period, but shows a positive relationship with ROE during the period of growth, and the post crisis period.

The size variable coefficient, α_4, is significantly and negatively related to our profit rate, ROA, during the periods examined, except for the growth period, which is positive and significant. We interpret the significance of size as an indication of higher efficiency of larger real estate firms operating in a sector, which is dominated by a few large companies. The sign of the coefficient also shows a negative a significant relationship with ROE during all periods, except for the post crisis period.

A positive and significant relationship is observed between the EQAS coefficient, α_5, and ROA during the 32-year and growth period, but is negative and significant during the crisis and post crisis period. The positive coefficient does rather suggest that equity to assets is positively related to the financial performance of real estate companies and, moreover, that well capitalized real estate firms face lower costs of financial distress and, in consequence, were able to manage their funding needs without having to rely on external funding.

Interestingly, the sign of the market capitalization coefficient, α_6, is negative with respect to our profit rate, ROA, for all different periods, except for the post-crisis period. Thus the level of capitalization per se is not a strong indicator of real estate firm's performance with the overall period and the period of growth. This trend is not reflected in the sign of the coefficient, α_6, which shows a negative and significant relationship with our profit rate, ROE, during the periods studied. The coefficient of the FTSE, α_7, our stock market measure, is negative and significant for the period of growth and the crisis period, but is positive and significant during the 32-year and post-crisis period. The findings show that the sign of the FTSE coefficient, α_7, is positive and significant during the period of growth and the crisis period, but is negative and significant with ROE during the 32-year and the post crisis period.

The results, somewhat surprisingly, indicate a statistically and economically insignificant relation between GDP and our profit rate, ROA, during the periods studied. For example, we would expect an increase in demand for commercial and other categories of property during the period of economic growth to increase, and to ultimately result in improvements in the financial performance of real estate firms. We would also expect the results to go in the same direction during the post-crisis period in light of the measures applied by the UK government, and the Bank of England to stimulate the economy. The coefficient, α_8, turns out to be positive and significant with ROE during all periods, except for the period of growth. We note immediately the positive relationship between inflation and the performance of real estate firms during the periods examined, except for the period of the financial crisis. We interpret this result as evidence of the ability of real estate companies to forecast inflation and, in so doing, to take a view on the future direction of interest rates. The sign of the inflation coefficient, α_9, indicate a negative and significant relationship with our profit rate, ROE, during all periods, except for the 32-year period. This result is expected, and reaffirms the

ability of real estate firms to forecast inflation and to interpret the possible direction of interest rates.

Table 5: Balanced fixed-effects panel regression – Empirical Estimates non-bank Financial Institutions

$$\pi_{it} = \alpha_0 + \alpha_1 MS + \alpha_2 MCON + \alpha_3 TINV + \alpha_4 TAS + \alpha_5 EQAS + \alpha_6 MCAP + \alpha_7 FTSE + \alpha_8 GDP + \alpha_9 P + \varepsilon_t$$

Panel A: Insurance companies

Dependent Variable	ROA 1980-2012	ROA 2002-2007	ROA 2007-2010	ROA 2010-2012	ROE 1980-2012	ROE 2002-2007	ROE 2007-2010	ROE 2010-2012
MS	-0.0861	0.2373	-0.3027	0.1789	0.8664	0.6964	0.2580	1.1535
	(-0.5707)	(0.7116)	(-0.9166)	(0.6081)	(2.1243)**	(0.6148)	(0.1860)	(1.7440)
MCON	0.0508	-2.4311	-0.6634	-0.6165	1.0092	-0.7967	2.3861	0.0079
	(0.1246)	(-1.3799)	(-1.0641)	(-1.4128)	(0.9152)	(-0.1331)	(0.9116)	(0.0080)
TINV	-0.3192	-0.4177	-0.2635	-1.0443	-1.5162	-1.5706	-0.5013	-2.8085
	(-2.8360)***	(-1.7761)*	(-1.2366)	(-4.8180)***	(-4.9842)***	(-1.9657)	(-0.5603)	(-5.7639)***
TAS	0.2531	-0.0697	0.2792	0.3770	1.6576	0.7097	1.9541	2.3490
	(2.6324)***	(-0.2967)	(0.6758)	(1.2965)	(6.3782)***	(0.8891)	(1.1266)	(3.5935)***
EQAS	0.3875	0.1544	0.5199	0.5639	-0.2601	-2.0762	-0.3890	-0.4287
	(5.2696)***	(0.6163)	(1.7033)	(2.7258)**	(-1.3089)	(-2.4398)	(-0.3035)	(-0.9217)
MCAP	0.0267	0.1066	-0.0804	0.5733	-0.0697	-0.2525	1.1857	1.2670
	(0.3134)	(0.4543)	(-0.3717)	(4.2950)***	(-0.3029)	(-0.3168)	(1.3065)	(4.2221)***
FTSE	-0.1860	-0.3555	0.0334	0.6096	-2.0487	-1.0227	-3.6005	-0.7512
	(-1.0927)	(-0.8314)	(0.0817)	(1.7816)	(-4.4524)***	(-0.7041)	(-2.0975)	(-0.9766)
GDP	0.3489	1.1457	-0.4538	-0.0405	2.8175	4.2951	3.6465	1.1365
	(1.1456)	(1.5740)	(-0.4750)	(-0.0572)	(3.4224)***	(1.7370)*	(0.9089)	(0.7135)
P	0.1301	-0.3209	-0.0428	0.1437	-0.4709	-0.4848	1.2295	-1.0985
	(0.9978)	(-1.0824)	(-0.1045)	(0.4930)	(-1.3365)	(-0.4813)	(0.7149)	(-1.6764)
R^2	0.650	0.821	0.878	0.972	0.724	0.799	0.867	0.984

***t*-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level.**

Table 5 (Continued)

Panel B: Investment trust firms

Dependent	**ROA**	**ROA**	**ROA**	**ROA**	**ROE**	**ROE**	**ROE**	**ROE**
Variable	1980-2012	2002-2007	2007-2010	2010-2012	1980-2012	2002-2007	2007-2010	2010-2012
MS	-0.0030	-0.1102	-0.0990	0.3013	-0.0061	-0.1051	0.0477	0.0501
	(-0.0573)	(-0.8553)	(-0.6284)	(1.6611)	(-0.1752)	(-1.1529)	(0.3904)	(0.4338)
MCON	-0.0162	-0.0995	-0.1877	-0.1007	0.0064	0.0856	-0.1889	-0.0083
	(-0.2846)	(-0.8995)	(-0.8930)	(-0.2093)	(0.1734)	(1.0884)	(-1.1523)	(-0.0572)
TINV	0.0083	0.1597	0.0360	0.1213	0.0599	0.2060	-0.0663	0.0764
	(0.2089)	(1.5644)	(0.2981)	(1.0406)	(2.2629)**	(2.9114)***	(-0.7060)	(0.9621)
TAS	0.0148	0.1094	0.1474	-0.0749	-0.0693	-0.1109	-0.0793	0.0120
	(0.3699)	(1.2217)	(1.3705)	(-0.7034)	(-2.6032)***	(-1.7435)*	(-0.9480)	(0.1657)
EQAS	-0.1393	0.3823	0.6692	0.6950	0.3198	-0.7922	-0.0359	-0.2080
	(-0.4455)	(0.6026)	(0.8205)	(0.9169)	(1.4003)	(-1.7588)*	(-0.0568)	(-0.4118)
MCAP	0.0020	0.0695	-0.0833	0.0074	-0.0020	-0.0692	-0.1884	0.0231
	(0.0607)	(0.7784)	(-0.6562)	(0.0921)	(-0.0924)	(-1.0916)	(-1.9073)*	(0.4285)
FTSE	0.0229	-0.0904	0.1691	0.2356	0.0472	0.1100	0.2972	0.1119
	(0.4098)	(-0.6183)	(1.0791)	(1.7023)*	(1.2800)	(1.0607)	(2.4311)**	(1.1958)
GDP	-0.2004	-0.4753	-0.5415	-0.2396	-0.0709	0.0453	-0.2289	-0.3777
	(-2.7194)***	(-2.6105)**	(-2.5363)	(-1.0066)	(-1.4633)	(0.3559)	(-1.3755)	(-2.4292)**
P	-0.0605	0.1030	0.1312	0.3312	-0.0106	-0.0664	-0.1069	-0.0009
	(-0.8718)	(0.6664)	(0.7293)	(1.5724)	(-0.2295)	(-0.6068)	(-0.7624)	(-0.0064)
R^2	0.011	0.093	0.133	0.187	0.023	0.149	0.125	0.129

***t*-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level**

Table 5 (Continued)

Panel C: Finance companies

Dependent Variable	ROA 1980-2012	ROA 2002-2007	ROA 2007-2010	ROA 2010-2012	ROE 1980-2012	ROE 2002-2007	ROE 2007-2010	ROE 2010-2012
MS	0.2714	0.2027	1.1288	0.3060	0.2848	0.5475	0.1055	-0.1741
	(3.5336)***	(1.0626)	(2.7422)	(1.0060)	(6.0263)***	(3.9032)***	(0.3953)	(-0.7569)
MCON	0.0697	0.9877	1.4937	-2.1542	0.1273	0.0703	-0.7570	-2.0891
	(0.2621)	(1.5402)	(0.7028)	(-1.2946)	(0.7965)	(0.1695)	(-0.5692)	(-1.1335)
TINV	0.1789	0.2758	0.3658	-0.3995	0.1583	0.2653	0.1084	-0.1664
	(3.7528)***	(1.3239)	(2.2128)	(-1.6539)	(5.4303)***	(2.2100)**	(1.0133)	(-0.6694)
TAS	-0.1574	-0.4641	-0.1862	0.8699	-0.3463	-0.6521	-0.2548	0.3684
	(-1.6746)*	(-1.4483)	(-0.7151)	(1.9149)	(-6.1147)***	(-3.4785)***	(-1.4828)	(0.9727)
EQAS	0.4627	0.5056	0.4039	0.2449	-0.1706	0.1039	0.1003	0.2390
	(4.7146)***	(1.7721)*	(1.0809)	(0.8227)	(-2.9547)***	(0.5316)	(0.4288)	(1.0753)
MCAP	-0.0750	0.1191	-0.8741	-0.7749	0.0110	-0.0541	0.2432	0.0402
	(-0.8511)	(0.6907)	(-2.0250)*	(-1.4882)	(0.2103)	(-0.4518)	(0.8479)	(0.1298)
FTSE	-0.0082	-0.3469	-0.4060	-0.5115	0.0326	0.1842	0.0136	-0.2151
	(-0.0908)	(-1.4697)	(-0.8528)	(-1.2251)	(0.5998)	(1.0756)	(0.0520)	(-0.6610)
GDP	-0.1109	0.8095	1.6963	-0.5429	0.0806	0.2351	-0.8643	-2.0546
	(-0.3486)	(1.3327)	(1.0765)	(-0.4596)	(0.4178)	(0.5553)	(-0.8340)	(-1.7372)
P	-0.0015	0.2698	-0.4059	0.6125	-0.2348	-0.1044	0.4161	-0.1103
	(-0.0107)	(0.8126)	(-0.4547)	(1.5351)	(-2.6669)***	(-0.4694)	(0.7899)	(-0.2671)
R^2	0.276	0.405	0.783	0.851	0.324	0.518	0.397	0.570

***t*-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level.**

Table 5 (Continued)

Panel D: Real estate firms

Dependent Variable	ROA 1980-2012	ROA 2002-2007	ROA 2007-2010	ROA 2010-2012	ROE 1980-2012	ROE 2002-2007	ROE 2007-2010	ROE 2010-2012
MS	0.2150	0.2638	0.4734	0.8969	0.1542	0.4325	0.4837	0.7621
	(1.4675)	(0.7062)	(1.2985)	(1.4571)	(1.2123)	(1.7433)*	(1.3497)	(2.3842)**
MCON	-0.0089	-1.4278	1.3405	-0.1549	0.3220	-1.1170	-0.6043	2.6038
	(-0.0231)	(-1.5178)	(1.0819)	(-0.1030)	(0.9579)	(-1.7881)*	(-0.4961)	(3.3356)***
TINV	-0.0035	-0.1211	0.0938	-0.0405	-0.0261	0.1559	-0.0659	0.0737
	(-0.0813)	(-1.0579)	(0.7943)	(-0.2528)	(-0.6999)	(2.0504)**	(-0.5680)	(0.8856)
TAS	-0.0261	0.9644	-0.8273	-0.7477	-0.1387	-0.0221	-0.1887	0.0173
	(-0.1017)	(1.4299)	(-1.3584)	(-1.0028)	(-0.6224)	(-0.0492)	(-0.3151)	(0.0446)
EQAS	0.3587	0.8905	-1.8114	-4.8052	0.0443	-0.3286	3.1591	1.8031
	(1.4544)	(1.7097)*	(-1.1089)	(-1.7128)	(0.2066)	(-0.9499)	(1.9673)*	(1.2376)
MCAP	-0.0847	-1.1349	0.4410	0.5960	-0.0154	-0.1916	-0.1948	-0.6664
	(-0.3310)	(-1.6887)*	(0.6932)	(0.7712)	(-0.0691)	(-0.4293)	(-0.3113)	(-1.6604)
FTSE	0.0141	-0.1264	-0.0148	0.0656	-0.0471	0.7683	0.1170	-0.2647
	(0.1059)	(-0.3477)	(-0.0422)	(0.1860)	(-0.4073)	(3.1828)***	(0.3394)	(-1.4456)
GDP	-0.0059	-0.2246	-0.0089	-1.3339	0.2571	-0.1536	0.3608	0.7323
	(-0.0345)	(-0.4986)	(-0.0172)	(-2.1805)*	(1.7327)*	(-0.5135)	(0.7131)	(2.3050)**
P	0.0086	0.3001	-1.0249	0.7606	0.0503	-0.4159	-0.8219	-0.3997
	(0.0426)	(0.5765)	(-1.3284)	(1.0808)	(0.2868)	(-1.2029)	(-1.0835)	(-1.0937)
R^2	0.018	0.178	0.317	0.436	0.033	0.321	0.271	0.821

***t*-Values in parenthesis. * Coefficient is statistically is significant at the 10% level. ** Coefficient is statistically significant at the 5% level. *** Coefficient is statistically significant at the 1% level.**

3.5.2 Test for the effects of Risk Shifting behaviour on Financial Performance

In this section we complement the previous analysis by investigating the effects of UK financial institution risk taking behaviour on performance. This exercise can shed light on the link between competition and the changing incentives and opportunities that may affect the risk taking behaviour at financial institutions over the economic cycle. This issue of risk taking is an important dimension, particularly in view of the highly competitive market environment in which the financial institutions in our sample have encountered. This highly competitive market for financial services, especially the highly competitive mortgage market, encouraged the willingness of some financial institutions to engage in somewhat contentious risk taking behaviour, as the commercial banks, insurance companies, and real estate firms regarded the boom in the housing market that resulted in the late 1990s and continued well into the 2000s as an opportunity to raise potential profits (by reducing lending standards), by speculating that the boom in the housing market would continue. We capture the effects of UK financial institutions risk taking behaviour on financial performance through the use of a designated risk variable.

The regression-based tests applied is focused on identifying the breaks, as represented by beta, utilizing the technique proposed by Bai and Perron (1998, 2003a, and 2003b) which will enable us to detect multiple structural breaks at unknown dates. Bai and Perron suggest using a linear regression model with *m* structural breaks (*m* + 1 regimes) as follows:

$$y_t = x_t'\gamma + z_t'\delta_j + \mu_j \qquad t = T_{j-1}+1,...,T_j \tag{3.4}$$

For $j = 1,...,m+1$ and where $T_0 = 0$ and $T_{m+1} = T$. y_t is the observed dependent variable at time t, x_t is $p \times 1$, and z_t is $q \times 1$, and γ and δ_j $(j = 1,...,m+1)$ are the corresponding vectors of coefficients, and μ_t is a disturbance term at time t. The break points $(T_1,...T_m)$ are treated as unknown, and are estimated simultaneously with the unknown coefficients when T observations are available. The objective is to estimate the unknown regression coefficients and the break dates $(\gamma, \delta_1, ...\delta_{m+1}, T, ...T_m)$ when T observations on (y_t, x_t, z_t) are available. On account of the sequential methodology one break point implies estimating *n* regressions, two break points imply estimating n^2 regressions, *m* break points imply estimating n^m regressions, and so forth.

The methodology of Bai and Perron is particularly well suited for capturing the changing risk profile at UK financial institutions over the period represented by the data, as it enables us to identify subsequent patterns from which the asset prices of the financial sectors in our sample are altered. The data used in this section consists of weekly logged sector index returns from which we compute the overall average Beta of the sector indices against the benchmark FTSE100 index for the period January 14, 2000 to December 28 2012. The estimation process consists of two stages. First, we perform the Bai-Perron multiple breakpoint tests and then proceed to estimate the panel-data OLS model from the previous section. Here, and, in preference to the use of a risk variable, we measure a financial institution risk taking behaviour by means of the "Z-score", which considers risk of failure to rely on the interaction of the income generating capacity, the potential size of return shocks, and the level of capital reserves available to absorb sudden shocks. Mathematically, the Z-score is expressed as follows:

$$Z_{it} = \left[\frac{\sigma_i (ROA_{it})}{E_i (ROA_{it}) + CAP_{it}} \right]^2 \tag{3.5}$$

where ROA_{it} is the return on assets of financial institution *i* in period t, $\mathrm{E}_i(.)$ the expected value, $\sigma_i(.)$ the standard deviation, and CAP_{it} the averaged ratio of equity capital to total assets for financial institution *i* in period t. The resulting Z-score should indicate the degree of exposure to operating losses, which ultimately has a drain on capital reserves that could be otherwise employed to offset adverse shocks. Financial institutions with low capital combined with a tenuous financial margin in relation to the volatility of returns will yield a high Z-score. Further, since the Z-score measure assigns importance to the solvency and financial strength of financial institutions, it is a measure of their relative strength or weakness. Soedarmono et al. (2013), for example, applied the foregoing Z-score approach in their study of banking competition and bank risk-taking behaviour.

Table 6 displays the return behaviour for the sector index series with the structural break points as identified via the Bai-Perron test. As can be seen, all return series, except the series for the finance company sector and the real estate company sector, exhibit at least five structural breaks over the full sample period. We detect five breaks for the banking, and investment trusts return series, 4 breaks for the insurance sector, 0 break for the finance company return series,

and 3 breaks for the real estate return series. These identified breaks are linked to either major global events such as the 2007 financial crisis and the economic recession that followed, the fallout from the 2008 UK banking crisis, and the 2009-2012 Eurozone debt crisis. We observe that the banking, insurance, and investment sector return series reveal structural breaks at similar time points which coincide with global economic, and domestic political events. In addition we provide the standard deviations at each of these structural break points identified.

Table 6: Structural breaks in UK Financial Institutions from the Bai-Perron test

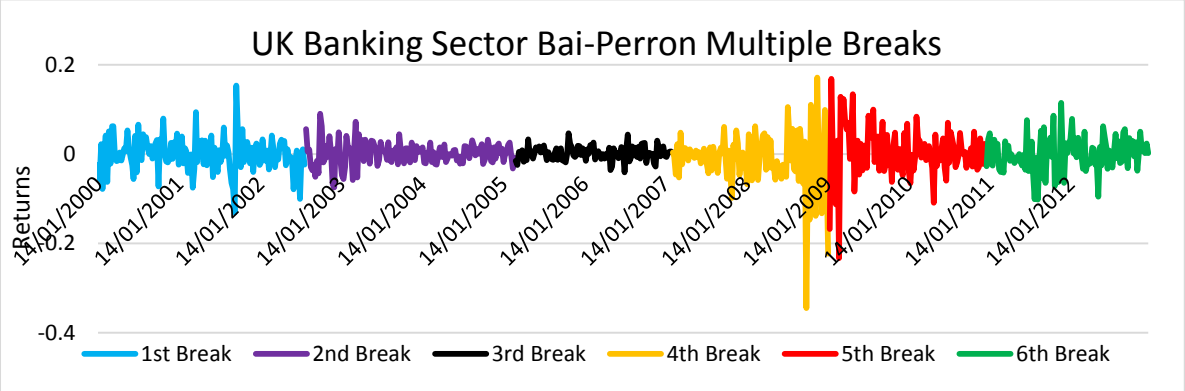
Sector	Break	Time Period	Standard Deviation
Banks	1	01/01/00-02/08/02	0.0385
	2	09/08/02-04/03/05	0.0257
	3	11/03/05-09/02/07	0.0156
	4	16/02/07-16/01/09	0.0627
	5	23/01/09-24/12/10	0.0576
	6	31/12/10-28/12/12	0.0386
Insurance	1	01/01/00-11/01/02	0.0521
	2	18/01/02-19/12/03	0.0487
	3	26/12/02-29/08/08	0.0269
	4	05/09/08-12/11/10	0.0302
	5	19/11/10-28/12/12	0.0221
Investment Trust	1	01/01/00-24/05/02	0.0296
	2	31/05/02-06/08/04	0.0246
	3	13/08/04-28/07/06	0.0178
	4	04/08/06-26/12/08	0.0353
	5	02/01/09-24/12/10	0.0243
	6	31/12/10-28/12/12	0.0177
Real Estate	1	01/01/00-11/02/05	0.0223
	2	18/02/05-09/02/07	0.0234
	3	16/02/07-16/01/09	0.0498
	4	23/01/09-28/12/12	0.0388
Finance Comp.	0	-	0.0262

The first major structural break is associated with the September 11 attack in 2001 and the downturn in UK economic activity that followed as investment and consumer spending decreased. Moreover, the second point change as defined by the increase volatility during the 2008-2009 period are correlated with the UK recession which commenced in 2007 and the UK banking crisis that occurred in 2008, with the subsequent volatility changes being consistent with the Eurozone debt crisis. In the structural breaks for the return series of each index depicted in Figure 3 – 7, the sudden changes highlights and confirms the results in Table 6.

Taken as a whole, it is apparent that before the financial crisis of 2007 several strong and sudden changes occurred, which impacted UK financial institutions in various ways. For example, the financial crisis of 2008-2009 and the subsequent recession that followed, and the 2009-2012 Eurozone debt crisis, affected the profitability, income and activity mix of the banking sector which compelled banks to alter their funding strategies as the financial crisis deepened.

When referring to Figure 3, we highlight times of when the Bai-Perron multiple break point failed to demonstrate structural breaks within the banking sector. We feel these events are significant but a casual observation of the data would suggest breaks are present. For example in March 2001 it is evident there are levels of volatility beginning with a trough period, which can directly linked to the markets expectation of slowed global growth as investors may seek greater returns elsewhere away from equities such as bonds. However, at the end of March 2001 there is a positive shift in the banking sector index, which was associated with a cut in the interest rates from the Bank of England making it cheaper to borrow capital, which ultimately aids the business model of banks through increased lending. Furthermore, when we continue towards September 2001, there is significant levels of volatility relating to the attacks of 9/11, which led to the market to panic sell equities and then rebounded a week later as the markets calmed down. Following on from this in October 2002, we see from Figure 3 there is an evident peak in returns. We feel this can be attributed to an increase in M4 money supply, which led to an increase in prices and greater lending from the banking sector enhanced the overall performance and therefore witnessed a strong positive return.

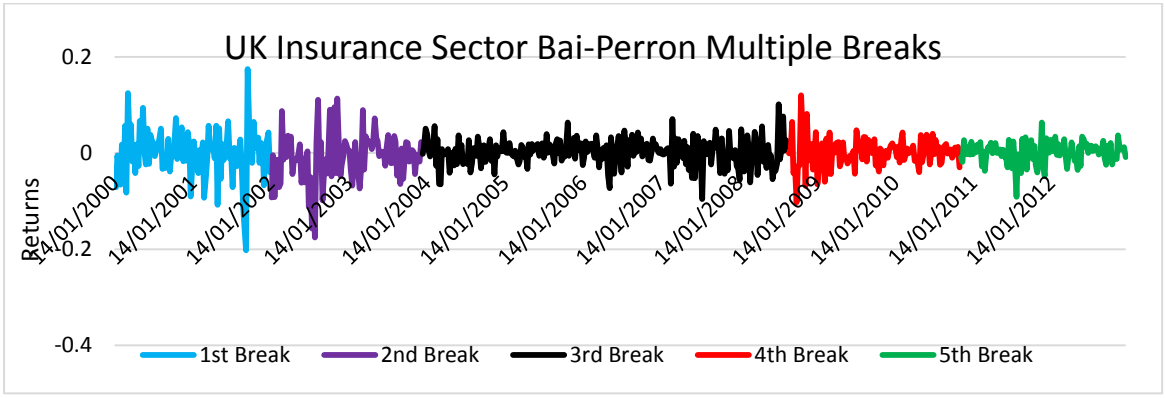
Figure 3: UK Banking Sector Bai-Perron Multiple Breaks



Considering the insurance sector from Figure 4, the strong and sudden character of the changes in the breaks is well in line with that observed for the banking sector, though clearly

the activity mix and funding strategies of insurance companies are affected differently. For example, the financial performance of the insurance company sector was affected by the increase in claims following 9/11, issues surrounding Lloyds of London, which closed 25 syndicates in the aftermath of mounting losses associated with asbestos claims, as well as other claims related to other underwriting activities that generated losses in an environment of increased liabilities and reduced rates. Outside of the identified breaks established by the Bai-Perron test, there is visible volatility in the insurance sector. In March 2000 it is evident there is a rise in returns for the insurance sector. This can be explained by investors shifting their profits made from the technology sector to the undervalued traditional banking and insurance sectors for greater returns. In September 2001, it is evident 9/11 held a vast impact towards the insurance sector within the UK as exemplified by the volatility levels in Figure 4. After the first identified break in 2002, there is clear indication of volatility in November 2002, whereby concerns for the insurance sector became more apparent as the cost of 9/11 continued to increase. This led to solvency issues towards the insurance sector, which was reflected in the equity price by the markets. In order to resolve the issues presented towards the sector, vast efforts were made to raise capital through equity and bond issues or through capital injections from parent companies for subsidiary insurance firms. Lastly, in July 2007 Figure 4 illustrates a strong negative return in the insurance sector which is can be correlated by floods, which hit the UK and held an estimated cost of at least £2billlion in damage claims. Overall this event would have altered the short-term business model to account for such disasters as they would be required to increase their premiums to current customers in order to cover the potential losses amounted.

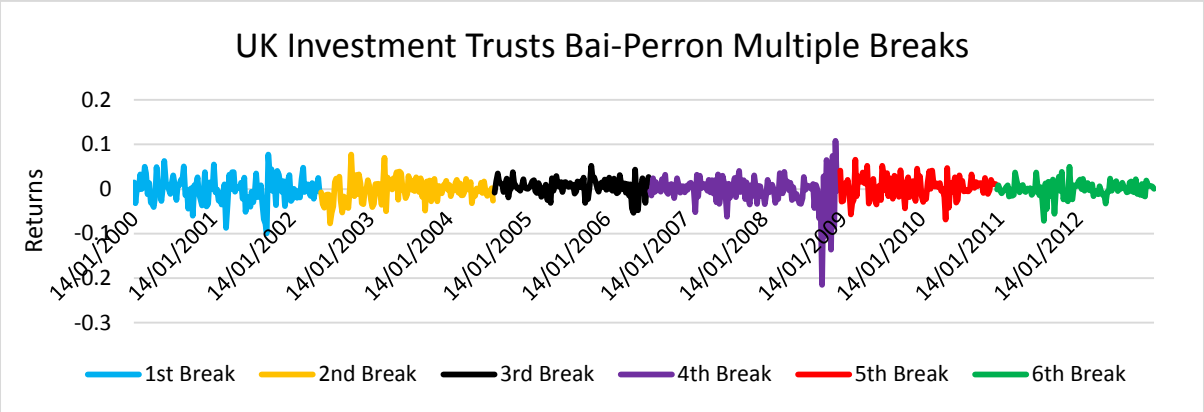
Figure 4: UK Insurance Sector Bai-Perron Multiple Breaks



Looking at Figure 5, the break points for investment trusts are clear and the patterns suggest synchronization with the banking and insurance sector and, moreover, are correlated

with external economic and domestic political events. In particular, following the first major structural break, associated with the 9/11 New York attack in 2001, the decline in UK economic activity, and a major correction in the FTSE 100 from 6700 in 2000 to 5100 in May 2002, ultimately affected the portfolio performance of the investment trusts sector. We can also see in Figure 5 there is very little volatility outside of the breaks among the investment trust sector, which is expected given the nature of their existence.

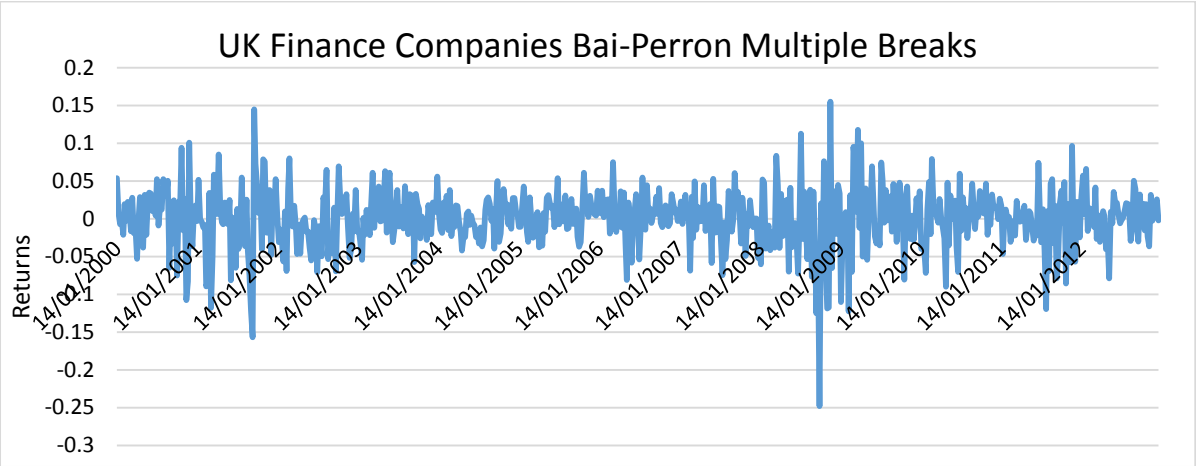
Figure 5: UK Investment Trusts Sector Bai-Perron Multiple Breaks



We notice that the finance companies index return series, shown in Figure 6, indicate no significant break point which we interpret as the market's response being muted. Finance companies are generally a subsidiary of bank holding companies, which may have predetermined the equity prices by the market and may have resulted in the failure to produce a structural break. When referring to Figure 6 it is evident there was large levels of volatility within the pricing of the sector. For example when referring to November 2000, we can see there is a large peak value of 9.4% returns, which can be attributed by the strength of the UK economy, whereby the cost of raising funds was reduced in terms of bond and or selling stock, which overall enhances financial performance of the sector. Following this period of increased equity performance, a negative period emerged in March 2001 which can be correlated towards the banking sector. This negative performance was reflected by the markets concern of growth, which ultimately led to base rate cuts and increased performance by April 2001. Further to this in Figure 6 there is a greater presence of volatility relating to the terrorist attacks of 9/11, which reached a peak of positive 15% return after the losses exceeded -15%. In October 2002 in the finance companies sector, there is a present a positive jump in equity pricing by the markets, which is correlated with the banking sector. This was a result of increase in money supply,

which increased inflation and overall led to improved financial performance due to increase in loans/business activity from the sector.

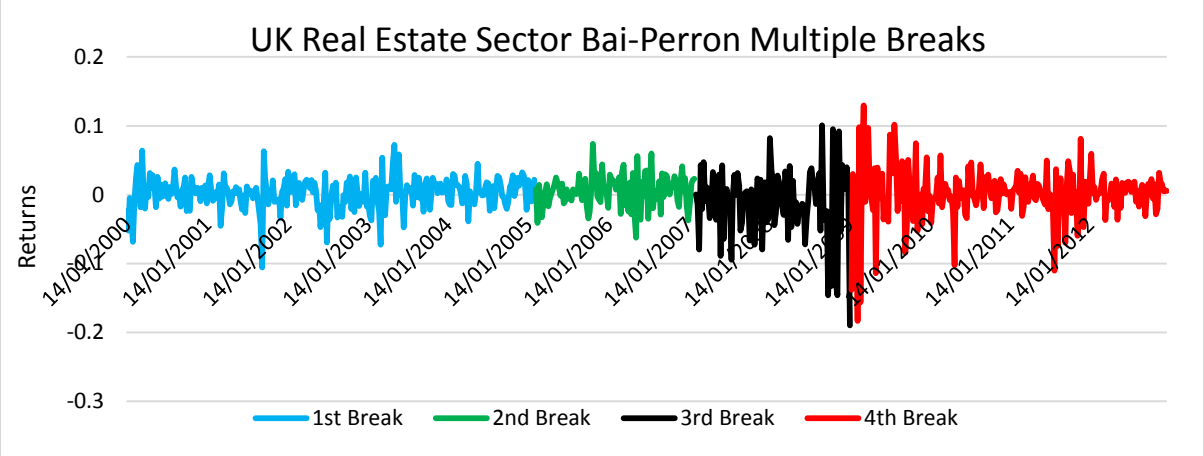
Figure 6: UK Finance Companies Sector Bai-Perron Multiple Breaks



It is apparent from Figure 7 that the real estate sector experienced 3 structural breaks, in 2005, 2007 and 2009, which corresponds to specific time periods of the UK economic cycle. For example, the 2005 structural break is associated with the London attack of July 7 2005, the economic effects of which were short lived and with the London Stock Exchange general index declining for a short period before recovering quickly. The 2005 break may also be explained by two additional events. First, worse than expected GDP growth rate forecasted figures of 1.9 per cent to actually 1.5 per cent, and second increased activity in the housing markets as prices began to peak, which enhanced the real estate sector's financial performance which is reflected in the equity price of the sector. Another feature is the rollover of the break into 2007 which corresponds with the peak, in monetary value, of the sector and the break in 2009 which coincides with the global financial crisis, which impacted the real estate sector causing declining real estate prices, as the crisis impacted the UK economy. Outside of the structural breaks identified by the Bai-Perron test, Figure 7 reveals an unambiguous pattern of volatility within each period. Clearly from about March 2000 there is a direct correlation with the insurance/banking sector with the index appreciating in value. The conclusion is that investors sought to benefit from an over-inflated technology sector by moving into financials which were perceived by the market as being under-valued. The same pattern exist for the real estate sector which corresponds with the period of slow growth coupled with increased uncertainty as a result of the impending invasion of Iraq, which reduced house prices and the declining

performance of the sector. Following the invasion of Iraq, in the latter part of 2003, confidence increased as investors returned to the market and began purchasing equities. At other times outside of the identified breaks, there are signs of high levels of volatility, particularly in 2010 and 2011, which reflects the fact that the volatility in 2010 coincides with the sovereign debt crisis, which highlighted the extent to which the UK financial sector was exposed to Eurozone sovereign debt, and the fact that in 2011 the government sought to stimulate the housing market through the help to buy scheme which induced the prices of housing in the UK market considerably, and directly benefits the real estate sector through increased purchases of housing which then impact positively on their performance.

Figure 7: UK Real Estate Sector Bai-Perron Multiple Breaks



To examine the effects of financial institutions risk shifting behaviour on performance, we obtain a measure of beta which captures the dynamic shifting beta levels within the sectors from the pre-determined Bai-Perron tests carried out. Next we estimate the following EGARCH model from Nelson (1991):

$$lnR_{it} = \alpha_0 + \beta R_{mit}[\varepsilon_{t-1}] + \gamma GOV_{t-1} + \epsilon \tag{3.6}$$

and

$$h = \alpha_0 + \frac{\boldsymbol{ABS}\left(\boldsymbol{Resid}_{[\varepsilon_{t-1}]}\right)}{\sqrt{\boldsymbol{GARCH}}_{[\varepsilon_{t-1}]}} + \frac{\boldsymbol{Resid}_{[\varepsilon_{t-1}]}}{\sqrt{\boldsymbol{GARCH}}_{[\varepsilon_{t-1}]}} + \mathbf{LOG}_{\boldsymbol{GARCH}_{[\varepsilon_{t-1}]}} + \boldsymbol{\beta}_1 + \boldsymbol{\beta}_2 + \boldsymbol{\beta}_n \ldots + \boldsymbol{\epsilon} \tag{3.7}$$

where lnR_{it} in Equation (3.6) captures the logged weekly returns of the sector index on index i at time t, $\beta R_{mit}[\varepsilon_{t-1}]$ the market model, and GOV_{t-1} the 10 year government bond yield which reflects financial market participants expectation of changes in the rate of interest. The

term $\frac{\boldsymbol{Resid}_{[\varepsilon_{t-1}]}}{\sqrt{\boldsymbol{GARCH}}_{[\varepsilon_{t-1}]}}$ in Equation (3.7) represents the leverage effect, $\mathbf{LOG}_{\boldsymbol{GARCH}_{[\varepsilon_{t-1}]}}$ is the GARCH element, and $\boldsymbol{\beta_n}$ the beta measure for the represented period and $\boldsymbol{\epsilon}$ an error term.

To determine the effect a financial institutions risk taking behaviour has on performance, we employ the variable derived from the Z-score which examines the default probability of an institution. With this standardised measure of risk we are able to then determine the causalities of default probability among the variables within our selected sample. Before reporting the results of the estimation of the regression model, as defined by Equation (3.1) and (3.2), the specification of the model is as follows:

$$Z_{it} = \alpha_0 + \alpha_1 ROE + \alpha_2 MS + \alpha_3 TAS + \alpha_4 LDEP + \alpha_5 EAS + \alpha_6 CAP + \varepsilon \quad (3.8)$$

For the nonbank financial institution in our sample, we estimate following:

$$Z_{it} = \alpha_0 + \alpha_1 ROE + \alpha_2 MS + \alpha_3 TAS + \alpha_4 TINV + \alpha_5 EQAS + \alpha_6 CAP + \varepsilon \quad (3.9)$$

Where Z_{it} is the Z-score defined in equation (3.5), CAP is the total capital, and all other variables as previously defined.

3.5.3 EGARCH Analysis

The estimated EGARCH approach which is used to capture the dynamic shifting beta levels within the sectors, reveals the level of risk the financial sectors were exposed to from early as 2000 to 2012. In Table 7 the estimates suggest the leverage effect is present and indicate a negative relationship between the past returns and future volatility of return, with statistical significance found in most sectors. In particular, the banking sector and the finance company sector display the highest leveraged, after experiencing greatest significance and coefficient levels, and highlights the higher leveraging risks these sectors possessed during the period 2000-2012. Clearly, both the real estate sector and investment trust sector are not as affected, for the reason that these sectors were less exposed to the global financial crisis, as their primary activity is not based on deposit taking or in creating loans.

With regard to the government bond variable, our results suggest a positive statistical significance for both the banking sector and the finance company sector. This relationship is

shown between the government bond yield and the returns within the indices, which suggests the markets had priced in the expectation of interest rate changes. Therefore, the banking and finance company sectors' asset pricing was induced by the market influenced by macro-economic factors, which led to the asset price reflecting market conditions rather than institutional performance. The results also indicate a positive shock will have less effect on the conditional variance compared to negative news events. With the conditional variance being the variance of the residuals obtained from Equation (3.7), which may be interpreted as positive news. This is found to generate less variance or volatility than the negative shocks for their sector, which overall reveals the level of exposures exposed by the onset of the financial crisis. Clearly, during times of volatile markets, the equity returns within the model indicate an increase in risk levels which induce investors to move out of equities.

From Table 7 we report the findings upon the changing beta through the EGARCH estimation. For the banking sector, from 2000-2002, we observe a positive beta which indicate increasing risk levels during this period which indicates a higher risk premium for the investors and demonstrates the required higher returns demanded. This period corresponds with a vastly volatile political environment with 9/11 and the dot com bubble in 2001. Following, 2002-2005 beta declined which suggests a rebalancing of risk within investors' portfolios and that the market viewed the banking sector to be a much safer environment than competing sectors, with the banking sector holding less risky assets on their balance sheets and thus a reduced beta value. Furthermore from Beta 2 we highlight the UK economy during this period widened its trade deficit, which indicates increased spending commenced a period of economic growth fuelled by a period of currency appreciation with the Pound Sterling against the US Dollar. This overall created a divergence between the two nation's base interest rates with the UK offering higher rates, which increased foreign investment to the UK economy, which resulted in greater economic conditions. In Beta 3, which covers the period 2005-2007, we demonstrate a strong positive shift in risk which coincides with the favourable conditions in bank credit market and the unfolding of the US subprime mortgage crisis. As the build-up of risk was incorporated into the beta level from the EGARCH estimate. We also note the positive shift in beta can be associated with the need for higher required returns for investors as the base rate endured an increasing trend during this period. The break in 2009 (Beta 4) is linked to when the crisis fully embedded itself to the UK economy with the banking sector suffering from a liquidity crisis due to losses amounted from the housing market, in particular from credit default swaps. Beta 5 we detect a gradual increase in the level of risk before Beta 6, which

corresponds with the period of the Eurozone sovereign debt crisis to which the banking sector was heavily exposed to. Overall, the results are highly accurate in terms of debt exposure to the sovereign debt crisis, especially since European institutions from Eurozone areas carried the highest exposure.

Regarding the insurance sector we establish 5 breaks within the data, from which the sector experienced the largest risk shifts in Beta 1, 4 and 5 from 2000-2002, 2008-2010 and 2010-2012. These periods correspond with crisis periods, the former being linked to 9/11 with the insurance sector paying out claims linked to the terrorist attacks in the US as this was also a market induced asset devaluation due to the increased systematic risk. The latter periods coincide with the sub-prime crisis and the sovereign debt crisis and highlight their large exposure levels, which mean they can be linked to their performance over this period. When identifying the breaks in 2008 and 2010, we can link these to the outbreak of the crisis and post crisis periods. In particular, the break witnessed in 2008 can be attributed to the beginning of the Icelandic financial crisis as well as the sub-prime crisis, to which the UK insurance sector held considerable exposure to. The high degree of exposure led underwriters to create losses as the level of delinquency subsequently increased with the level of interest rates. Furthermore, the witnessed structural break in 2010 can also be associated by the markets signalling the end of the sovereign debt crisis, after all the nations accepted bailouts, which restored confidence in the markets. Performance impacts can be linked to the crisis periods as the insurance sector generated fees in order to insure the mortgages the banking sector created. Therefore, once the crisis periods came to light the market priced the risk accordingly within returns and their response to the exposure held by the insurance sector is reflected by beta.

For the real estate sector, we find fluctuating beta which indicates the degree of negative shift for all betas', except beta 2, for the period 2005-2007 – the pre-crisis period. This suggests the market viewed the real estate sector as low risk because the housing market bubble was in its early formation from 2000-2005, helped by a low interest rate environment in the US. However, from Beta 3 and 4 we observe the occurrence of a large negative shift with statistical significance (Beta 3) which suggests a rebalancing of risk within the real estate sector and increased risk management.

Considering the investment trust sector, the results highlight a common element of continuous risk management within a negative manner. The only periods in which they are significant is Beta 4 and 5, which cover the period 2006-2008 and 2008-2010. These critical

years capture the pre, during, and post crisis periods that coincides with the sub-prime US mortgage crisis, which we interpret as the investment trusts sector being watchful over their investment portfolios by applying appropriate investment strategies so as to minimise risk exposure. This is represented by the negative shifts in beta in relation to the returns of the sector index. Interestingly, there are no identified breaks for the finance company sector, which suggest that risk was managed at a constant rate and, as a result, the sector incurred no shifts in beta from the market's perspective.

Table 7: EGARCH Approach to Identify Changes in Risk.

	Banks	**Insurance**	**Inv. Trusts**	**Real Estates**	**Finance**
Intercept	-0.0006	0.0015	0.0005	0.0017	0.0003
	(-1.0323)	(2.0362)**	(1.3994)	(2.2571)**	(0.4591)
ER	0.8670	0.9770	0.9662	0.9126	1.0000
	(35.3526)***	(19.5010)***	(44.4146)***	(24.0838)***	(34.4069)***
GOV	0.0839	0.0360	0.0013	-0.0259	0.0611
Variance	(3.5444)***	(1.5383)	(0.0938)	(-0.9425)	(2.6132)***
Intercept	-0.0175	-0.1813	-0.5650	-0.2841	-0.2402
	(-0.8609)	(-4.6783)***	(-4.0488)***	(-3.7316)***	(-4.3131)***
$\frac{ABS(Resid_{[\varepsilon_{t-1}]})}{\sqrt{GARCH}_{[\varepsilon_{t-1}]}}$	-0.0211	0.0986	0.2297	0.0921	0.1580
	(-0.8464)	(3.8316)***	(4.7619)***	(2.9142)***	(5.1064)***
$\frac{Resid_{[\varepsilon_{t-1}]}}{\sqrt{GARCH}_{[\varepsilon_{t-1}]}}$	-0.0538	-0.0268	-0.0466	-0.0022	-0.0573
	(-3.8228)***	(-1.7566)*	(-1.4931)	(-0.1209)	(-3.2967)***
$LOG_{GARCH_{[\varepsilon_{t-1}]}}$	0.9964	0.9860	0.9586	0.9733	0.9851
	(682000)***	(241.0809)***	(71.8704)***	(116.79)***	(162.59)***
β_1	2.6531	-7.4819	-10.0765	-4.0547	-
	(2.9979)***	(-3.0024)***	(-1.5706)	(-2.2381)**	-
β_2	-2.0767	-1.0767	-5.0807	0.1676	-
	(-2.6564)***	(-1.2659)	(-1.1031)	(0.0844)	-
β_3	4.1698	-3.8312	-3.1581	-5.4809	-
	(1.8011)*	(-2.8566)***	(-0.9111)	(-4.0002)***	-
β_4	-2.2002	-8.9206	-6.2932	-2.3242	-
	(-5.4905)***	(-3.4145)***	(-3.9438)***	(-1.4445)	-
β_5	-4.0876	-17.7276	-5.8983	-	-
	(-4.8319)***	(-3.2549)***	(-2.7698)***	-	-
β_6	-3.3332	-	-3.1446	-	-
	(-1.3048)	-	(-0.9598)	-	-
R^2	0.649	0.297	0.759	0.44	0.651

Z-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

3.5.4 OLS Methodology Analysis

An important feature of our study is the consideration of the impact of UK financial institutions risk on performance. Interestingly when the Z-score value is the dependent variable we observe a notable change in our empirical estimates, as Table 8 reports. It is clear from estimates for the banking sector that market share is statistically significant and, moreover, indicates the existence of an inverse relationship between market share and risk. This means that the higher the insolvency risk the banking sector is exposed to the less market share the sector holds. From a theoretical perspective we can relate this result by an increase in competition may lead to a reduction in market share, consequently banks take excessive risk as managers are under increasing pressures to increase revenues, which can lead to increased default probability. The loans-to-deposit ratio yields a statistically significant and positive correlation with the risk z-score value, which is explained by an increased loan book that could potentially lead to an increase in loan loss provisions and therefore has the potential to increase probability of default risk default.

Among all other variables within the model for the banking sector, there is no further statistical significance which can explain the risk insolvency probability. Nonetheless, we can comment on the positive or negative relationships within the model. First, ROE is found to have a small positive association with the z-score value and is reflected in improved financial performance, due to increased risk-taking activities during the sample period. Second, the prospect of default risk probability increased as a result. Third, the total assets variable is found to invoke risk insolvency which is explained by institutions taking on more risk exposure, which may lead to an increased in the likelihood of default. Table 8 sheds light on the equity-asset ratio and total capital in determining the z-score value. Regarding the equity-asset ratio's positive result, which indicates when the banking sector is more leveraged, and with the higher default probability being as a result of the sector being capitalised by equity. This observation shows that during the period 2000-2012 it was beneficial for the sector to be funded by debt, which ties in with the build-up of excessive loans being made, and their over-aggressive strategy which ultimately resulted in liquidity problems in 2008. The total capital level yields a negative relationship with risk insolvency, which is explained as bank managers being subject to increased scrutiny to increase profits. Therefore, by holding less capital as their optimal level, the sector was able to build up their loan portfolio and as a result increased the likelihood

of default, which explains why in the post crisis periods there is a much stringent structure of imposed regulation.

The generated empirical estimates for the insurance company sector and investment trusts sector yield insignificant results for all variables, which would seem to suggest the inability of the model to explain the z-score value. The results here may be due to the lack of observations, given that our sample covered the period 2000-2012. With regards to the insurance sector, ROE is positively correlated with the z-score value, which is similar to the banking sector as discussed previously. The ROE contributes to the overall z-score value due to the increased performance that creates equity value which is the result of efficiency gains within the sector, as represented by the net operations of claims exceeding premiums. In addition, market share is observed to yield an inverse relationship with risk insolvency, which is an accurate assessment of the UK insurance sector. This is explained by the high concentration within the UK market, which is dominated by few insurance firms, as well as their size and earnings from premiums, which allow them to reduce their risk insolvency and supports the theory of "too big to fail". The total assets variable suggests otherwise because the more assets the insurance sector holds, the more likely is the increase in insolvency. The negative relationship associated with the investment portfolio of insurance firms and risk insolvency is to be expected given the nature of their business. For instance, insurance firms accepted fees for providing insurance cover for mortgage loans advanced by banking firms in the build-up to the 2007-2009 financial crisis which, in turn, encouraged them to increase their investments in securities such as stocks and bonds, and to reduce their probability of default value. However, once the crisis took hold, this resulted in a decline in portfolio value and in a negative outlook for insolvency risk as reduced investments led to the availability of less funds for meeting known and increasing liabilities. When turning out attention towards the equity-asset ratio there is a small positive relationship towards the risk insolvency. The ratio would seem to suggest that insurance firms were negatively affected as a result of their high holding of equity securities, which may be considered wasteful capital in assuming more risk. This is enhanced by total capital yielding a positive correlation with risk insolvency probability.

The results regarding the investment trusts' sectors inverse association with ROE with our z-score value suggests the strategies employed by fund managers failed to deliver adequate investor returns which result in increased probability of default, particularly since investors are free to search for alternative investment opportunities with the prospect of obtaining higher rates of return. As Table 8 shows, there is no relationship between the variable market share

and our z-score value. Total assets is found to have a negative relationship with our z-score value, which implies that the investment trust sector is reliant on investors for funding, since a reduction in total assets would ultimately increase the prospect of default. Further the relationship between total investment portfolio and insolvency risk indicates a positive relationship which is expected, as the more investments held by the trusts in securities, exposes the trust to a higher degree of market risk. Regarding the equity to asset ratio and total capital of the investment trust sector, both variables show a positive relationship with our z-score. And although the equity-asset ratio can be defined by as investment trusts holding high levels of equity, this suggests that investment trust capital is not utilised to the maximum, as they are required to invest in capital market securities in order to generate high shareholder returns. Hence the total capital level has a positive influence through the holding of more capital which enables the investments trusts to increase their holding of securities and, by doing so, increase their default probability.

The estimates for the real estate sector, shown in Table 8, indicate a positive relationship with the total investments variable and with our z-score value. The findings here are similar to the reported results for the investment trust sector, as the higher the value of the investment portfolio the greater the associated risk. This is because market fluctuations can increase the probability of default during times of market instability, as the global financial crisis demonstrated, when the number of defaults increased leading the housing market to crash and, in consequence, the repossession of houses by the financial sector and ultimately reduced property prices and land values. Estimates for the finance company sector indicate a positive and statistically significant relationship with the variable market share, total asset, equity-asset ratio and the total capital variables within the model. First, we find a negative relationship between market share and risk, which suggests increased competition within the UK finance company sector led to the sector making riskier investments, which increased the overall probability of default. To support this observation, we find total assets to have a positive impact on our z-score value which, suggests the sector took on more assets as a result of increased competition. And, as with the other sectors included in our study, the finance company sector demonstrates a positive equity-asset ratio with statistical significance and highlights the need for the sector to fund their activities through loans so as to present a low default risk profile. This observation is similar to the banking sector, since we would expect a negative relationship to arise with total capital. Finance company managers were subject to increased pressure to

produce higher profits, which they could only do by holding less capital as their optimal level, to increase their portfolio and as a result increased the likelihood of default.

Table 8: Balanced panel OLS regressions fixed effects results

	Banks	**Insurance**	**Trusts**	**Real Est.**	**Finance**
ROE	0.0125	0.0080	-0.1314	0.1129	0.4953
	(0.9248)	(0.1185)	(-1.3382)	(1.4974)	(1.4754)
MS	-0.8593	-0.3646	0.0041	0.2108	-0.9252
	(-1.8465)*	(-0.6585)	(0.0247)	(1.0664)	(-2.6464)**
TAS	0.4276	0.2742	-3.0037	-1.4846	1.1101
	(0.5612)	(0.6811)	(-1.0934)	(-1.2487)	(2.4933)**
LDEP	1.2837	-	-	-	-
	(1.7233)*	-	-	-	-
TINV	-	-0.0599	0.5017	0.1446	0.0353
	-	(-0.1841)	(0.6135)	(2.7879)***	(0.2706)
EQAS	0.9146	0.0683	2.3014	0.2717	0.9564
	(1.0214)	(0.1887)	(0.8150)	(0.4878)	(2.1616)**
CAP	-0.0953	0.1096	0.5395	1.1602	-0.8184
	(-0.1504)	(0.9721)	(0.3873)	(1.1432)	(-2.6175)**
R^2	0.736	0.582	0.027	0.884	0.630

t-statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

3.6 Conclusions

The study investigates the performance of UK financial institutions, namely banking firms, finance companies, insurance companies, investment trust companies, and real estate companies, over the period 1980-2012 which corresponds to good, turbulent, and post turbulent years for the UK economy. The purpose was to combine a set of firm specific determinants as instructed by the literature on bank profitability and, a measure of investment, that could accurately represent a driver of profitability for the non-bank financial institutions included in our sample, in order to examine their influence on the profitability of UK financial institutions. In so doing, we deliberate several internal ─ firm specific ─ and external ─ market related ─ determinants from the extant literature.

The performances of UK financial institutions are evaluated by using a balanced fixed-effects panel regression model. Our estimates showed that the combined set of variables for the banking sector demonstrated the overall explanatory power of the model. We conclude banking in the UK earn greater profits due to the highly concentrated market from which there is evidence of collusion present in the market, which validates the SCP hypothesis. This result is a challenge now put forward to the competition regulators within the UK as banks are able to earn higher profits due to the monopolistic conditions which they operate within. We come to conclude the SCP hypothesis does not hold primarily across all non-bank financial sectors examined.

Additionally, external macroeconomic conditions are found to be a major driver of profitability for the financial sectors as a whole. The macroeconomic variables examined provide a great insight into the determinants of profitability for the financial sectors of the economy as variables such as GDP, inflation and market capitalization essentially underpin the overall performance.

We conclude the risk-return hypothesis is evident across the financial sectors apart from the insurance sector. This highlights the overall importance of risk management within the financial sectors, which is a pivotal variable in order to determine performance. When we examined the risk variable further we were able to demonstrate the changes in risk from the equity prices through identifying the structural break. The breaks identified coincide with significant political or economic events, which highlights the extent of risk management being portrayed by the financial sectors. Moreover, we establish variables such as investment portfolio (LDEP for banking sector) and the equity-asset ratio to determine risk across the

financial sectors. In addition we find capital endures a negative relationship towards although not statistically significant in the banking sector (finance company sector enjoys statistical significance). These results can overall aid regulators, central banks and the financial institutions themselves in order to gain improved performance for the financial sectors and economy as a whole.

Although the results produced from this study shed a new light towards the UK financial sector. I personally call for more research within this field in order to enrich the literature and help develop a greater understanding of the financial sector, furthermore to confirm or reject the findings.

CHAPTER 4

Explaining the Changing Risk Profile of UK Financial Institutions: Non-Crisis and Crisis Related Periods

4.1 Introduction

The financial crisis of 2007-2009 revealed that UK financial institutions search for higher returns, and coming with it, increasing risk, can sometimes impact negatively on their financial performance which ultimately has consequences for the investment and growth prospect of the economy if business and the household sector are caught in a credit crunch. For this reason the government took steps to reform the failed tripartite regulatory system while at the same time stressing the importance of adequate capital and the need to strengthen bank risk management processes so as to limit systemic risk. It is for these reasons why the measurement of expected returns and risk continues to dominate the finance literature. On the issue of risk and return, the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) Mossin (1966) remains an important model for quantifying the risk return relationship and argues that the only relevant risk measure is the beta coefficient which reflects the systematic risk. Owing to the models appeal and strength of predictions, the model continues to be widely used by financial practitioners and investors to estimate various kinds of risk, such as, for example, cash flow, the cost of capital or the performance of managed funds. Nonetheless, despite the models intuitive appeal, the model has come under increasing examination as empirical findings suggest that asset returns cannot only be explained by the market beta. This is because a number of studies, such as Banz (1981), Bhandari (1988), Jegadeesh (1990), and Fama and French (1992) have shown that average returns may be determined not only by firm size, earnings yield and leverage, but also book-to-market and prior return.

A key element of the CAPM is the assumption of constant betas during a rising and falling market. But if beta varies with market conditions, then it is likely that deductions based on its stable make-up can be found to be misleading. In respect to this, Fabozzi and Francis (1977) who were the first to test the stability of betas over the bull and bear markets, found no evidence to support the hypothesis that stock market affects betas asymmetrically, while in their study Woodward and Anderson (2009) argued that the publication of separate alphas and betas over bull and bear markets by investment houses highlights just how significant the beta/market condition relationship is. In addition to these studies, Clinebell et al. (1993) report

that differences in the beta coefficients they discovered over bull and bear market conditions were significant, while Wiggins (1992) note that the dual-beta model of Fama and French (1992) better explains portfolio returns formed by size, past beta and historic return performance, and Reyes (1999) who studied the relationship between size and time-varying betas finds no statistical power for both small and large firm indexes of the UK market.

As highlighted by Brooks *et al.,* (1998) and Faff *et al.,* (2000) their research provides a great insight into the performance of modelling techniques surrounding estimating a time varying systemic risk variable, beta. The approaches in which they adopt are namely the M-GARCH model's presented by Bollerslev (1990), which utilises conditional variance estimates produced by GARCH (1,1), from which are then able to construct a conditional time varying beta series. They also apply the time varying heteroskedastic market model produced by Schwert and Seguin (1990) as well as the Kalman Filter algorithm, as utilised by Black, Fraser and Power (1992), Adrian and Franzoni (2009), Zhou (2013) and Ortas and Moneva (2013). Engle and Kroner (1995) produced a more stable GARCH-M model through a BEKK model, which is the conditional covariance matrix, there onwards can generate a conditional beta series. Since the BEKK introduction from Baba et. al (1990), it has been utilised by many authors in their quest to capture the time varying beta studies from Choudhry (2005), Mergner and Bulla (2008) and Choudhry and Wu (2009) being examples. Further methods have also been implemented from the literature gathered through the rolling regressions technique, which was first suggested by Fama and Macbeth (1973) to estimate a time varying beta along with Groenewold and Fraser (1999). However, more recently studies have also incorporated the rolling regression method through Zhou (2013) and Celik (2013). The aforementioned studies, have not the established the differing behaviour of time varying beta across the UK financial spectrum, more importantly pre and post crisis period. Given these methods highlighted above we will implement five methods within this chapter to capture the time-varying beta of the UK financial sectors. We apply the Kalman filter with a random walk as outlined by Harvey (1993) and Hamilton (1994), the rolling regression technique as highlighted by Fama and Macbeth (1973), the third method we apply is the dynamic conditional correlation GARCH (1,1) (DCC-GARCH) approach, proposed by Engle (2002). The fourth method is the bivariate diagonal BEKK GARCH model as presented by Engle and Kroner (1995) and lastly we apply a GJR-GARCH model introduced by Glosten et al. (1993).

The research set forward will aim to answer the question how did beta ultimately vary throughout 2000-2012 as well as between the differing UK financial sectors? From which we

develop hypotheses in order to aid our attempts to answer the research question set. The contribution of this study will enable us to identify how the risk profile of UK financial institutions altered at an advanced level over stable and volatile periods as well as how to manage risk which can produce greater economic stability. As of yet there is no study that solely focusses upon explaining the UK financial sectors time-varying beta across recent periods that capture the financial crisis. The findings of our empirical study may be of interest to managers of financial institutions, investors and policy makers concerned with the movement of the systematic risk of the UK financial sectors. An important concern for policy makers in times of crisis is how best to contain and manage risk. This applies even more so as the goal of maintaining a stable financial system has received much importance following the global financial crisis and the European sovereign debt crisis. In addition, our empirical findings are relevant given the continuous discussions on financial regulation and the focus on risk measurement and the management of risk. Importantly, effective policy measures can only be based on a firm understanding of the risk that present itself in financial markets of which stock price volatility plays a central role, reflecting the uncertainty of market participants.

In short, our results illustrate that the insurance sector possesses the highest systematic risk across all financial sectors and holds greatest variability in terms of time-varying beta. This can be explained through the insurance sector underwriting the loans from banking and non-banking institutions as well as underwriting all forms of insurance to earn premiums and manage risk within their business model. We also find the banking sector also possesses a high degree of systematic risk following the modelling of the time-varying beta. Naturally, one would expect these sectors to present a higher beta due to the size of the UK banking and insurance sectors. It highlights these two sectors in particular held a large degree of risk from which the market priced accordingly in terms of their beta values as these sectors reacted greater than the rest of the market during the crisis period. Our findings also suggest the highest precision of in-sample forecasting is most suited to rolling regression technique in accordance with the Mean Squared Error (MSE). We also find the Kalman filter approach illustrates its superiority over all other methods consistently via the modified Diebold and Mariano test statistic in the short-term.

The chapter is organised as follows. Section 2 reviews the existing literature, Section 3 illustrates the empirical approach of the study. Section 4 highlights the results and Section 5 concludes the chapter.

4.2 Review of the Literature

As it currently stands there is no literature to our knowledge which is relevant to our study in terms of investigating the changing risk profile of UK financial sectors from a beta standpoint. There are few studies that even consider UK markets for investigation for the stability of beta. So immediately the study we undertake will become a starting point within the literature to open a debate upon the nature of risk management among UK financial institutions over the economic cycle. Historically, studies within the existing literature hold a primary focus towards the stability of beta within the CAPM since its creation by Treynor (1961, 1962), Sharpe (1964), Lintner (1965) and Mossin (1966) off the framework of Markowitz (1952) theory on diversification. To this present day it is still actively used by fund managers along with modern portfolio theory. The first strand of literature we introduce is the stability of beta within the CAPM model, which is the main criticism of the model. Jacob (1971) first identified this issue as time progresses so does the behaviour of markets and therefore beta theoretically follows a time-varying nature. Blume (1971) also examined the behaviour of risk over time with the results confirming Jacob (1971) that beta is time-varying. Additionally, Blume (1971) illustrated that once a time-varying beta was regressed within their model, greater accuracy of results prevailed in the forecasting of risk. Following Blume (1971), extensive research from the academic community continuously questioned betas' stability within the CAPM with studies from Fabozzi and Francis (1978), Sunder (1980), Alexander and Chervany (1980), Bos and Newbold (1984), Collins *et al.*(1987), Faff *et al.* (1992) and Kim (1993) all deriving beta to be time-varying.

Following the debate of the stability of beta within the CAPM, the literature disperses into the most suitable techniques to capture the time-varying beta. The next strand of literature we begin from here is from Brooks *et al.* (1998), which investigated three different estimation techniques of a conditional time-varying beta, the multivariate generalised GARCH, the Schwert and Seguin (1990) and the Kalman filter approaches. The aforementioned techniques were applied to the Australian industry indices and the Australian stock exchange (ASX). Once the conditional betas were calculated Brooks *et al.* (1998), then estimated in and out of sample forecasts in order to derive the most accurate method of conditional time varying beta as well as re-apply the estimates into an OLS regression to compute the CAPM. Their research highlights the unconditional estimates of systematic risk is not stable over time and such information should not be disregarded. Overall the results from Brooks *et al.* (1998) highlight the best approach to calculate returns is to undertake the Kalman filter in both in-sample and

out-of-sample forecasting. However, each method does provide a similar parameterisation of risk once comparing their mean values. Brooks *et al.* (1998) further note that the Kalman filter and Schwert and Seguin approaches produce a lower level of variation in comparison to the GARCH approach, which illustrates a higher varying beta. The mean absolute error (MAE) and mean squared error (MSE) were calculated and found to yield similar results, which highlights the Kalman filter as the best approach. Faff *et al.*, (2000) follows Brooks *et al.* (1998) by investigating the performance of multiple modelling techniques that estimate time varying systematic risk in the UK equity indices. The techniques explored by Faff *et al.,* (2000) include many types of GARCH models, specifically utilises the EGARCH approach proposed by Nelson (1991) as well as the TARCH model proposed by Glosten, Jagannathan and Runkle (1993) and Zakoian (1994). Further to the GARCH models, the Kalman filter algorithm was used with three approaches from Harvey (1993) and Hamilton (1994), which account for the random walk, random coefficient and auto regressive estimation approaches as well as utilising the Schwert and Seguin (1990) approach. Faff *et al.,* (2000) then construct an in-sample forecast and utilise the MSE to determine the differences in forecast. Further to this, the modified Diebold and Mariano test statistic is applied as arranged by Harvey *et al.,* (1997). The overall results suggest that beta is unstable over time and systematic risk is time-varying. Furthermore, as Brooks *et al.,* (1998) highlight, the best method is found using the Kalman filter with the random walk specification, which consistently out-performs the other methods in the study. However, Faff *et al.*, (2000) also mention that each method may capture different aspects of the time-varying beta as well as all models under-estimated the size of returns and lacked sensitivity. Choudhry (2005) focused his research upon the Asian financial crisis and investigates the time-varying nature of beta. Choudhry (2005) applies a BEKK GARCH model in order to capture the conditional time-varying beta as proposed by Engle and Kroner (1995). The study concentrates on the changing economic conditions countries suffer as a result of crisis periods, from which Choundhry (2005) highlights specifically 10 Malaysian and 10 Taiwanese firms, reaction in beta to such periods. Overall the contribution of the paper illustrates Malaysian firms were more affected in terms of beta changes in comparison to those in Taiwan. The results collated further illustrate that as the crisis period takes a firm grip, the firms experience a higher degree of systematic risk. Whereas countries not as affected by crisis periods (Taiwan - experienced the least volatility of Asian financial crisis) show beta to remain more stable. Mergner and Bulla (2008) continue to build the recent literature within this field of conditional time-varying beta. Mergner and Bulla (2008) estimate the conditional beta via two Markov switching models, two Kalman filter approaches, bivariate stochastic volatility

model via Monte Carlo likelihood estimation and a bivariate GARCH (1,1) model. Their results are in line with previous research as the Kalman filter approach with a random walk is the model which yields the most accurate forecasts across European sector betas as well as confirming beta is unstable over time. Surprisingly, other results worth of note is that the non-linear modelling via Markov switching model is found to yield the most inferior results in comparison to all other techniques utilised within the study.

The next strand of literature to be introduced is of high importance due to the recent developments made in the debate of systematic risks time-varying nature. Choudhry and Wu (2009) focussed their study on UK firms from which they examined the forecast ability of beta via four different methods; the bivariate GARCH, bivariate BEKK, bivariate GJR-GARCH as well as the Kalman filter. Choudhry and Wu (2009) apply the MSE and MAE as well as perform the modified Diebold and Mariano test in order to determine which method is most accurate to forecast out-of-sample stock returns. The results found show conclusive evidence, from the forecasts errors as well as the Diebold and Mariano tests, further supports the Kalman filter as the most desirable method in order to compute beta forecasts as well as fully supporting the notion that beta is time-varying. Zhao (2013) further contributes to the literature by concentrating on REITs within the US equity indices. The techniques adopted within this study include DCC-GARCH model from Engle (2002), rolling regression from Fama and Macbeth (1973), Schwert and Seguin (1990), Kalman filter and the Markov switching model following the process of Hamilton (1989). Zhou (2013) assessed the techniques like previous work via the MAE and MSE, from which the Kalman filter remains consistently the best technique. However, the Markov switching model is found to be highly accurate in terms of in-sample forecasting along with the DCC and Rolling regression. Once out-of-sample forecast accuracies are taken, the Markov switching model results are in line with previous research as it being an inferior technique. Further analysis is conducted via the modified Diebold and Mariano test, with the results yielding a positive result for the Kalman filter as the superior technique in comparison to every other method. Celik (2013) a more recent study investigated the behaviour of sector betas in the Turkish stock exchanges utilising the rolling regression and recursive regression techniques during the global crisis period of 2007-2009. The results illustrate that beta is not stable over time and investors should be wary when making an investment decision as well as managing a portfolio.

Following the literature above we firstly hypothesise and expect beta to be a time-varying variable as given by the studies which we have highlighted as given by Jacob (1971), Blume

(1971), Fabozzi and Francis (1978), Alexander and Chervany (1980), Bos and Newbold (1984) and Faff *et al.,* (1992). Secondly, we hypothesise the banking sector possessed the greatest risk profile as determined by the market given the events that followed from 2008 onwards with the record bailouts. This hypothesis is given by Choudhry and Wu (2009), which call upon the academic community for further research within the time-varying beta concept. Lastly, we create a hypothesis concerning the techniques of modelling time-varying beta as there seems to be a debate within the literature regarding which method deemed most accurate. However, we expect the Kalman filter to be the most accurate method in modelling of time-varying beta due to its nature of not being a regression model but rather an algorithm as given by Brooks *et al.,* (1998), Mergner and Bulla (2008), Choudhry and Wu (2009) and Zhou (2013).

4.3 Empirical Approach

4.3.1 Data

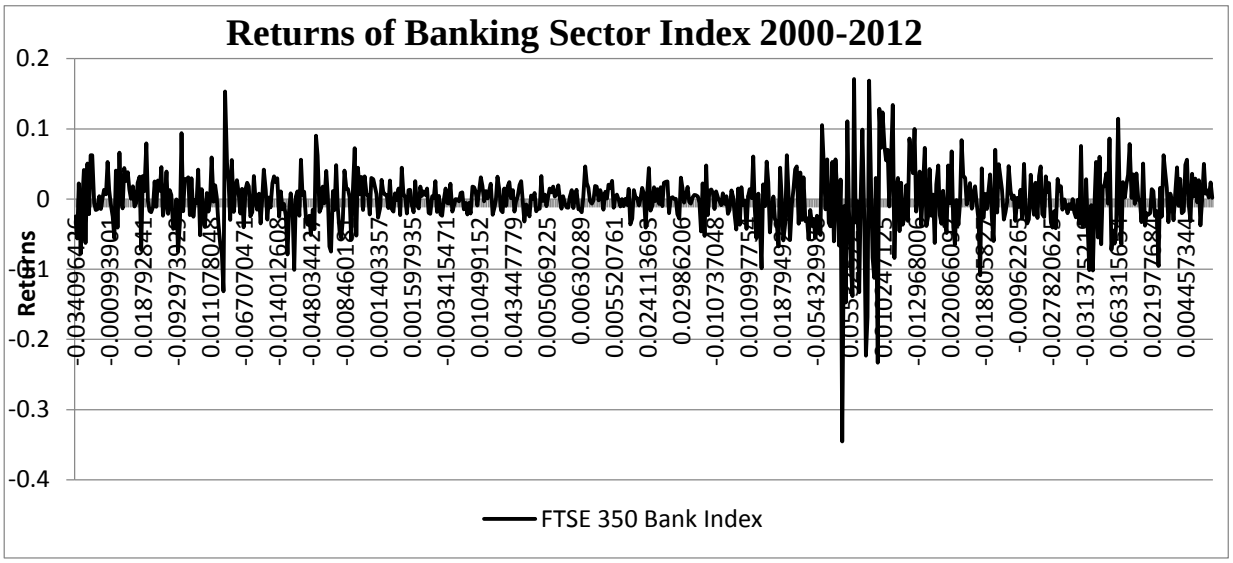
Our empirical analysis relies on weekly return data obtained from Bloomberg for the period January 2000 to December 2012 which is restricted to the FTSE 350 Banking index, the FTSE 350 Insurance index, the FTSE 350 Real Estate index, the FTSE 350 Investment Companies index, the FTSE 350 Finance companies index, and the return series of the benchmark market portfolio which is the FTSE All-Share Index. The choice of the data range is based on the availability of the data and because the range includes periods of economic crisis and political events corresponding to various shocks which impacted global markets negatively, including the New York attacks in 2001, the London attack in 2005, the global financial crisis of 2007-2009, and the Eurozone debt crisis of 2010, which allows for a better understanding of market volatility. Therefore, the period will allow us to make inferences regarding the link between the return series. The main reason for using weekly returns is that it will allow us to identify the shifts in beta across these financial sectors over an extended period of time. Since we include the market model in our estimation, it is necessary to use returns rather than excess returns as theory suggests. This is because importance is given, more often than not, to absolute profit and loss. Thus we define $r_t = \ln P_{it} - \ln P_{it-1}$.

The results for the logarithmic return series over the sample period are shown in Figure 1. We observe that banking sector returns volatility increased quite dramatically, in comparison to the return series of the other four financial sectors included in our sample, in the period that

coincides with the contagion effects of the 2007 financial crisis which started in the United States (US), which were widespread and global, and which resulted in a UK banking crisis when a loss of investors' confidence in the value of securitized mortgages resulted in a liquidity crisis. As the crisis unfolded it revealed, in the autumn of 2008, the full extent to which financially distressed UK banks carried high debt, high-risk investments and, moreover, were over reliant on short-term financing, thus leading many banks to insolvency. As short-term credit markets froze, and with the UK financial system on the verge of collapse, the Bank of England and the UK government stepped in to rescue financially distressed banks by providing liquidity assistance. The crisis not only affected consumer confidence, but also investment and economic growth. To maintain liquidity of the banking system, as well as to ensure bank lending to the corporate and household sector, the Bank of England applied measures aimed at stimulating the UK economy including the reduction in Bank Rate to 0.5 per cent, its effective lower bound, and in making large-scale asset purchases or quantitative easing. At the same time investors perceived a higher risk to most investments and, in consequence, purchased perceived safer investments such as gold and a flight to quality investments such as government treasury securities resulted. The figure also shows that insurance sector and finance company sector return series display sharp but moderate increase in volatility, particularly in 2001 which coincide with the 9/11 New York attacks, and the dot com bubble of 2002, while the investment company return series indicate minimal levels of volatility.

From a visual inspection of our weekly volatility of the financial sectors, displayed in Figure 2, we find that the banking and insurance sectors display quite a dramatic increase in the level of volatility which again corresponds with the global financial crisis, after which, in early 2009, the global markets experienced a deterioration in macroeconomic outlook which caused a further volatility but the increase was not as dramatic, followed by a phase of stability and tentative signs of recovery in late 2009. After that, a mild form of volatility erupted due to the onset of the Eurozone sovereign debt crisis over the period 2010–12. It is noticeable that both the real estate company sector and the finance company sector display dramatic levels of volatility during stable time periods while the investment company sector display a moderate level of volatility. On account of the volatility levels indicated by the return series, we would expect changes in beta to coincide with the volatility dynamics displayed in Figures 1 and 2, as well as for there to be lower variations in beta (risk) across the UK financial sector during periods of growth and stability, particularly for the banking, insurance and finance company sectors.

Figure 1: Returns of Financial Sector Indices 2000-2012



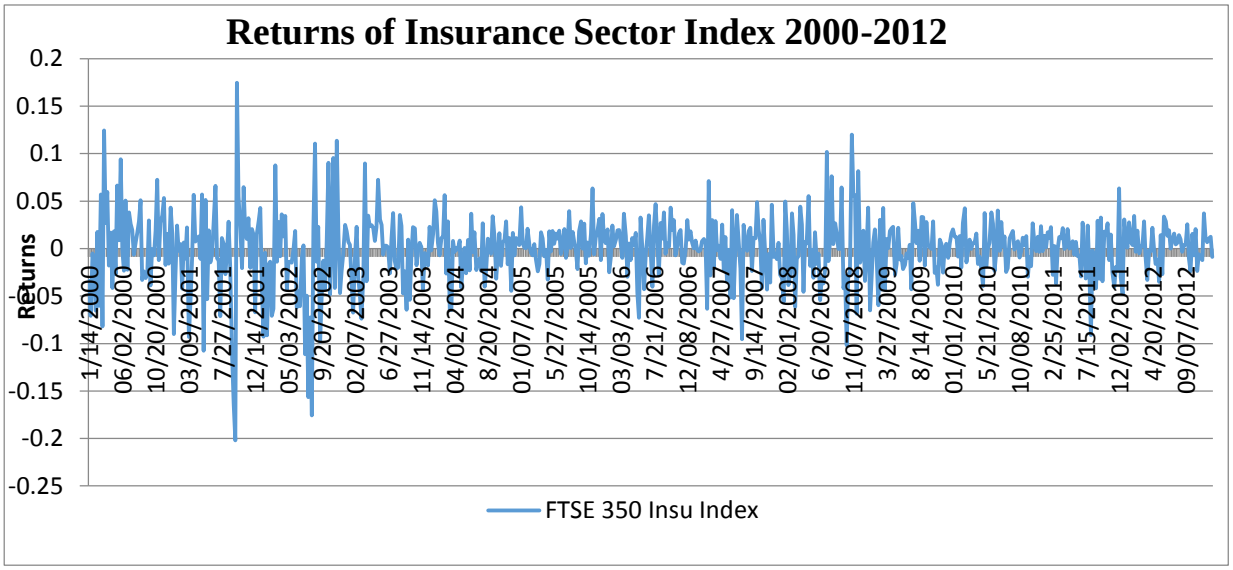
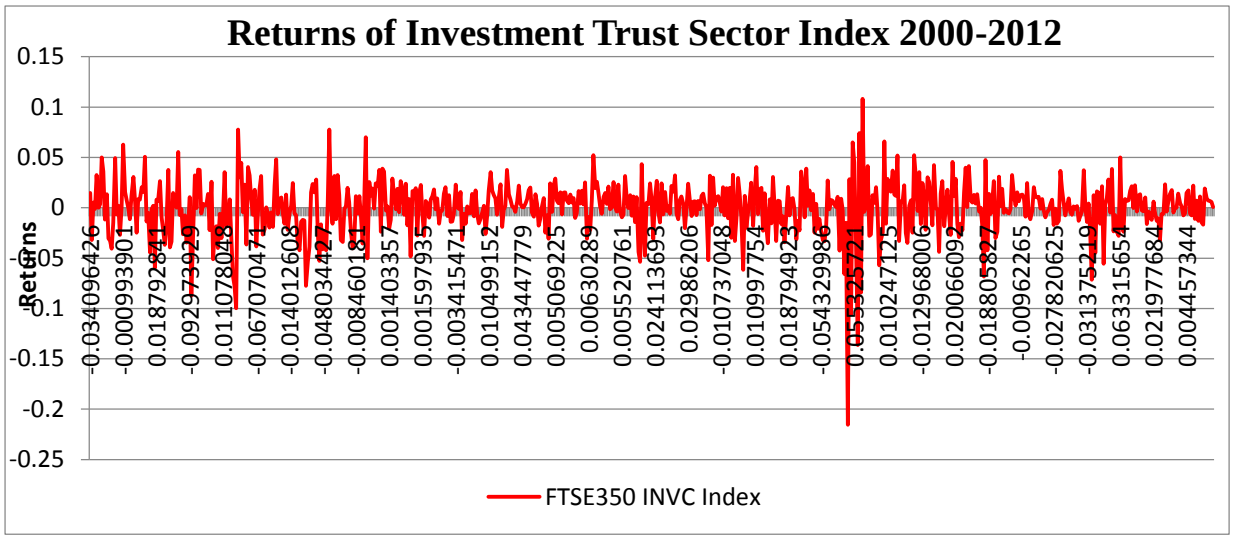
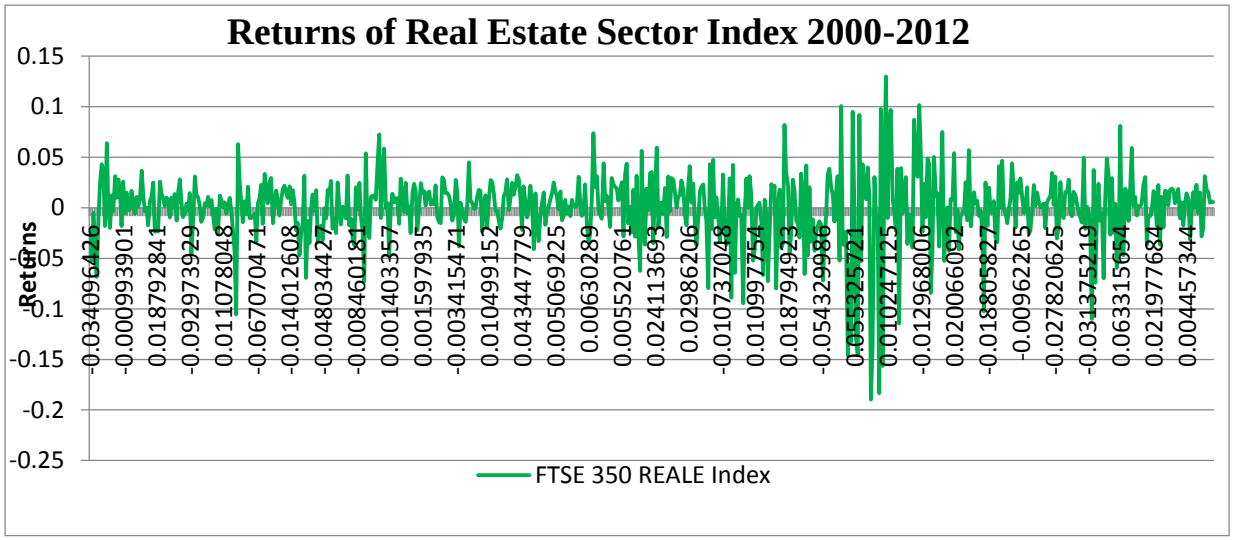


Figure 1 Continued.





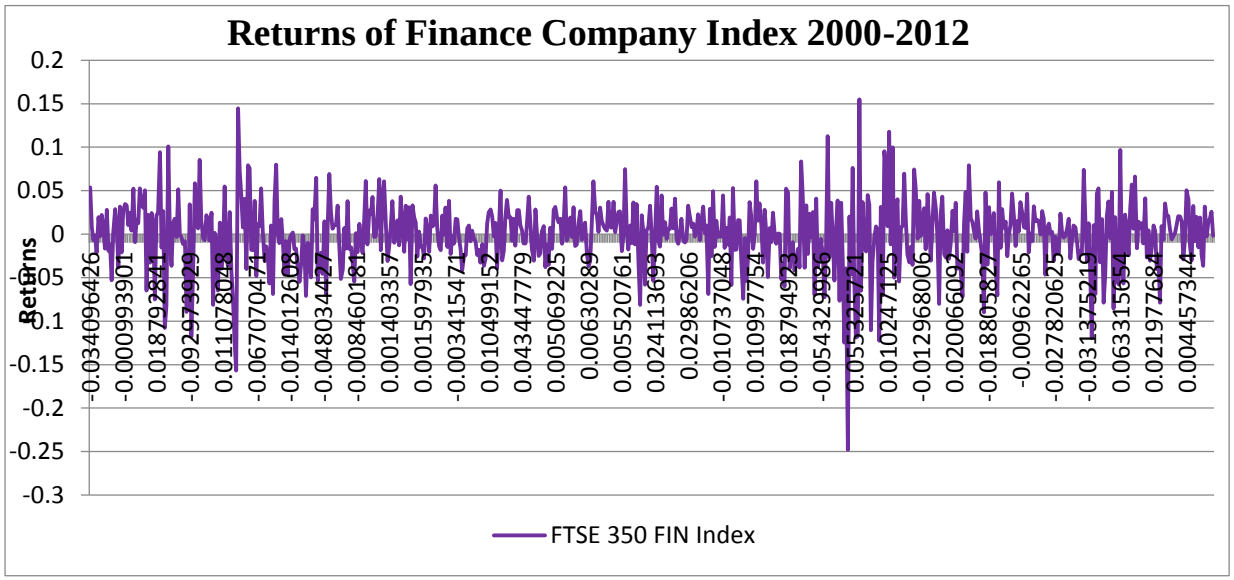
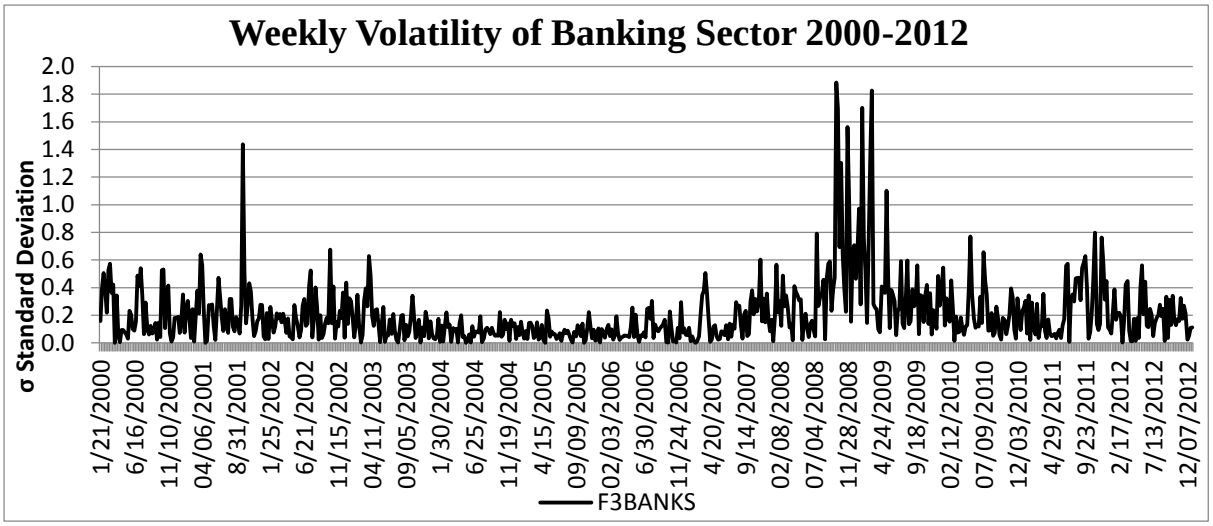
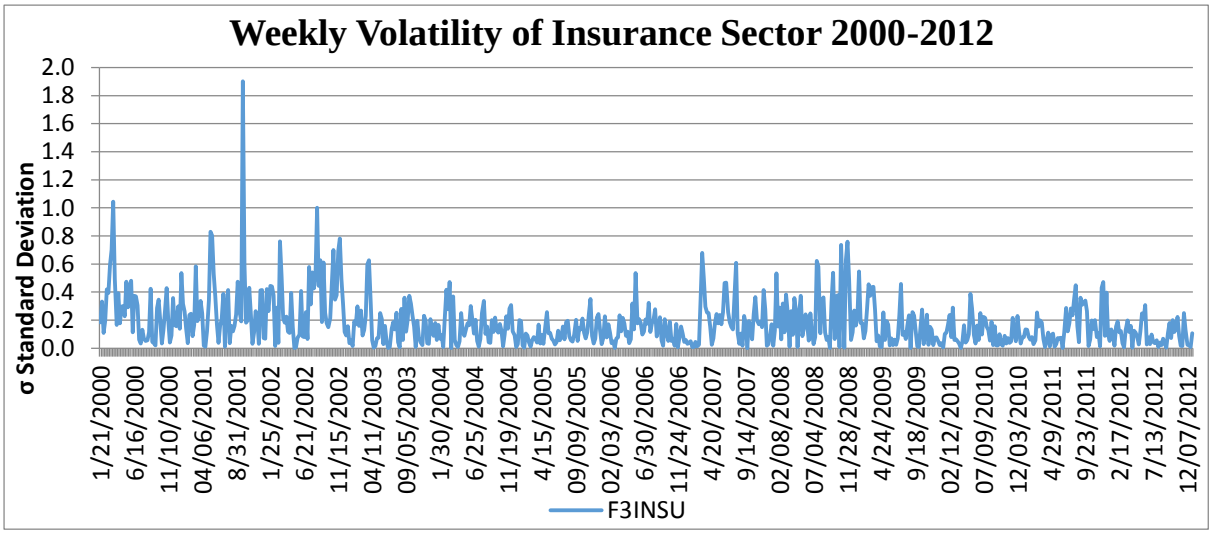


Figure 2: Volatility of Financial Sector Indices 2000-2012





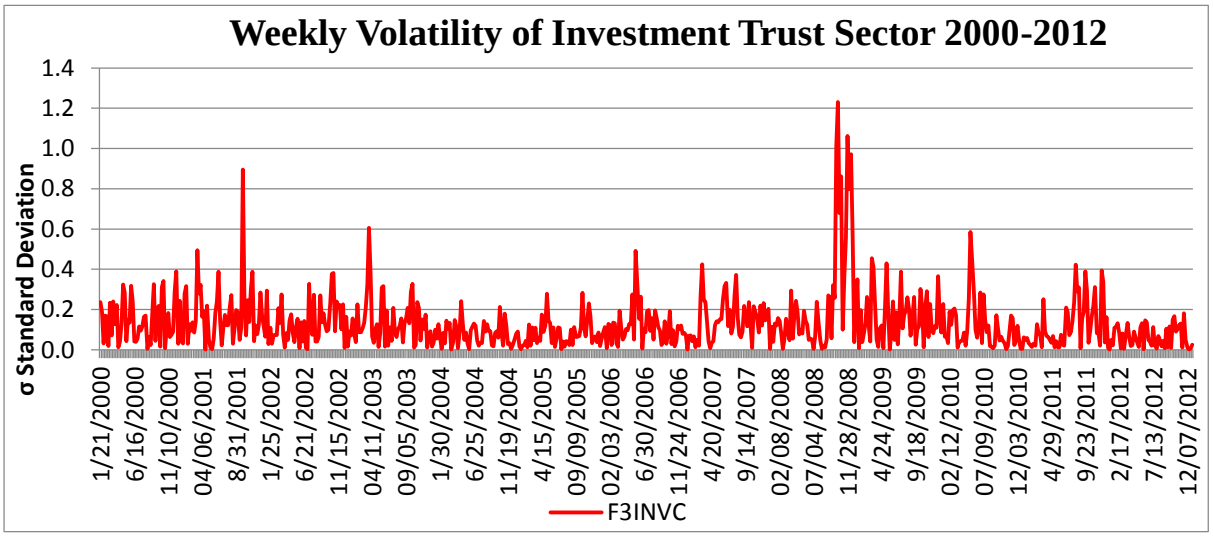
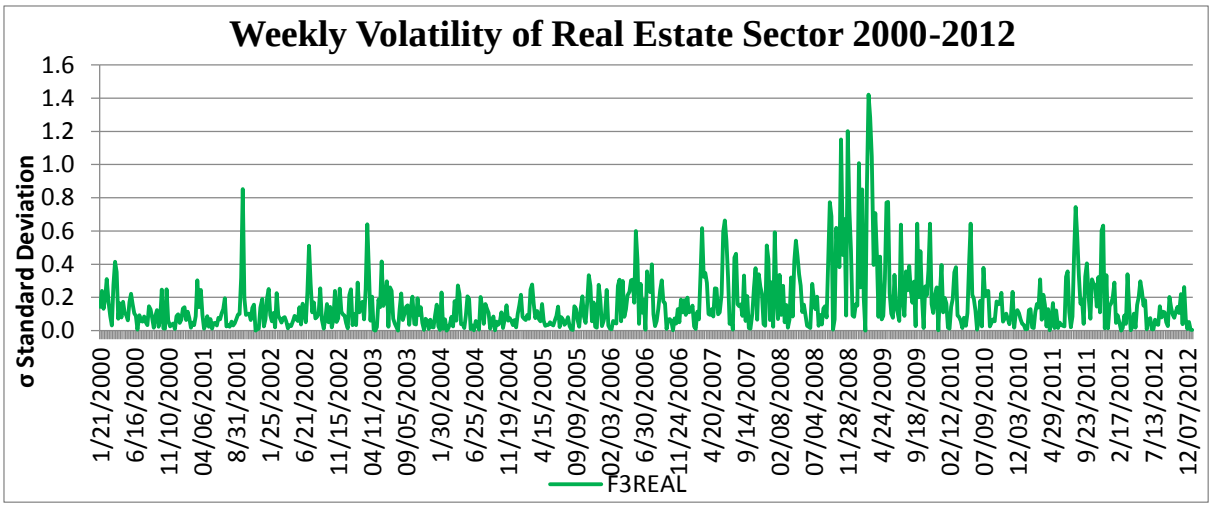
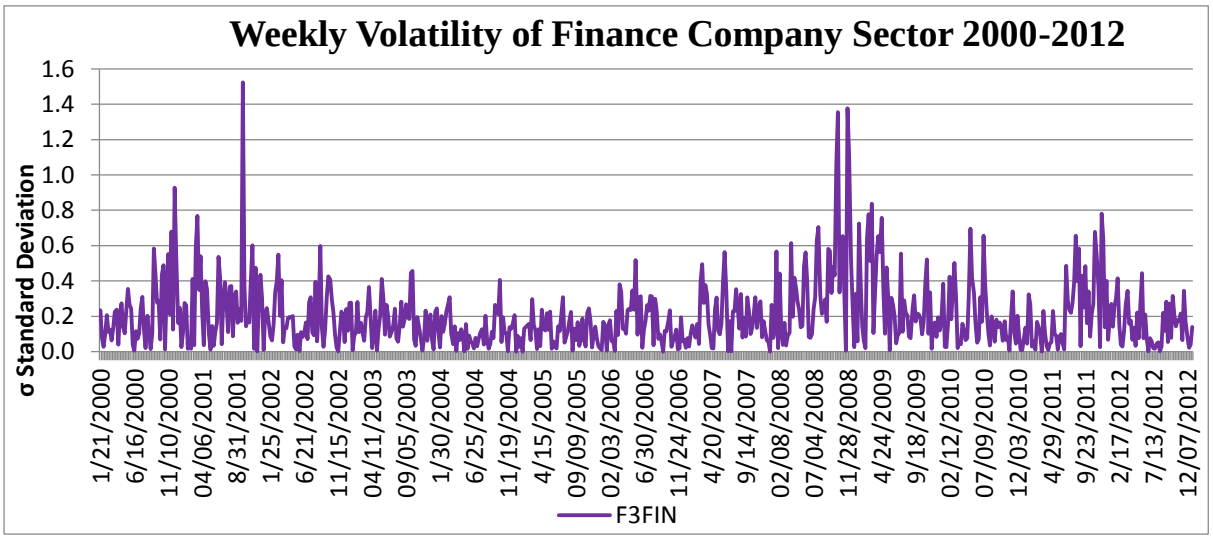


Figure 2 Continued.





4.3.2 Descriptive Statistics

Table 1 below shows us the descriptive statistics of all sector indices returns as well as the FTSE returns. Firstly, we can comment that all variables achieve stationarity at level through the Augmented Dickey-Fuller (Dickey and Fuller, 1979) and Phillips-Perron unit root tests, which means we are able to proceed with modelling without acquiring the 1st difference of the data. Secondly, we can note all variables are not normally distributed in accordance to the Jarque-Bera test. Thirdly, all variables enjoy a kurtosis value of greater than 3, which highlights a leptokurtic distribution. This suggests a sharper than normal distribution with values namely concentrated towards the mean, however there is a high probability for extreme

values to prevail. The banking sector illustrates the highest kurtosis value of 13.0469, which suggests, as expected this is the sector with greatest volatility, given unfolding events impacting the banking sector primarily. Skewness of all variables are all left skewed distributed, where most values are concentrated on the right of the mean, with the extreme values to the left. The most extreme value of skewness between the sectors is found within the investment company sector with a value of -1.237, this could be said due to their high exposure to the stock markets. In terms of skewness, insurance companies are found to be the most diversified as they the least volatile with a value of -0.5611. The standard deviation is another measure of volatility/risk from which we can clearly see the banking sector is the most volatile with a value of 0.0423 in accordance with the kurtosis. However, the least volatile sector according to the standard deviation is said to be the investment companies sector which produces a value of 0.0262, which is conflicting against the skewness as it suggests they are in fact the most diversified sector and closest to the standard deviation of the FTSE. Furthermore, we can also highlight within the returns of each sector the banking sector demonstrates the lowest mean of -0.0008, which enhances the debate of this sector being deemed the most volatile, which is then followed by the insurance sector with a value of -0.0004. We find the real estate sector produces the highest mean value of 0.0003. In terms of returns the highest maximum value is demonstrated by the insurance sector of 0.1745 with the banking sector produced the lowest minimum value of -0.3452. The maximum and minimum value to a certain extent highlights the ranges of the sector values.

Table 1: Descriptive Statistics

	FTSE	**Banks**	**Insurance**	**Invest. T.**	**Real Ests.**	**Finance C.**
Mean	-0.0001	-0.0008	-0.0004	0.0002	0.0003	0.0002
Median	0.0016	0.0005	0.0022	0.0015	0.0032	0.0028
Maximum	0.1258	0.1712	0.1745	0.1082	0.1297	0.1550
Minimum	-0.2363	-0.3452	-0.2020	-0.2154	-0.1896	-0.2481
Std. Dev.	0.0263	0.0423	0.0358	0.0262	0.0336	0.0387
Skewness	-1.0998	-1.1136	-0.5611	-1.2370	-1.1515	-0.5897
Kurtosis	14.5560	13.0469	7.5989	11.6426	8.7998	6.7468
Jarque-Bera	3903.461	2987.26	632.126	2279.6670	1098.4	435.242
Aug. D-Fuller	-28.1757	-27.300	-25.337	-16.5106	-26.476	-26.179
Phillips-P	-28.1974	-27.2963	-25.418	-26.7477	-26.485	-26.204

4.3.3 Methodology

We employ five different methods in order to compute the conditional time varying beta. Firstly, we must estimate the traditional market model in order to gather estimated expected returns with the market model estimated as follows:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it} \quad (4.1)$$

Where;R_{it} is the logged returns of the sector index, R_{Mt} is denoted as the logged returns of the market index, β_i = COVARIANCE(R_i,R_M)/VARIANCE(R_M), α_i is denoted as the natural logged risk-free asset denoted as the UK 10 year government bond and ε_{it} = 0 as the disturbance term.

The first method we apply in order to capture the time varying beta is the Kalman Filter, which is a state space model estimated via a recursive algorithm as proposed by Harvey (1993) and Hamilton (1994). The Kalman Filter being a state space model can be applied to incorporate unobserved variables into a model and estimate them along with the observed variables. We can use this as illustrated by Faff *et. al* (2000) and Choudhry and Wu (2009), whereby the Kalman Filter will recursively forecast conditional betas from an initial stochastic process, which will generate a series of conditional intercepts and beta coefficient for the CAPM. Furthermore, when following then Kalman Filter approach we must be aware of misspecification of the transition equation, whereby a failure of convergence highlights the error.

We follow Faff *et al.* (2000) to apply the random walk method due to reliability of results, which is estimated by firstly applying equation (1). We then apply the random walk process to compute beta which is illustrated as follows:

$$\beta_{it}^{KRW} = \beta_{it-1} + v_{it-1} \quad (4.2)$$

The second approach we employ is the rolling regression method as firstly utilised by Fama and Macbeth (1973) as well as in more recent studies from Zhou (2012) and Celik (2013). This method comprises estimating an OLS regression of equation (1), follows by a window size of 15 to estimate the market beta, with a rolling size of 1, meaning a time varying beta is calculated on a weekly basis, thereafter 15 observations we generate a conditional beta series.

The third method we apply is the dynamic conditional correlation GARCH (1,1) (DCC-GARCH) approach, first proposed by Engle (2002). The advantage of opting for this

methodological approach is for the detection of potential alterations within the conditional correlations across a time series, which will highlight to us the responses of the market interpretations of dynamic changes in risk. Furthermore, Cho and Parhizgari (2008) highlight the DCC-GARCH model will enable us to estimate the correlation coefficients of the standardised residuals and therefore accounting for heteroskedasticity. The DCC-GARCH continuously adjusts the correlations for the time-varying volatility, which provides a superior measure for correlation. The DCC-GARCH methodology we apply consists of a two-step procedure, the first is the estimation of a univariate GARCH model. Secondly is the estimation of the conditional correlations that vary through the time-series.

The DCC-GARCH design is demonstrated as follows:

$$H_t = D_t R_t D_t \tag{4.3}$$

Where: H_t is a matrix of (2×1) containing the natural logged returns of the stock index and market index.

$$D_t = diagonal(\sqrt{h_{1,t}}, \sqrt{h_{2,t}}, \dots \sqrt{h_{n,t}}) \tag{4.4}$$

$$R_t = (diagonal(Q_t))^{-1/2} Q_t (diagonal(Q_t))^{-1/2} \tag{4.5}$$

$$Q_t = (1 - \psi - \zeta)\bar{Q} + \zeta Q_{t-1} + \psi \delta_{i,t-1} \delta_{j,t-1} \tag{4.6}$$

Where: D_t is the diagonal matrix of conditional standard deviations for return series, which is obtained from the estimation of the GARCH (1,1) model, where $\sqrt{h_{n,t}}$ on the diagonal *i*th term. R_t is defined as the conditional correlation matrix of the standardised returns, where Q_t is the positive definite matrix containing the conditional variances and covariance of ε_t. $(Q_t))^{-1/2}$ is defined as the inverted diagonal matrix with the square root of the diagonal elements of Q_t. $\bar{Q}$ is the unconditional correlations of $\delta_{i,t-1}, \delta_{j,t-1}$, ψ and ζ are nonnegative scalar parameters as followed by Engle (2002).

Where the log-likelihood of the estimators are given as:

$$L = -\frac{1}{2}\sum_{t=1}^{T}[(n\log(2\pi) + \log|D_t|^2 + \varepsilon_t' D_t^{-1} D_t^{-1} \varepsilon_t) + (\log|R_t| + \delta_t' R_t^{-1} \delta_t - \delta_t' \delta_t)] \tag{4.7}$$

The dynamic conditional correlations are produced by the following:

$$\rho_{ab,t} = \frac{(1-\psi-\zeta)\overline{q_i} + \psi\delta_{i,t-1}\delta_{j,t-1} + \zeta q_{ij,t-1}}{[(1-\psi-\zeta)\overline{q_{ii}} + \psi\delta_{i,t-1}^2 + \zeta q_{ii,t-1}]^{\frac{1}{2}}[(1-\psi-\zeta)\overline{q_{jj}} + \psi\delta_{j,t-1}^2 + \zeta q_{jj,t-1}]^{\frac{1}{2}}} \tag{4.8}$$

Where the time varying beta is capturing by $\rho_{ab,t}$, asβ_i can also be defined as the correlation between the two series returns of the stock index and market index.

The forth methodological approach we apply is the bivariate diagonal BEKK GARCH model as presented by Engle and Kroner (1995), which follows Choudhry (2005). Multivariate GARCH models are suitable to capture the time varying beta, as according to Engle and Kroner (1995), they allow the variance and covariance to depend on the information set in a vector auto-regressive-moving-average (ARMA) method. The BEKK model enables the conditional variance (H_t) to be positive for all *t* according to Bollerslev *et al*. (1994).

The Bivariate BEKK GARCH is parameterised as follows:

$$y_t = \mu + \varepsilon_t \tag{4.9}$$

$$\frac{\varepsilon_t}{\Omega_{t-1}} \sim N(0, H_t) \tag{4.10}$$

$$vech(H_t) = C'C + \sum_{K=1}^{K} + \sum_{i=1}^{q} A'_{K_i} \varepsilon'_{t-i} A_{ki} + \sum_{K=1}^{K} + \sum_{i=1}^{p} B'_{Kj} H_{t-j} B_{kj} \tag{4.11}$$

Where y_t is a 2×1 vector containing the natural logged returns of the stock index and market index and μ is a 2×1 vector of a constant. H_t specifies the multivariate GARCH conditional variance of both variables, returns on stock index and the returns of market index, which is a function of the information set in Ω_{t-1}.A'_{K_i}, $i = 1, q, K = 1, K$ and $B'_{Kj}, J = 1, p, K = 1$ and K, are all matrices of $N \times N$. Following Engle and Kroner (1995) method we apply the BEKK bivariate GARCH(1,1) which will enable us to use less parameters as we apply a diagonal restriction to the model, where *K*=1.

Where:

$$H_t = C'C + A'^{\varepsilon_{t-1}\varepsilon'_{t-1}} A + B' H_{t-1} B \tag{4.12}$$

$C$is a 2×2 lower triangular matrix with intercept parameters, *A* and *B* are 2×2 square matrices of parameters. More specifically, *A* highlights the volatility linkages element, whilst *B* illustrates the extent to which the conditional variances and covariance are correlated with past innovations. Thus then leads us to compute the time varying beta which, is calculated as follows:

$$\beta_{i,t} = H_{12,t} / H_{22,t} \tag{4.13}$$

Where: $H_{12,t}$ is the estimated conditional covariance between the returns on stock sector index and market index and $H_{22,t}$ is denoted as the conditional variance of the return on the market both given by the BEKK GARCH (1,1) model.

For the final approach we employ is a GJR-GARCH approach. The GJR-GARCH model introduced by Glosten et al. (1993) allows for positive and negative innovations to returns, which ultimately can have a different impact towards the conditional variance. They show us how to capture the asymmetry effect or more commonly known as the leverage effect, through a dummy variable attached to the original GARCH model. We are able to apply this version of GARCH models as we are able to capture the variance and covariance of two variables which can be applied.

$$h = \alpha_0 + \alpha b_{t-1}^2 + \alpha b_{t-1}^2 b_{t-1<0} + \alpha \delta_{t-1} \quad (4.14)$$

Where α represents a constant parameter, b holds a residual value and δ denotes the GARCH element within the model and $\alpha b_{t-1}^2 b_{t-1<0}$ captures the leverage effect, which is the conditional variance. In order to then obtain the time varying beta, we then apply equation (13).

In order to verify how accurate our time varying beta series are for each sector we apply an accredited evaluation tool to our generated beta series, the mean squared error (MSE). This is calculated as follows:

$$MSE_i = \sum (R_{it}^* - R_{it})^2 / T \quad (4.15)$$

Where: R_{it}^* is the generated beta series multiplied by the returns on the FTSE for index I on time t. R_{it} are the actual returns and T is the number of observations.

In order to then demonstrate the most accurate method of computing time varying beta, we apply the modified Diebold and Mariano test statistic as demonstrated by Harvey, Leybourne and Newbold (1997). Diebold and Mariano (1995) originally developed a test of equal forecast accuracy to test two different sets of forecast errors, in our case the MSEs ($G(e)_1$ and $G(e)_2$). The test statistic is formulated as follows:

$$E[d_t] = 0, \text{ Where,} d_t = G(e)_{1t}^2 - G(e)_{2t}^2 \quad (4.16)$$

In order to then test the null hypothesis we firstly have to estimate the original Diebold and Mariano test statistic:

$$DM_1 = [\hat{V}(\hat{d})]^{1/2} \hat{d} \text{ Where, } \hat{d} = n^{-1} \sum_{t=1}^{n} d_t \text{ and } \hat{V}(\hat{d}) \text{ is the variance of } \hat{d} \quad (4.17)$$

Where n is the number of observations. As we have a large number of observations in our in-sample forecasts, we apply the modified Diebold and Mariano test as set identified by Harvey *et al.* (1997) with the aim of tackling the issue of dealing with a large set of data, which is calculated as follows:

$$DM_1^* = \sqrt{\frac{n+1-2H+n^{-1}H(H-1)}{n}}\,DM_1, \text{ Where n = 676 and H = 1} \quad (4.18)$$

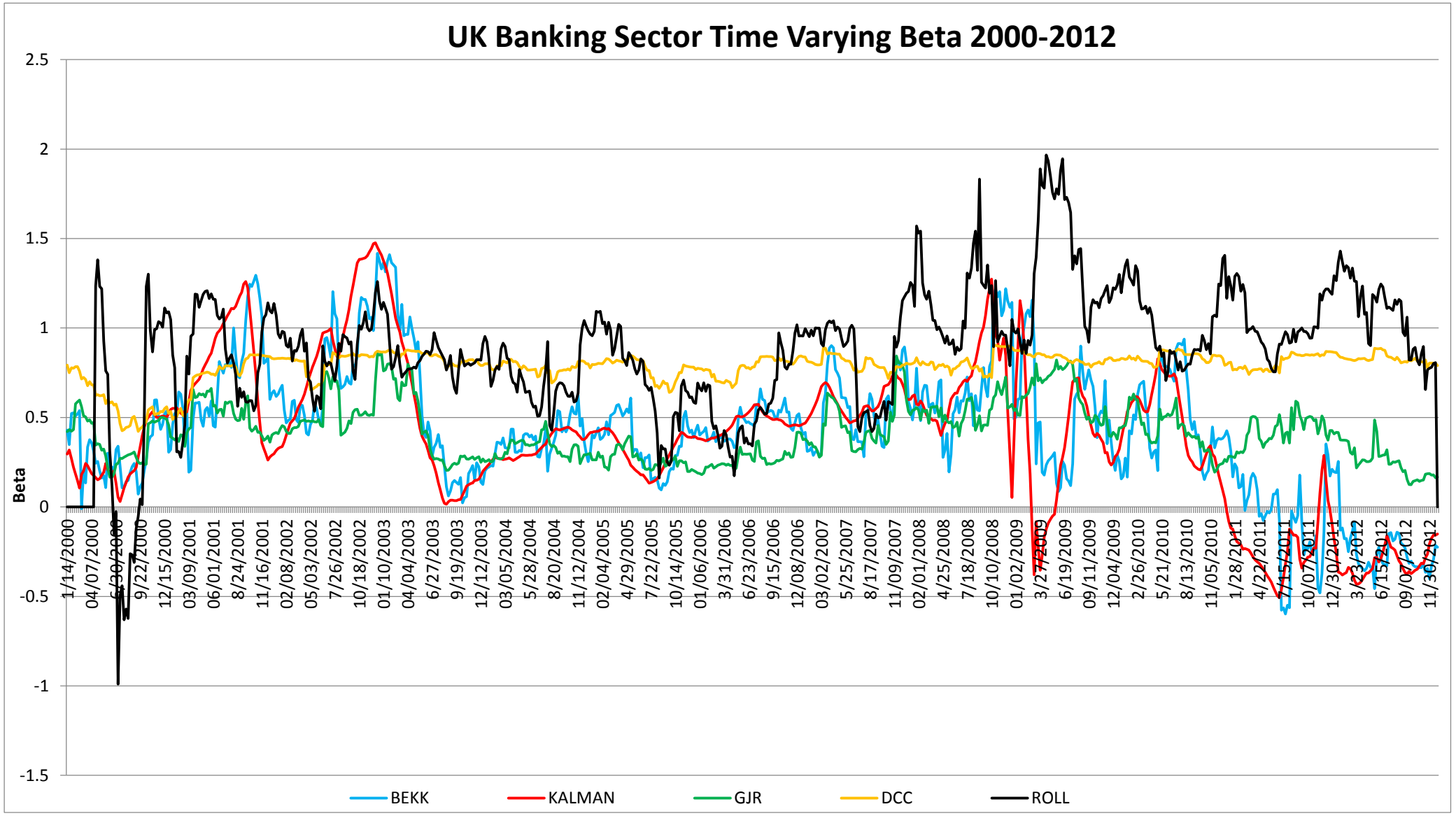
Once we have obtained the DM_1^* statistic, we can then apply the student t-test with n-1 as the number degrees of freedom, in order to derive whether statistical significance is present.

4.4 Results

We begin to decipher the results from the study which will answer our research question, "How did beta ultimately vary throughout 2000-2012 as well as between differing UK financial sectors?" Our first assessment within our results identify that beta was not stable throughout the period 2000-2012 (refer to Figures 3-13) among the UK financial sectors, which is in line with the existing literature (refer to Brooks *et al.* (1998), Faff *et al.* (2000), Choudhry (2005), Choudhry and Wu (2009) and many more). From the banking sector we notice in Figure 3 from the years 2000 to 2003 a rise in the risk profile, which can be attributed towards the terrorist attack of 9/11. This event severely impacted the UK financial markets deeply and ultimately crashed the equity prices, with the FTSE reaching a low in March 2003 as well as resulted in a decline of GDP growth from 4.8% in 2000 to 2.5% in late 2002. The decline in GDP growth may have led the increased risk profile of the sector as a slowdown in the economy caused an increase in the unemployment rate from 4.9% to 5.3% by 2003 and therefore increases the likelihood of defaults on their loan portfolio. Following a peak in 2003, there is the beginning of declining trend till of risk profile to August 2004, which coincides with a period strong housing price growth. The reduction in beta illustrates the confidence within the sector during this period as the increasing loans being made underpins the strength of the economy and therefore reduces outlook of negativity on defaults occurring. However, from 2004 there was evidently a steep increase in risk profile, following the increase in interest rates in order to slow down economic growth as part of the economic cycle. This led to a slowdown in the rapid rise of housing prices from 20% growth to as little as 1.8% rise in 2005, which led to their risk profile reducing in the early part of 2005. However, as the UK economy began to pick up momentum during 2005-2006, so did the banking sector beta. This coincided with falling

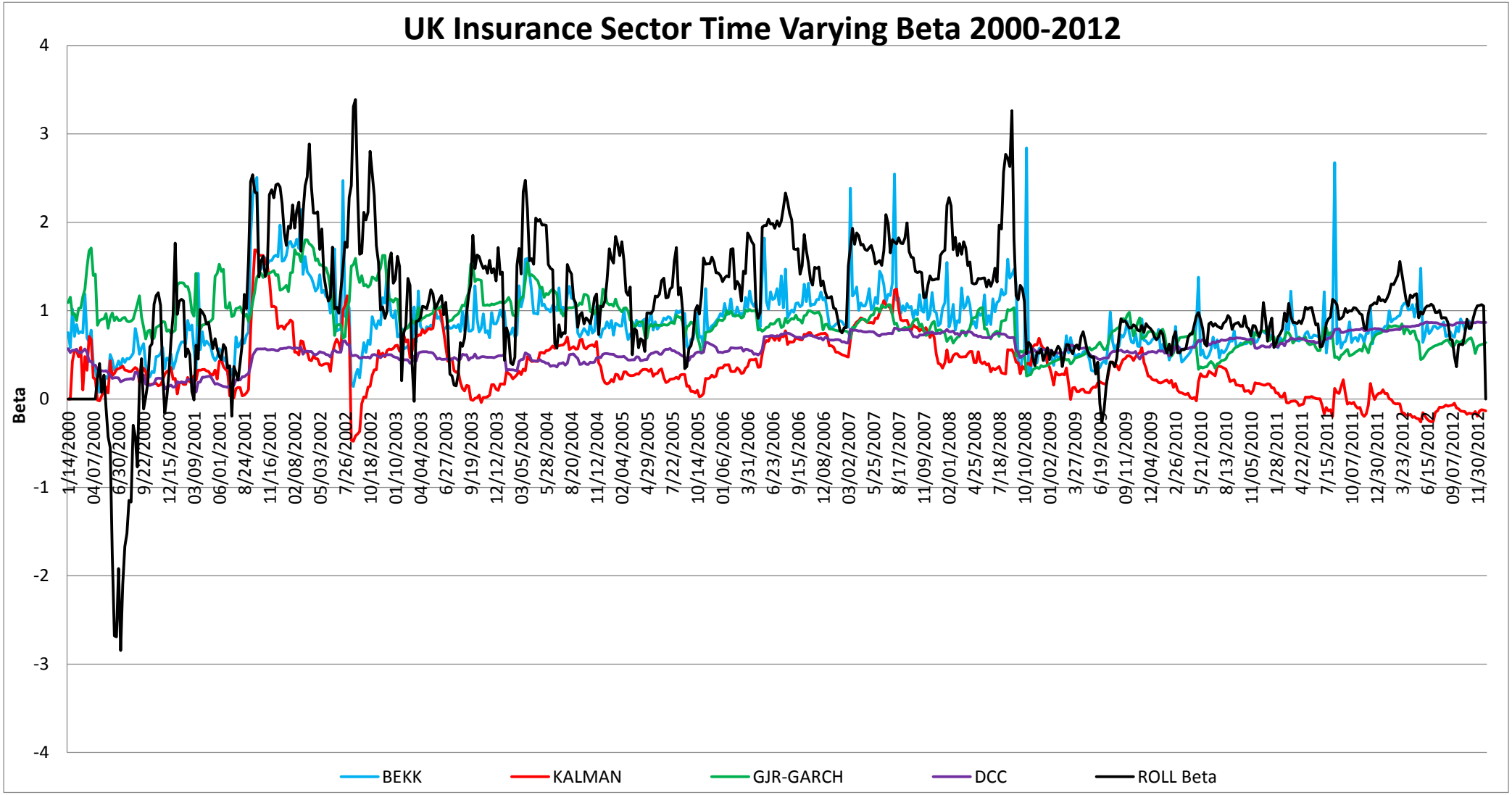
unemployment within the UK economy as vast growth was emerging following higher output from the rest of the economy leading to lower defaults and increased lending, which significantly overshadowed deposits. From 2007-2009 the banking sector beta became very volatile as one would have expected during the outbreak of a financial crisis, whereby uncertainty was driving the financial markets on a day-to-day basis. From 2010 onwards we find the banking sector beta to continue the trend of increasing and decreasing risk profile, which coincide with the sovereign debt crisis events in 2010 and again in 2012. This is due to the issues surrounding Eurozone sovereign debt crisis as the nations impacted the banking sectors' balance sheets due to their significant exposure levels to Ireland, Greece, Portugal, Spain and Italy.

Figure 3: UK Banking Sector Time Varying Beta



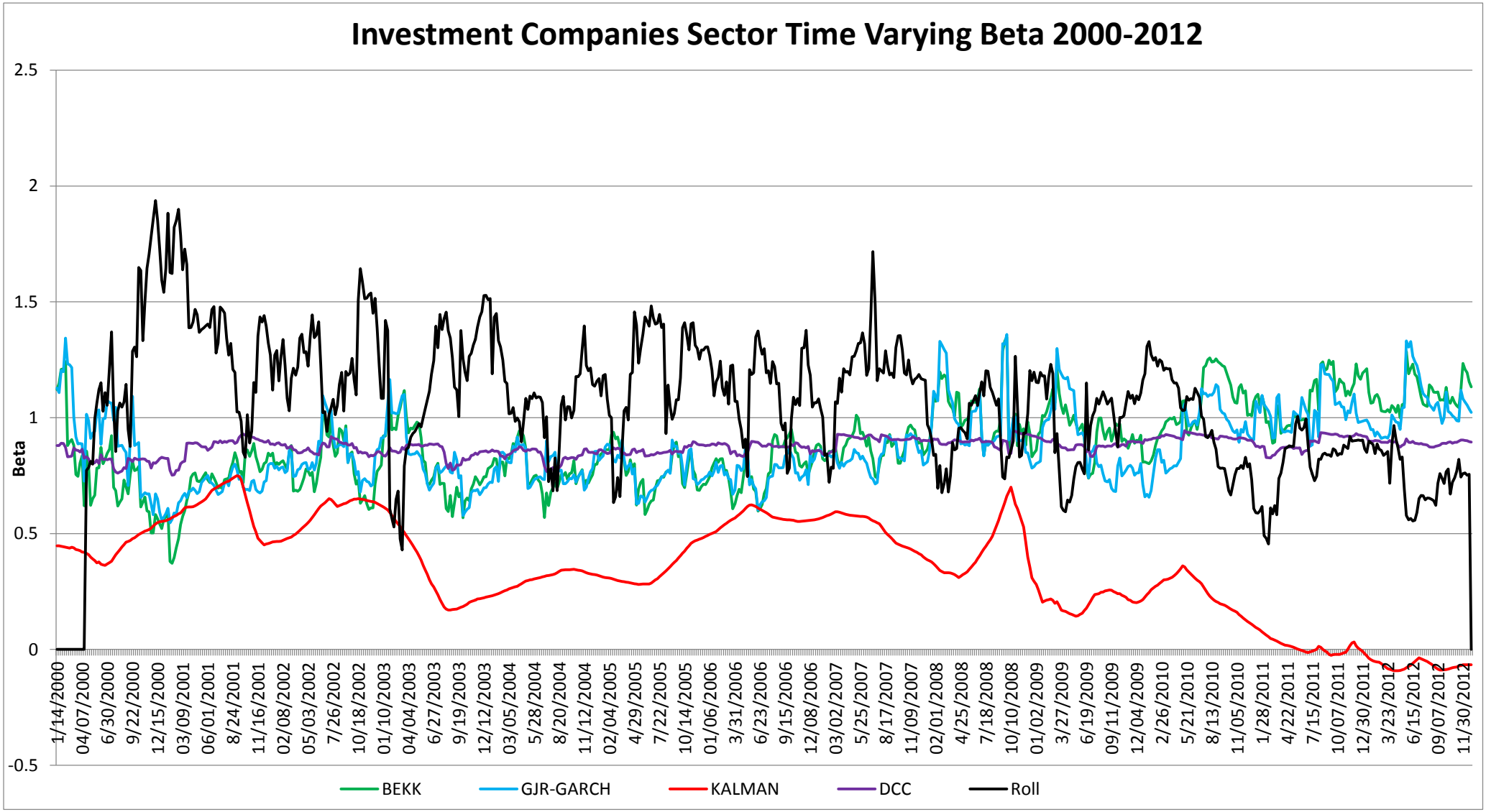
We turn our focus towards Figure 4 and the insurance sector in the UK. It is clear there are visible trends within the data, which enables us to link these with events and create a greater understanding of the risk profile of the sector. From 2000-2002 we visualise beta to be rising, which can be attributed towards 9/11 as the insurance sector was impacted either directly or indirectly through financial markets. This event led to the market to price the insurance sector at an elevated level due to the damages that would have been required by the sector to pay out. In late 2002-2003 it is evident there is a reduction in the risk profile, which is largely attributed to a recovery in the economy as the FTSE rebounded sufficiently by the end of 2003. The economic expansionary period extended up until September 2005 when there was an increase in interest rates, which led the decline in risk profile of the sector from a beta value of 2.47 to 0.36. The increase of interest rates revised the markets expectation of the risk-free rate, which created an upward pressure in the risk-free premium and led to the FTSE to match the market expectation as improved performance materialised. When referring to 2005 - August 2006, there is an evident increase in the risk profile given beta increased from 0.36 to 2.33 due to the build-up of increasing exposure of equity and property markets within their balance sheets. Following this peak, the insurance sectors' beta became relatively stable and in fact declined as a result of declining GDP, which led investors to flee the insurance sector due to GDP being a positive influence upon financial performance for the sector. After a reduction in beta experienced in the insurance sector vast levels of volatility came to fruition from August 2007 – September 2009 due to the losses created by the financial crisis as asset values suffered a correction, which led to the insurance sector to experience losses on their balance sheets. Accordingly, after the financial crisis, beta remained relatively stable and followed the market with the average level of beta being 0.65 from 2010 onwards as a result of being in a low-interest rate economy, which declines the yields of short-term assets, which the insurance sector has great exposure to given their need to service claims. However, spikes in beta were present, which reflected the European sovereign debt crisis as a result of assets losing value within the balance sheets of the insurance sector.

Figure 4: UK Insurance Sector Time Varying



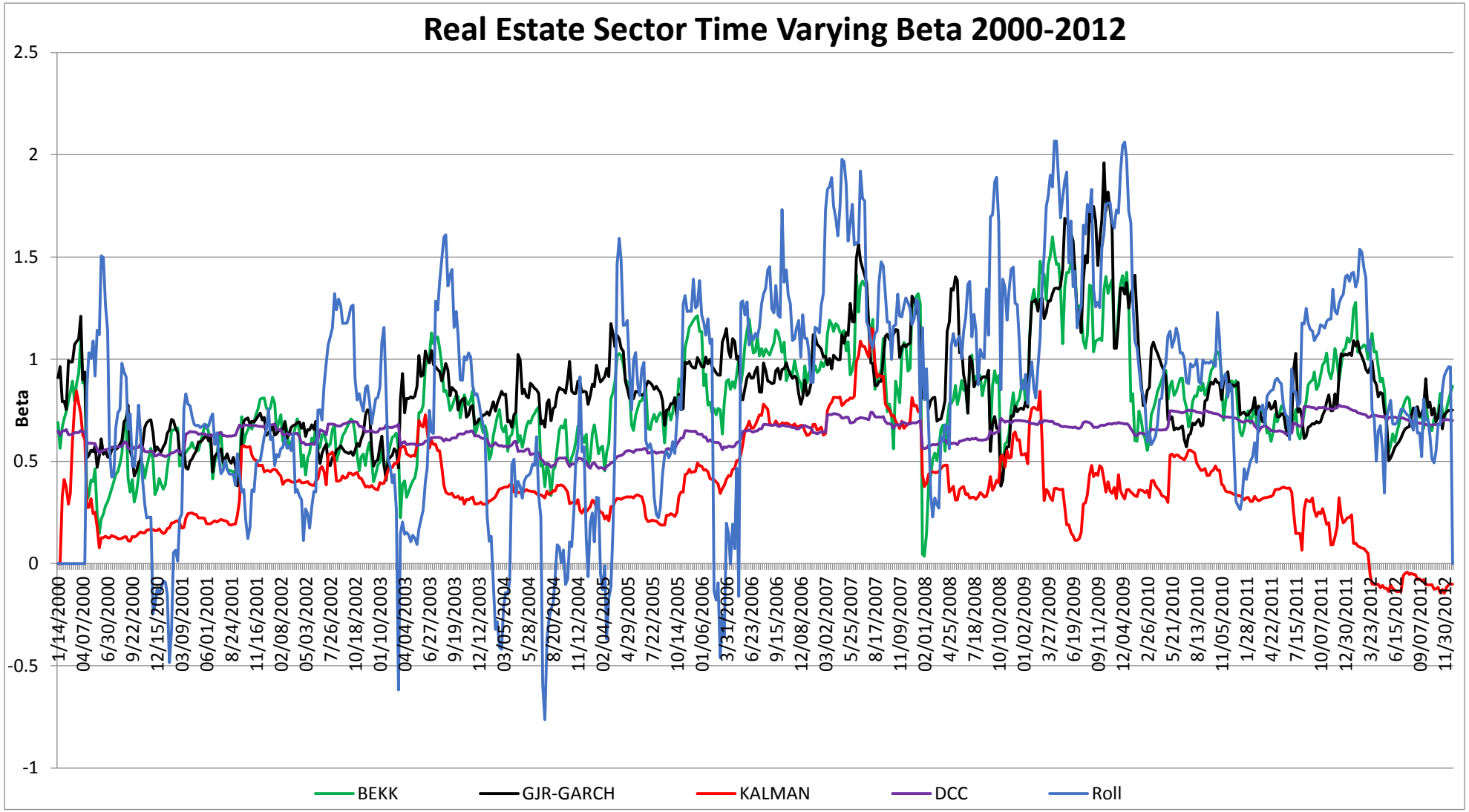
When referring to the investment trust sector and Figure 5 we show how beta has evolved over time. We also demonstrate the best modelling method within this sector was the rolling regression technique as given by the MSE. The trends that are found within the time-varying beta are consistent with their operations as beta does not exceed a value of 2. This is due to their business model, which is to pool investment from small investors into a large fund, which is then reinvested to equity markets and will follow the trends of the market. We see a change in the value of beta at times of heightened volatility, this is evident during 2000-2001 whereby market volatility hit the equity markets in the UK due to technology crash, which is associated with the dotcom bubble. The only other period in which we experience an increase in beta is during 2007-2009, which coincides with the high levels of stock market index volatility that the crisis brought. We see the investment trusts sector are able to utilise the skills they possess in terms of personnel, which are able to manage risk through strategies adopted by fund managers. The strategies adopted may lead to stable returns and maintain beta in comparison to other financial sectors due to the diversification of risk they exert in order to produce sufficient returns for investors of the fund.

Figure 5: UK Investment Companies Sector Time Varying Beta



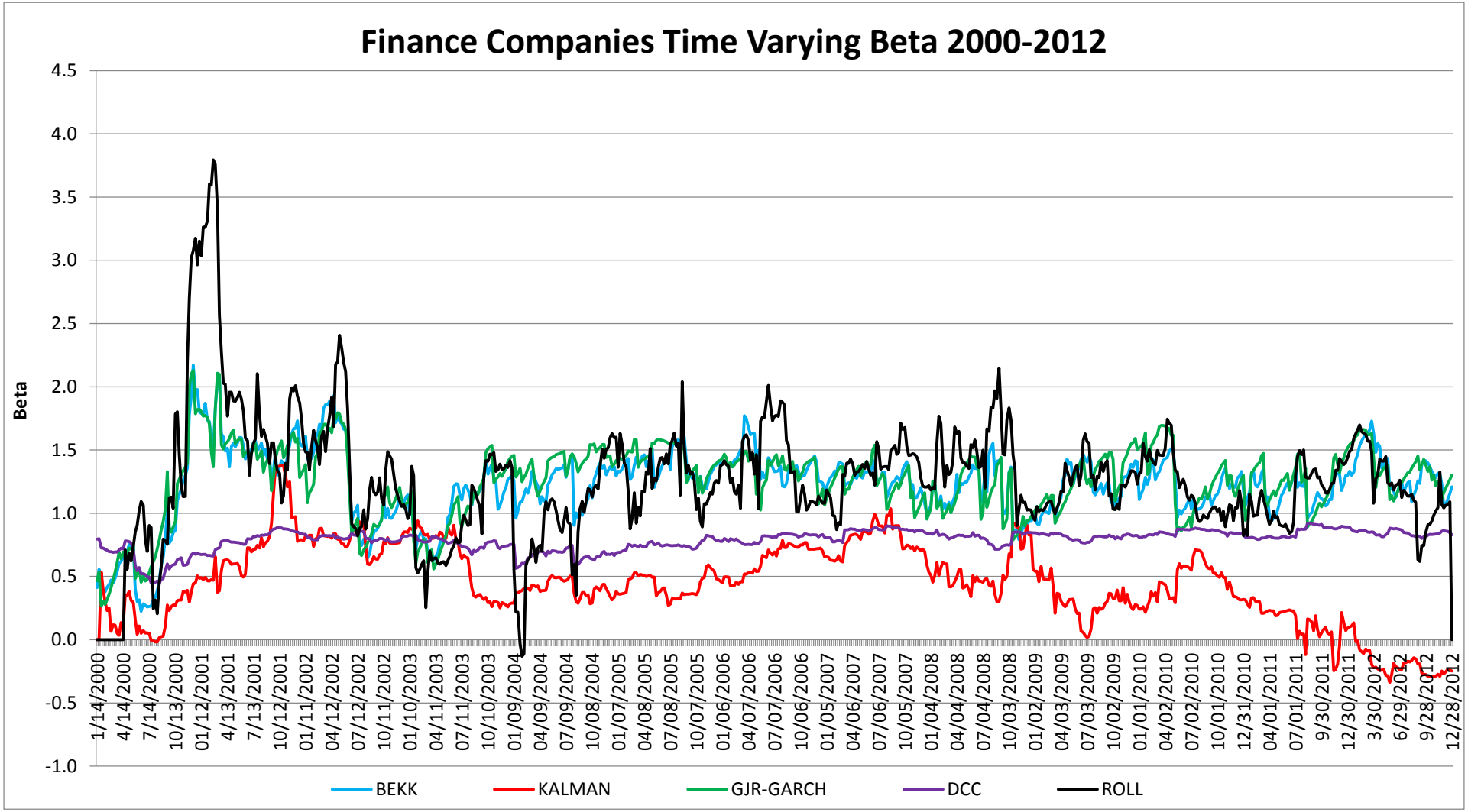
We now refer to the real estate sector and Figure 6 which demonstrates the time-varying beta. It is evident there were dynamic shifts in the risk profile of the real estate sector during the sample period. From 2000-2002 beta remained fairly stable via the BEKK and GJR-GARCH techniques with a range of 1.2-0.1 with the average being 0.75. Once 2003 commences, it is evident there is an increase in the risk profile of the real estate sector, which can be linked to a slowdown in the UK economy with increased uncertainty with the impending invasion of Iraq. Furthermore, there was a reduction in the housing prices which can lead to declined performance by the sector as the banking sector was not lending as much as they were prior to this. However, following the invasion of Iraq (end of 2003), there was a restoration of confidence to the markets on a global scale, which increased investors purchasing equities as well as the improving housing market conditions. This caused the real sector to improve financially and therefore reduced the perceived risk profile of the sector in the latter half of 2004. From 2005 till 2007 we witness a steady increase in beta, which coincides during a period when housing prices increased incrementally until the outbreak of the crisis in late 2007, when losses from the housing markets began to emerge. The overall volatility in beta that proceeded during the crisis years is due to the market pricing the sector at an elevated level of risk due to impact their business model withstood as housing prices in the UK suffered a correction. From 2010-2012 the beta of the sector remained fairly stable with an increasing trend as the housing market in particular began to recover as a result of the implementation of "help to buy scheme" from the new government formed in 2010, which encourages first time buyers to purchase houses.

Figure 6: UK Real Estates Sector Time Varying Beta



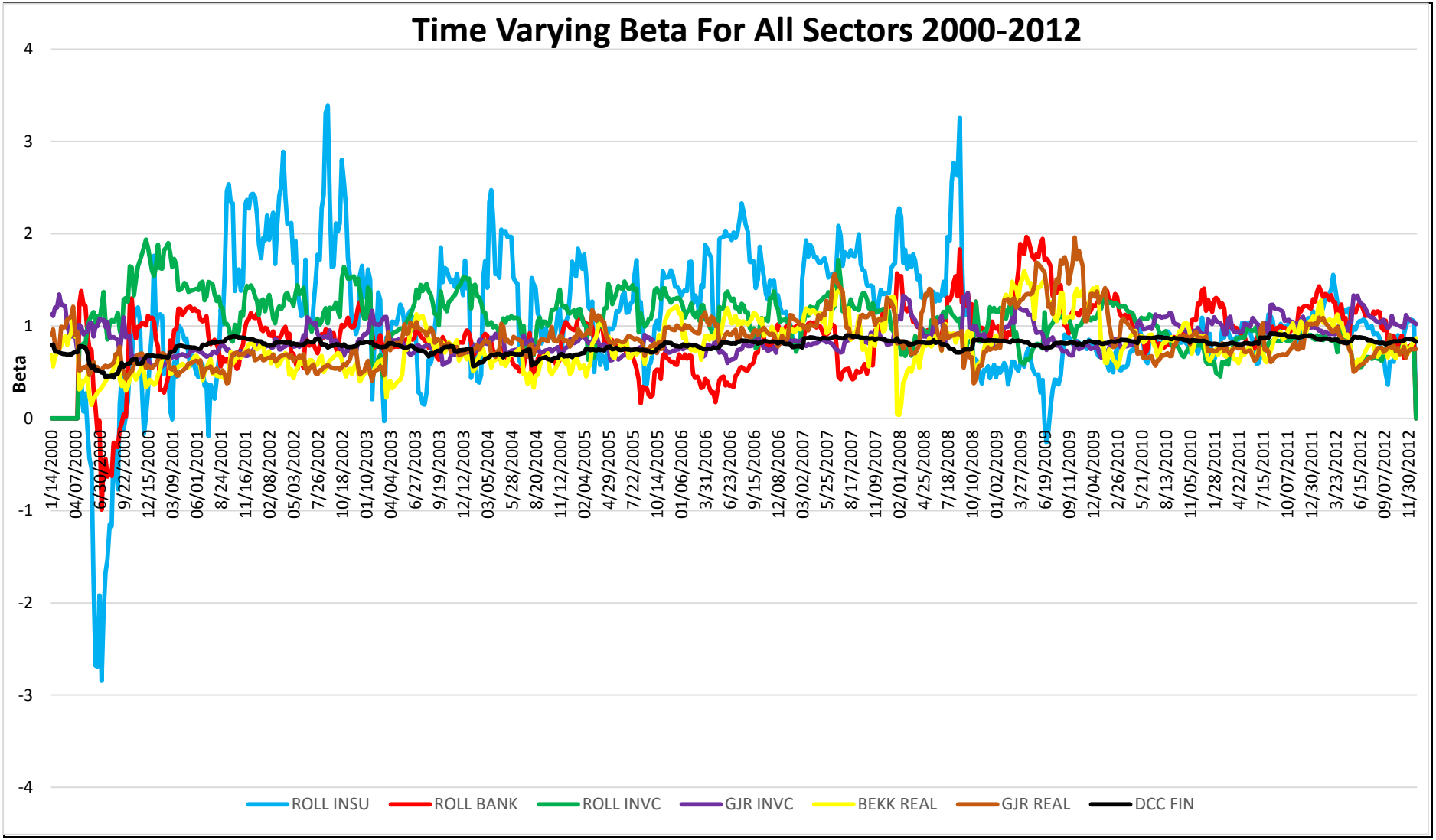
When turning our attention towards the finance companies sector and Figure 7 we illustrate the time-varying beta of this sector. In accordance to Table 2 we demonstrate the DCC-GARCH modelling technique was the most precise given the MSE value. We find with this technique is that beta remained fairly stable throughout our sample period and generally followed market trends. This overall highlights the market correctly prices the sector accordingly. However, when we turn our attention towards other techniques we do find elements of time-varying beta nature. For example, when following the Kalman filter approach from 2000-2001 there is a steep rise in beta, which suggests the risk profile increased during this period due to the strength of the UK economy, whereby the cost of raising funds was reduced in terms of bond and or selling stock, which overall enhances financial performance of the sector. Upon reaching its peak value of 1.5 there is a correction in the beta value, which was induced by the market as a result of 9/11 and uncertainty of the direction of the economy. After this event beta remained below the value of 1 meaning that the sector followed the market fluctuations. This can be explained by finance companies generally being subsidiaries of bank holding companies and therefore have less of an impact towards the economy in terms of loan creation, so overall possess less risk.

Figure 7: UK Finance Companies Sector Time Varying Beta



We turn our focus towards Figure 8, which demonstrates the best time-varying beta techniques of each sector from 2000-2012 and 2007-2012. For 2000-2012, we establish from 2000-2002 (the period captures 9/11), the sectors most affected in this timely period was the insurance sector. The market was able to distinguish higher systematic risk fell towards the insurance sector, in particular 9/11, given the costs to which the insurance sector in the UK had vast exposure to and therefore is reflected within the beta. Furthermore, the investment trusts sector was affected from 2000-2002, which highlights their exposure to equity markets following the dot com bubble. The results tell us the market was able to effectively analyse their position and as a result increase systematic risk for the investment trust sector. Following Figure 2 previously, it was shared the finance companies sector experienced high levels of volatility, which can be held true in regards to the Kalman filter approach as beta dramatically increased from 0.2 to 1.36 within a short time period. Following 2002, beta among the sectors relatively remains stable and on the decreasing trend specifically for the banking sector, which experienced stable growth till 2006. From 2002-2006, a period of strong stable economic growth for the UK economy, the insurance sectors' beta remains consistently higher than the other sectors as per market valuation of systematic risk. In the pre-crisis period, (2007) we notice a strong and significant increase sector indices beta for the insurance and banking sector as well as declines in the real estate sector, primarily before the housing bubble burst. We can interpret these results as the real estate sector was experiencing strong significant growth and as a result beta was reduced by the market. Moreover, the banking and insurance sector follow the volatility pattern in Figure 2 as beta subsequently increased before the crisis unleashed its effects. During the turbulent period of 2008-2009, we note significant increases in beta of 0.9 to 1.98 within the real estate sector as the market became fully aware of the financial crisis. The finance companies during the same period remained constant throughout the crisis period in question, however experienced a dip in 2009 according to the Kalman filter. In the post-crisis era (2010-2012), our results illustrate a relatively stable UK financial sector in terms of systematic risk with little variation between the sectors.

Figure 8: UK Time Varying Beta - All Sectors 2000-2012



The first examination period utilised in this study was from 2000-2012, from which Table 2 reports the estimated mean squared errors from the different methods applied in order to capture the conditional time varying beta for each respective financial sector. The result most surprises us is the Kalman filter not being the most appropriate measure as indicated in the literature by Brooks *et al*, (1998), Faff *et al*, (2000), Mergner and Bulla (2008), Choudhry and Wu (2009) and Zhou (2013) for the period of 2000-2012. The results in Table 2 indicate a common theme among the banking, insurance and investment trusts indices, which is the rolling regression exhibits the lowest mean squared error and superiority through the Modified Mariano and Diebold test. However, among the investment trust sector, we find that the GJR-GARCH approach is equally superior to the rolling regression method technique. Furthermore, with regards to the Real Estate sector we find the bivariate GARCH approaches the most accurate for in-sample forecasting. Interestingly enough the results concerning the finance company sector, we establish the most accurate method is the DCC-GARCH approach. Table 3 sheds further light on the in-sample forecasts via the modified Diebold and Mariano test statistic, whereby we highlight the insignificant results through a bold font. In Table 3 for the banking sector we highlight; Kal vs. DCC and Kal vs. BEKK; insurance sector; Kal vs. DCC, BEKK vs. GJR and for the investment trust, real estate and finance company sectors we highlight BEKK vs. GJR. The insignificance within these pairs highlight that there is little difference between the techniques in terms of in-sample forecast accuracy. Overall this highlights the rolling regression is superior consistently towards the DCC, BEKK and GJR GARCH techniques across all sectors as statistical significance is achieved.

Table 2: Mean Squared Error 2000-2012

Sector	**KALMAN**	**ROLL**	**DCC**	**BEKK**	**GJR-GARCH**
Banks	0.00006	0.00001*	0.00052	0.00032	0.00053
Insurance	0.00038	0.00000*	0.00017	0.00028	0.00001
Investment T.	0.00040	0.00006*	0.00007	0.00007	0.00006*
Real Estates	0.00005	0.00011	0.00010	0.00003*	0.00003*
Finance C.	0.00006	0.00086	0.00005*	0.00023	0.00023

*** Indicates Best Method**

Table 3: Modified Diebold-Mariano Test Results 2000-2012

	Banks	**Insurance**	**Invest. T.**	**Real Est.**	**Finance C.**
Kal-Roll	-5.3890	-6.7087	-11.4082	-3.4065	-4.3624
	(0.0001)***	(0.0001)***	(0.0001)***	(0.0005)***	(0.0000)***
Kal-DCC	**0.1168**	**-0.6012**	-9.8519	-6.0721	-5.9103
	(0.907)	**(0.5487)**	(0.0001)***	(0.0001)***	(0.0000)***
Kal-BEKK	**0.8275**	-5.8632	-9.1193	-5.3590	-5.5256
	(0.4085)	(0.0001)***	(0.0001)***	(0.0001)***	(0.0000)***
Kal-GJR	2.2545	-7.0182	-8.7434	-5.3590	-5.6392
	(0.0241)**	(0.0001)***	(0.0001)***	(0.0001)***	(0.0000)***
Roll-DCC	2.8134	5.9452	7.9174	3.0267	3.8322
	(0.0055)***	(0.0001)***	(0.0001)***	0.0025)***	(0.0001)***
Roll-BEKK	3.6472	-4.7864	4.5323	2.5525	2.6408
	(0.0001)***	(0.0001)***	0.0001)***	0.0109)**	(0.0084)***
Roll-GJR	4.5606	4.9935	4.6651	2.2804	2.5608
	(0.0001)***	(0.0001)***	(0.0001)***	0.0229)**	(0.0107)**
DCC-BEKK	1.8020	-3.5358	-3.3067	-4.3136	-4.7206
	(0.0719)*	(0.0004)***	(0.0010)***	(0.0001)***	(0.0000)***
DCC-GJR	9.1386	-7.2726	-2.4290	-6.9735	-4.8574
	(0.0001)***	(0.0001)***	(0.0154)**	(0.0001)***	(0.0000)***
BEKK-GJR	3.7280	**1.4970**	**0.7052**	**0.8042**	**0.0826**
	(0.0002)***	**(0.1348)**	**(0.4809)**	**(0.4216)**	**(0.9342)**

***** =1% Significance, ** = 5% Significance, * = 10% Significance and bold letters signifies insignificance.**

We also explored another sub-set period, from 2007-2012. This enabled us to explore the short-term changes to beta during a volatile period. Table 4 reports the MSE, which are contrasting to Table 3, as we can clearly see the Kalman filter is the most suited technique to forecasting beta in the shorter-term in all sectors bar the Finance company sector. Furthermore, we see in Table 5 the results of the Diebold and Mariano test, which highlights the Kalman filter to be the most dominant method in comparison to all other techniques utilised. After Kal vs. Roll, very little significance is achieved in the other sectors apart from the finance company sector, which enjoys more statistical significance. The Kalman filter superiority over other techniques could be down to its flexibility as the random walk process suggests. The random walk process can adapt to innovations in data variations, which allows the state space model to capture a more accurate beta as a result.

Table 4: Mean Squared Error Results 2007-2012

Sector	**KALMAN**	**ROLL**	**DCC**	**BEKK**	**GJR-GARCH**
Banks	0.002027*	0.003543	0.002859	0.003742	0.003384
Insurance	0.000099*	0.000654	0.000099*	0.000106	0.000197
Investment C.	0.000000*	0.000052	0.000019	0.000004	0.000026
Real Estates	0.002231*	0.003015	0.002583	0.002918	0.002961
Finance C.	0.000255	0.000021*	0.000458	0.000216	0.000147

*** Indicates Best Method**

Table 5: Modified Diebold-Mariano Test Results 2007-2012

	Banks	**Insurance**	**Invest. T.**	**Real Est.**	**Finance C.**
Kal-Roll	2.1823	-3.7290	-5.5822	3.5680	-3.1678
	(0.0298)**	(0.0002)***	(0.000)***	(0.0004)***	(0.0016)***
Kal-DCC	**-0.4055**	**-0.5572**	**0.2289**	**-0.3442**	-4.7843
	(0.6857)	**(0.5827)**	**(0.8191)**	**(0.7311)**	(0.0000)***
Kal-BEKK	**-0.5181**	**-0.4598**	**0.1344**	**-0.3744**	-4.7725
	(0.6048)	**(0.6465)**	**(0.8931)**	**(0.7087)**	(0.0000)***
Kal-GJR	**-0.3782**	**-0.0386**	**0.3018**	**-0.3761**	-5.1336
	(0.7056)	**(0.9697)**	**(0.7631)**	**(0.7071)**	(0.0001)***
Roll-DCC	**0.2019**	**-1.1049**	**-0.4764**	**0.1402**	2.4064
	(0.8408)	**(0.2721)**	**(0.6341)**	**(0.8887)**	(0.0167)**
Roll-BEKK	**-0.0363**	**-1.1893**	**-0.7157**	**0.0235**	1.7420
	(0.9713)	**(0.2389)**	**(0.4751)**	**(0.9816)**	(0.0824)*
Roll-GJR	**0.0275**	**-0.8093**	**-0.3438**	**0.0134**	**1.6293**
	(0.9781)	**(0.4191)**	**(0.7318)**	**(0.9896)**	**(0.1043)**
DCC-BEKK	**-0.4329**	**0.2813**	**-0.5171**	**-0.2814**	-3.1180
	(0.6661)	**(0.7788)**	**(0.6055)**	**(0.7788)**	(0.0019)***
DCC-GJR	**-0.2064**	**0.8791**	**0.1897**	**-0.2648**	**0.7759**
	(0.8369)	**(0.3801)**	**(0.8497)**	**(0.7919)**	**(0.4389)**
BEKK-GJR	**0.3973**	**0.8890**	**0.7904**	**-0.0495**	**-0.0980**
	(0.6916)	**(0.3752)**	**(0.4299)**	**(0.6244)**	**(0.9219)**

***** =1% Significance, ** = 5% Significance, * = 10% Significance and bold letters signifies insignificance.**

Figure 9: Banking Sector Time Varying Beta 2007-2012

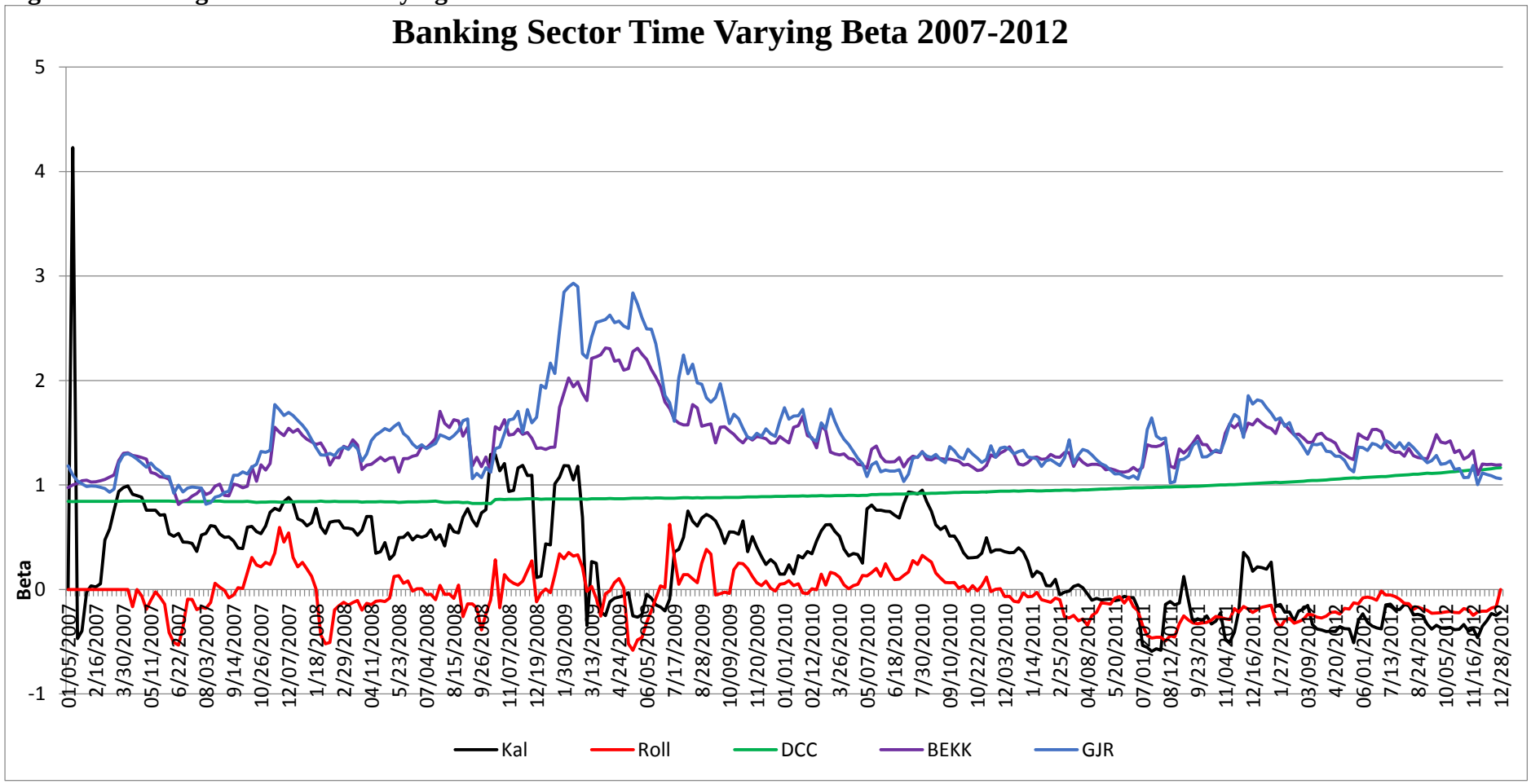


Figure 10: UK Insurance Sector Time Varying Beta 2007-2012

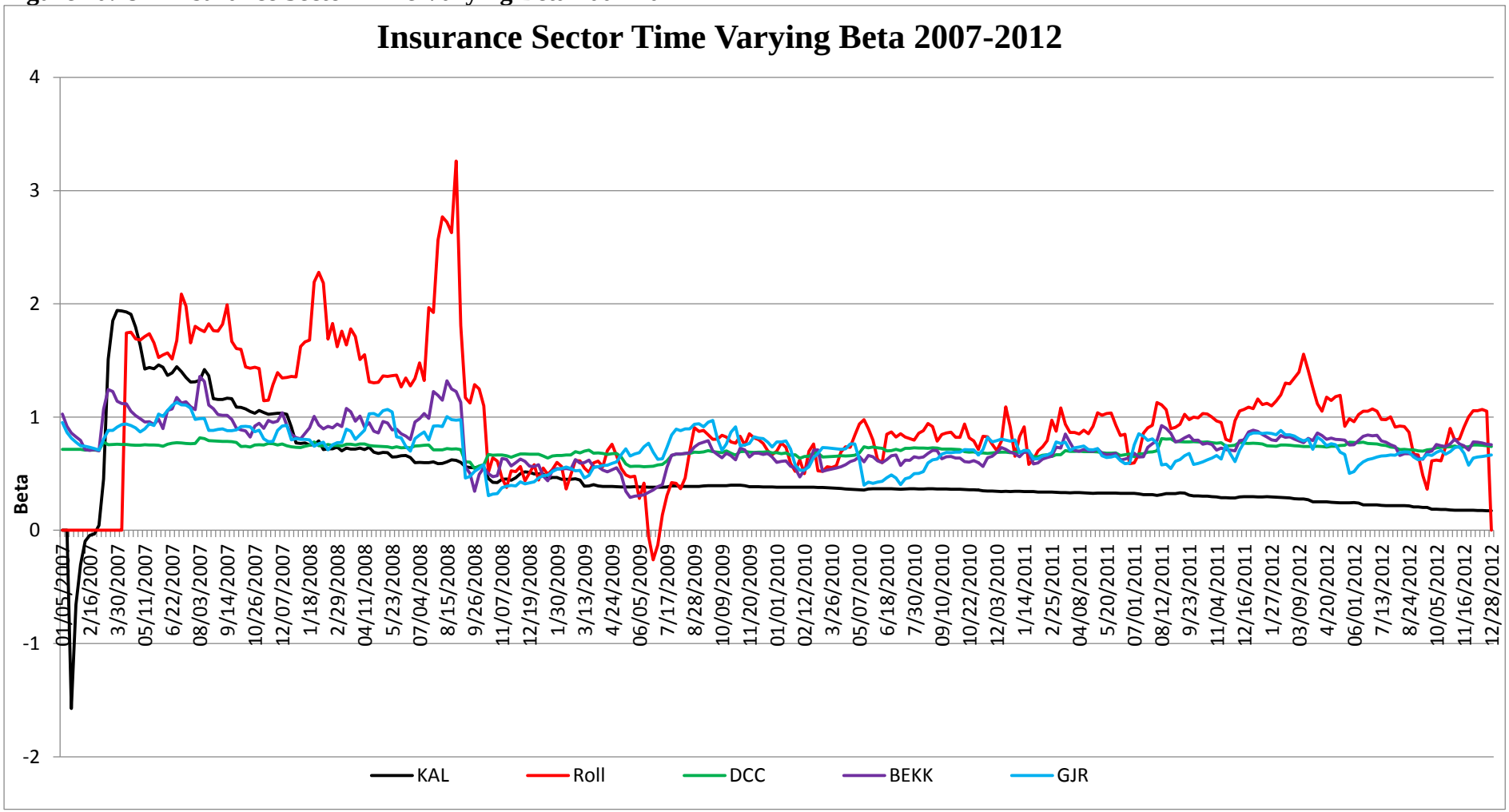


Figure 11: UK Investment Trusts Time Varying Beta 2007-2012

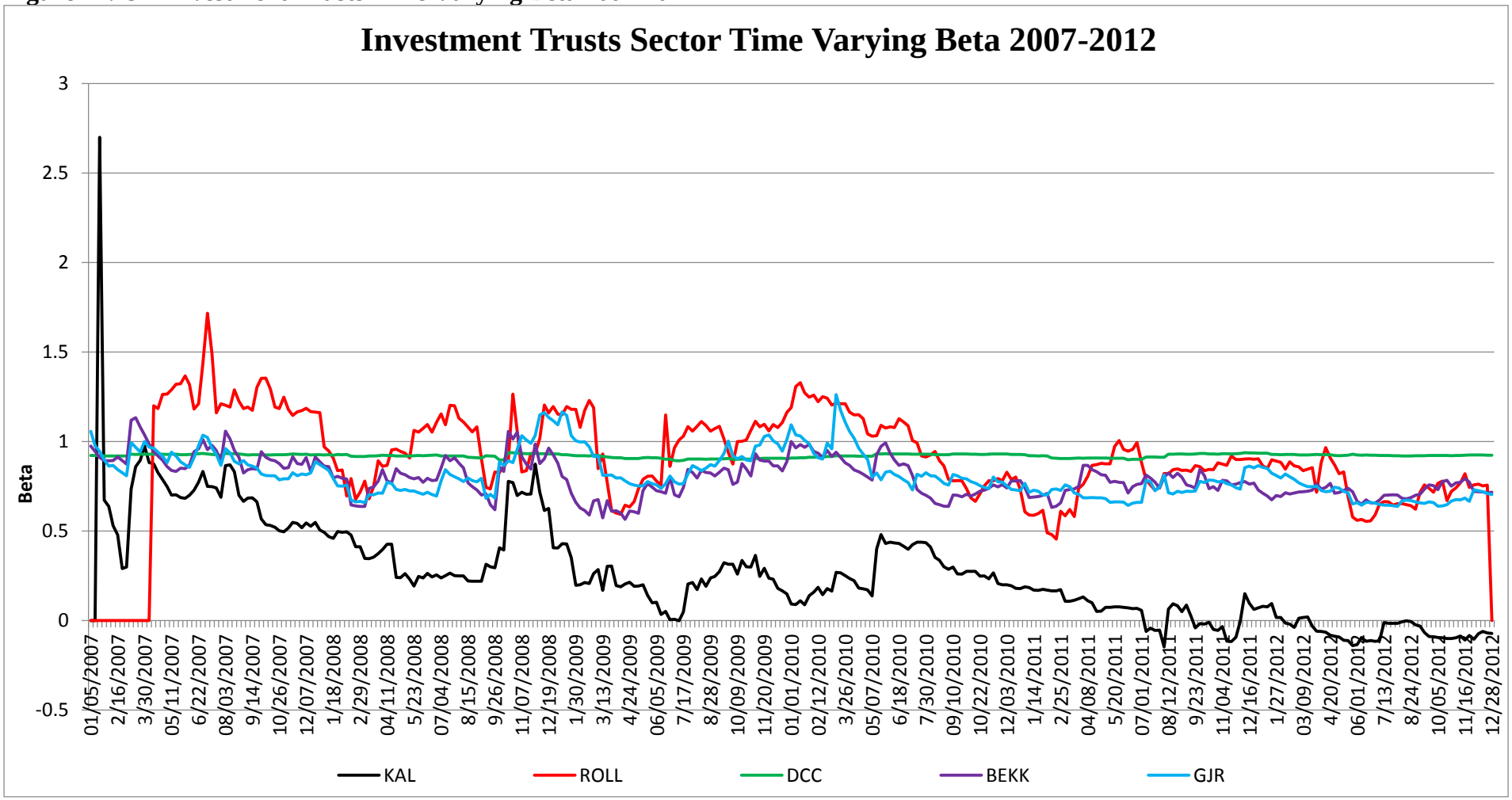


Figure 12: UK Finance Companies Time-Varying Beta 2007-2012

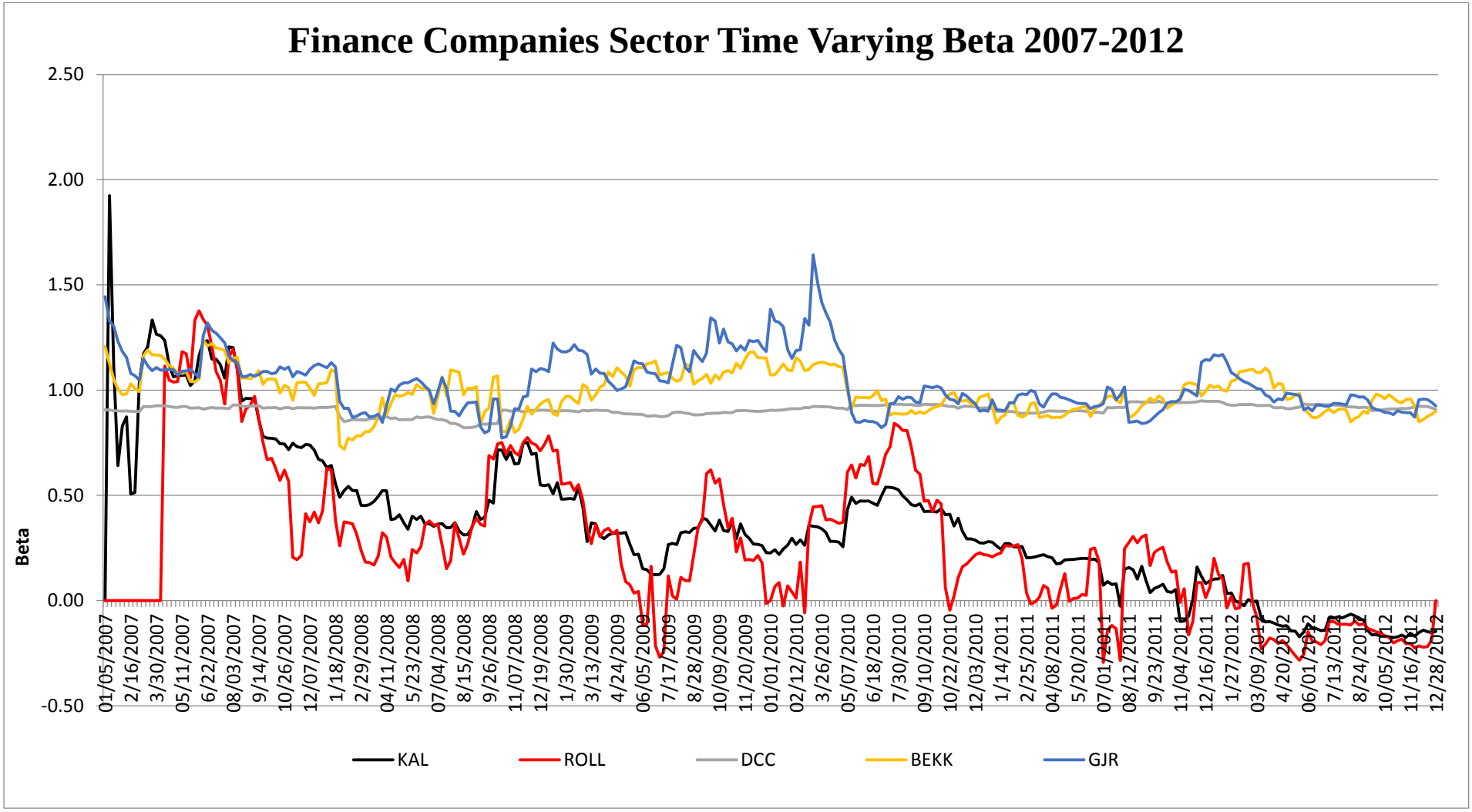


Figure 13: UK Real Estate Sector Time-Varying Beta 2007-2012

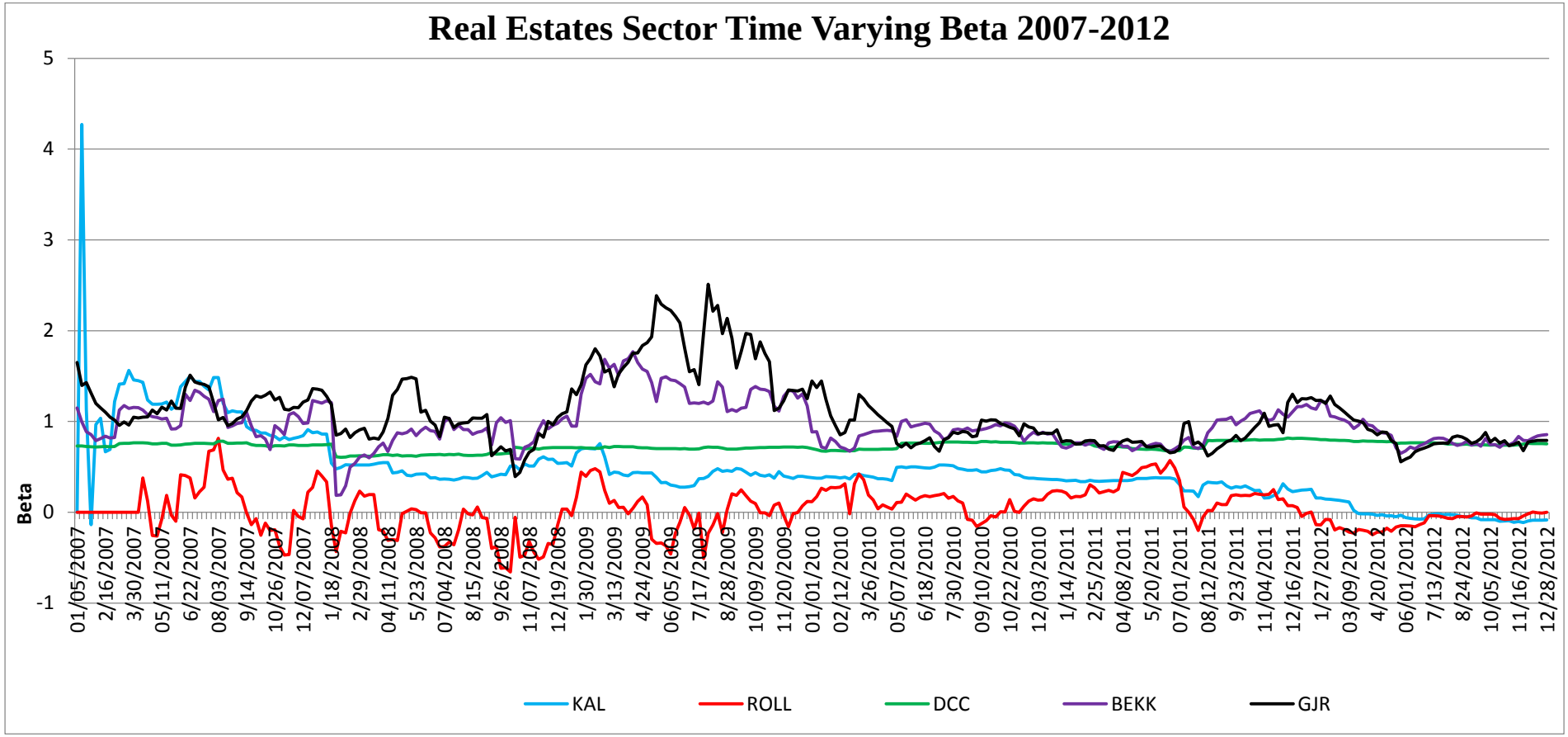
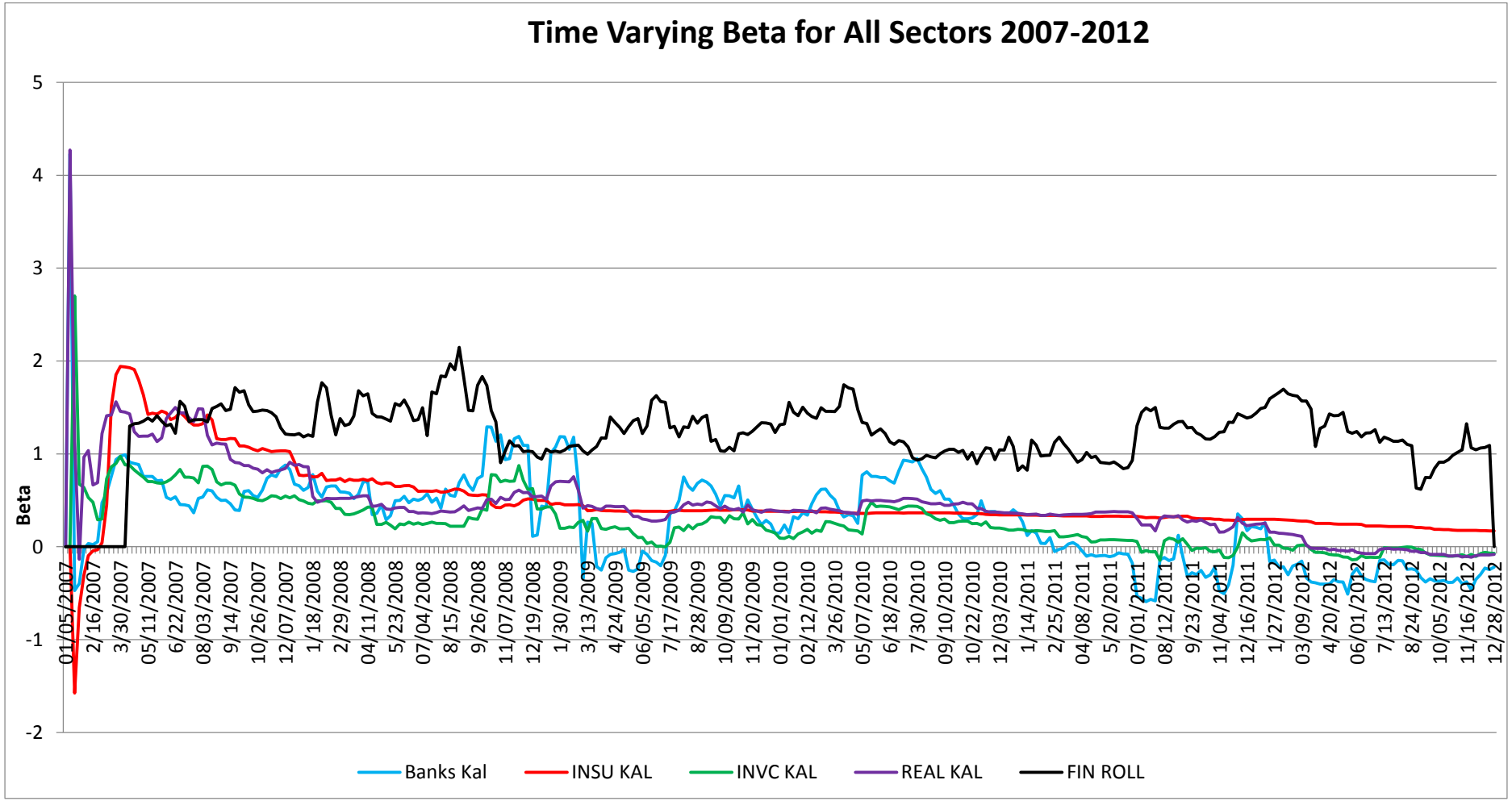


Figure 14: Time-Varying Beta All Sectors 2007-2012



4.5 Concluding Remarks

We set out this chapter to explain the changing risk profile of financial institutions over non-crisis and crisis periods. The significance of the study may be of interest to managers of financial institutions, investors and policy makers concerned with the movement of the systematic risk of the UK financial sectors. An important concern for policy makers in times of crisis is how best to contain and manage risk. This applies even more so as the goal of maintaining a stable financial system has received much importance following the global financial crisis and the European sovereign debt crisis. In addition, our empirical findings are relevant given the continuous discussions on financial regulation and the focus on risk measurement and the management of risk. For the perspective of policy makers, they gain a greater understanding of sector systemic risks that are prevalent in the economy, from which they can safeguard the economy through implementing effective regulatory policies. Furthermore, investors are able to have a greater understanding of their risk exposure to the financial sectors and will be able to possess greater power in terms of managing their portfolio and achieve improved diversification/returns. In order to carry this out we set testable hypotheses to determine the following; (i) to determine beta as a time-varying variable as given by the rich literature within this area; (ii) the banking sector possessed the greatest risk profile as given by the market; (iii) the Kalman filter to be the most accurate method in modelling time-varying beta. We applied five different methodologies using weekly data to determine the time-varying beta against the UK financial sectors which included the following; Kalman Filter; rolling regression; DCC-GARCH model; Bivariate BEKK model; GJR-GARCH.

To respond to our first hypothesis, we determine that beta is time-varying among the UK financial sectors, which is in line with Jacob (1971), Blume (1971), Fabozzi and Francis (1978), Alexander and Chervany (1980), Bos and Newbold (1984), Faff *et al.*, (1992) and many more. However, we do conclude that the time-varying beta is less volatile among the financial company sector within the UK and remains fairly stable as derived by the MSE within the DCC-GARCH methodology. This can be attributed towards their impact on the financial system within the UK as the banking sector has a significant presence within the market. The second finding is the insurance sector was the riskiest in the UK as perceived by the market via the systematic risk profile, beta. Beta is consistently held at a higher level within the insurance sector in comparison to all other financial sectors including banking. This can be aligned to the fact for every loan created, it is underwritten by an insurer, which covers the banking institutions in the case of default. Further to this the insurance sector also underwrites a wide

variety of insurance products, which again creates greater liability within their balance sheets and it's the sector ability to manage these risks appropriately, which determines their risk profile. We also demonstrate the banking sector adopts a large degree of systematic risk, specifically surrounding the build-up of the financial crisis as well as the variability during the crisis years. Other major findings include most accurate in-sample technique is the rolling regression technique as adopted by Fama and MacBeth (1973) in accordance to the MSE. However, the Kalman filter demonstrates its superiority over other techniques investigated as given by the modified Mariano and Diebold test, which is in line with by Brooks *et al.*, (1998), Mergner and Bulla (2008), Choudhry and Wu (2009) and Zhou (2012). Overall, all techniques are highly accurate and suitable to compute time-varying beta. We also mention that in the short-term the most suitable forecasting technique is the Kalman filter as our results demonstrate and is highly correlated to the literature. Furthermore, this research conducted will aid financial institutions, investors and portfolio managers in their valuation of systematic risk as well as financial decision making among the UK financial sectors.

CHAPTER 5

A Multivariate Analysis of the Effects of Macroeconomic News on the Equity Prices of UK Financial Institutions

5.1. Introduction

In recent years the global economy (spanning from the US to Western Europe and the Euro-Zone as a whole) have been wrestling a 'Financial Crisis', which has been the deepest since the 1930s. Countries from the developed and emerging world have been severely impacted by the crisis. This paved way for a sovereign debt crisis among some Euro-Zone countries, which relied on the debt markets to roll over national debt as means of policy responses from the concerned governments. On a daily basis most forms of media outlets have been dominated by financial headlines relating to the crisis. This in turn induced further volatility among the financial markets across the developed world, as investors learned to pull their investments as the crisis came into fruition. In order to restore confidence in the advanced economies, vast macroeconomic policy responses were implemented by respective governments and central banks from the US and Western Europe. The large scale initiatives were able to restore confidence to an extent and avert financial collapse. The global economy is still suffering from the consequences in terms of global demand as the world economy is lagging and not reached pre-crisis economic output levels. The UK has remained in a low interest rate environment in their bid to establish sufficient inflation as well as economic growth. Furthermore, other competitive economies such as the Euro-zone have exhausting all powers in order to attempt to avoid deflationary/disinflation issues and combat economic stagnation. These are the lasting effects of the financial crisis which are still present in today's economy, where several nations from Europe have now embarked upon negative interest rates. This is within their bid to regenerate demand and economic prosperity as the austerity measures implemented from European nations have successfully ruined prospects of any real growth in the EU as a whole including the UK. Youth unemployment across the UK and Europe has been severely fragmented since the outbreak of the crisis, from which has been on an increasing trend along with the debt-to-GDP ratio of the respective nations, most of which are above the 100% threshold. Despite the strong austerity measures undertaken by the majority of European nations, stock indices are nearing all-time highs, without the necessary economic growth to

coincide with such stock market activity. All these issues give rise to conducting research upon the effects of macroeconomic news impacting the financial markets and hopefully enrich the literature further.

To date there has been very little literature which has delved into researching the impact of macroeconomic news events within the UK financial sectors from the recent financial crisis. The relevant research within the literature has not covered all UK financial sectors with the focus being held towards banking institutions across many nations with also a different focus. The prime examples can be found from studies such as King (2009), Aït-Sahalia et al. (2012), Fratianni and Marchionne (2013), Dumontaux and Pop (2013), Klomp (2013) and Grammatikos et al. (2015). We aim to focus solely upon all UK financial sectors as the crisis impacted each sector in one form or another as they had to navigate through such volatility and challenging circumstances as unprecedented losses from institutions were surfacing to the public eye. By analysing the impact of news events we will be able to make accurate judgement upon how the UK financial market reacted to the interventions of the Bank of England, European Central Bank, Federal Reserve, International Monetary Fund, UK Government, US Government, European Governments and significant announcements from UK banking institutions. In order to conduct said research we will implement three regression modelling techniques to capture the markets' reaction to the unfolding events. The first method we apply is the traditional event study methodology as given by MacKinlay (1997). The second method we apply a multivariate regression model in a SUR model as introduced by Zellner (1962) and lastly we apply the GJR-GARCH approach as stated by Glosten et al. (1993).

From analysing the impact of macroeconomic news events towards the UK financial sectors is particularly interesting, mainly due to the following reasons. Firstly, from a policy perspective, if financial markets are found to hold inefficiencies in the pricing, whereby investors may have prior knowledge to the news events materialising this may present unfair market conditions and becomes a challenge for policy makers to produce further clarity to the markets. Secondly, we will be able to understand how integrated modern financial markets are today through including announcements from other western economies such as the USA and the EU. Thirdly, we will be able to determine how significant the actions from the respective central banks, governments and institutions were in such detrimental times.

This study contributes to the relevant literature in several ways; firstly it covers all UK financial sectors during a period which was the deepest financial crisis since the great

depression; Secondly, it enhances our knowledge for future reference when crisis periods arise and understand how the markets react from particular institutions. Lastly, it will provide an analysis into how successful each body were in regaining market confidence through the interventions and measures taken.

The chapter is organised as follows, Section 2 reviews the literature and hypotheses, Section 3 illustrating the data and methodology. Section 4 reviews the empirical results and Section 5 draws the chapter to a conclusion.

5.2. Review of Literature

The wealth of event-study literature surrounding the sub-prime financial crisis is one that is consistently growing and holds high importance for understanding future financial crisis periods. King (2009) examined the market reaction to government rescue packages across six nations through utilising Mackinlay's (1997) event study methodology and illustrated that bank stock prices continued to underperform in all nations bar the US. Also government interventions were found to benefit creditors at the expense of shareholders as bank CDS spreads were found to narrow around the announcement in all cases examined. Other additional contributions to the literature include as expected, the stock price of banks receiving support perform worse than banks which did not receive support. The drawback of this study was highlighted by Grammatikos et al. (2015), which indicates King (2009) did not consider serial heteroskedasticity, event induced volatility and overlapping events, from which can introduce biasness within the results and are not completely robust. Grammatikos et al. (2015) undertook an EGARCH (Nelson (1991)) approach in order to resolve the issues from King (2009), as the EGARCH model allows one to effectively model positive and negative shifts within the data and therefore will be able to identify shocks that the market received. Their results illustrated that US policy announcements had a stronger impact on European and US banking sectors than European policy announcements. Aït-Sahalia et al. (2012) constructed a detailed database of events relating to the unfolding crisis, which will be utilised within this study. However the paper focussed on interbank credit and liquidity risk premia during the crisis and found the policy interventions were associated with a reduction in interbank risk premia. As the market responded most effectively towards the cutting of interest rates and the bank recapitalization towards the restoring of confidence and reduced volatility. Furthermore Aït-Sahalia et al. (2012) highlights international spill-overs of policy announcements increased as the crisis

deepened and policy makers did their utmost to restore stability. Once central banks began to coordinate their policy responses, market confidence globally was able to be restored. Fratianni and Marchionne (2013) examined the impact of government interventions through the market responses in bank equity values, by undertaking traditional even-study methodology followed by robust modern econometric techniques to control for heteroskedasticity and auto-correlation. Once time-series effects issues have been corrected, virtually all announcement impacts vanish in Europe, whereas they weaken in the US. This suggests that the policies introduced were not credible in the eyes of market participants. Further, results suggest general announcements generate positive abnormal returns and lower market risk, whereas specific announcements generate negative abnormal returns and higher market risk, as the market are able to identify the risk levels between institutions. Fratianni and Marchionne (2013) did acknowledge the limitations of their study to the financial markets and to short-term reactions. Actual government interventions, as opposed to announcements of interventions, may exert positive effects on corporate borrowers' stock returns (Norden et al., 2011) or banks' loan supply (Li, 2013). Black and Hazelwood (2013) considered the effects of the Troubled Asset Relief Programme (TARP) capital injections on banks that received funding, which were advised to then create additional loans to economy in order to restore confidence at a time where borrower default risk was running high, through analysing the risk ratings of the bank's loan originations during the crisis. Their results highlighted that relative to non-TARP banks, the risk of loan originations increased at large TARP banks but decreased at small TARP banks. Furthermore, their results indicate the inverse relationship between loans and size of bank highlights an issue of moral hazard, whereby large banks increased in risk-taking activity without an increase with lending. Dumontaux and Pop (2013) extended literature within this field by focussing on the failure of Lehman Brothers in September, 2008. The study included modelling stock market data and credit default swap (CDS) spreads through event in order to identify any spill over effect on the surviving institutions through the SUR multivariate regression framework combined with the event study methodological approach. The overall empirical analysis indicated that the collateral damage was limited to the largest financial institutions, with the non-bank financial service firms being the most affected. Furthermore there were signals suggesting a significant abnormal jump in CDS spreads that are interpreted as evidence of sudden upward revisions, suggesting possible systemic market failure was perceived by investors. This study is consistent with the work from Merton (1974) which states the decline of stock prices results in an increase of leverage, contributing to a rise of default risk, which can be evident within CDS spreads. Klomp (2013) further enriched the literature

strand concerning the effectiveness of financial sector rescue packages provided by governments during the crisis. Klomp (2013) highlights issues with previous research, which undertook panel regression models, as exposure levels were different among institution, which ultimately leads to a heterogeneity problem and may cause biased results. This problem was rectified through quantile regression models on an individual institution basis by estimating the relationship between the CDS spreads and announcements of rescue packages. Interventions aimed at specific financial institutions were found to be more effective in preventing banking risk as opposed to broader interventions to stabilize financial markets. The main contribution towards the literature was finding a statistically negative relationship between the announcement of the financial sector rescue packages and the daily change of the credit default premium. However, through using the quantile regression method Klomp (2013) was able to distinguish that most interventions do not decrease the risk of intermediate to low-risk banks, but did overall stress the need for continued research behind the reaction of markets towards policy announcements.

Given the literature examined above we will set four hypotheses in order to direct our research specifically against. The first hypothesis states investors within banking sector were able to distinguish the risk exposure levels among UK banking institutions via the CDS. This hypothesis is drawn upon from the efficient market hypothesis, whereby we examine whether market inefficiencies arise within the CDS market. The theory being that markets are efficient and therefore all relevant information is correctly priced into the asset. We expect the outcome to be that investors were able to distinguish risk levels among the differing banks as given by the size of each institution during the outbreak of the crisis. The second hypothesis will examine importance of the central banks during periods of instability. The theory states the central banks are known as the lender of last resort, which highlights their significant role within financial markets. Therefore, the monetary policy initiatives of the Bank of England were more effective than the measures applied by the UK Government to restore confidence in the banking sector. We expect this theory to be exemplified during the crisis period as the efforts made by the BoE were more significant than the UK Government. However, the element of surprise by the government's actions may prove to be equally significant. The third hypothesis we introduce is as follows; announcements from Western economies such as the USA, Europe and International Monetary Fund (IMF) had a more significant effect on non-banking institutions than the combined announcements of the UK Government and the Bank of England. The underlying theory behind this testable hypothesis highlights the new integrated

global financial world. Whereby, financial institutions in the UK hold exposure to other Western economies such as USA and Europe. This was evident among certain banks in the UK and we wish to extend this to non-banking institutions. Lastly, we hypothesise announcements from the major central banks (Federal Reserve, European Central Bank) and the IMF had a positive effect on the UK banking sector. This will examine the exposure levels UK banks held to other nations. From this hypothesis we expect a positive outcome as these major international central banks have a key role in global economics/financial markets and that their announcements should have a positive impact upon equity prices.

5.3. Empirical Approach

5.3.1 Data

Our dataset consists of logged daily returns of all listed UK financial institution's and the FTSE100 index over the period from January 3rd 2006 to December 31st 2012. These dates enable us to capture the unfolding pre-crisis, during the crisis and post-crisis events. For all institutions we will collect daily returns of 10-year UK Government bonds as a rise in the bond rates would suggest the perception of a crisis was upon as investors seek to safe haven assets and reduce as much exposure to the sub-prime collapse as possible. In order to capture the risk element of relevant institution's, daily CDS spread data throughout the same period is collected for the banking and insurance sector opting for 5 year CDS spread data as this is the most liquid in the market. The data is collected from financial databases Bloomberg and Thomson Reuters Datastream with the event list illustrated in Appendix 1, with a list of the companies and their total assets in Appendix 2.

5.3.2 Methodology

5.3.2.1 Event Study

The unfolding financial events that we witnessed collectively within the developed world from 2007 onwards were an immediate consequence of liquidity within the interbank markets freezing and gave entry to the UK government and Bank of England (BoE) as a lender of last resort to intervene, in order to estimate the markets' reaction we employ a an event-study led methodology firstly following the approach of Mackinlay (1997). Firstly, we estimate the abnormal returns (ARs) through the market model with an estimation period of 295 days prior to the first event window, which in this instance will be 5 days prior to the first event. Event

windows of -/+5 days before and after event date as well as -/+1 day is opted in order to reduce event clustering as much as possible. This is implemented as follows:

Market model is estimated as:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it} \quad (5.1)$$

Where; β_i = COV(R_i, R_M)/VAR(R_M) and E(ε_{it}) = 0

Once the market model is computed for respective institution, the ARs are then obtained through the differences within actual stock return and the predicted by the market model, which is as follows:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{Mt}) \quad (5.2)$$

The ARs are then cumulated (CARs) over specified time periods concerning the events, through considering 10-day (-5, +5) and 3-day (-1, +1) event windows, with the CARs computed as follows:

$$CAR_i(t_1, t_2) = \sum_{t=t1}^{t2} AR_{it} \quad (5.3)$$

Where t_1 and t_2 are the start and end date of considered window periods. The CARs for each event are then aggregated on a cross-section basis for a portfolio of N observations as well accommodate for type of event, with the Cumulative Average Abnormal Returns (CAARs) calculated as follows:

$$CAAR(t_1, t_2) = \frac{1}{N} \sum_{i=1}^{N} CAR\ (t_1, t_2) \quad (5.4)$$

We employ non-parametric hypothesis tests from Boehmer, Musumeci and Poulsen (1991) and Cowan (1992) due to their robustness. As the issues in parametric tests, witness too frequently a rejection in the null hypothesis as increased variance in the stock returns close to the event days may cause unreliable and/or distorted results according to Boehmer, Musumeci and Poulsen (1991) which is also demonstrated in Campbell and Wasley (1993), which provide evidence that nonparametric rank tests provide more reliable inferences in comparison to parametric tests.

We apply the standardised cross-sectional test by Boehmer, Musumeci and Poulsen (1991), which is an extension of Patell (1976) and is a robust approach to event induced variance increase in stock returns, from which we suspect the financial crisis caused. The test statistic produced from the standardised cross-sectional test is examined against a null hypothesis where the cumulative abnormal returns are set to zero. The calculation to gain the test statistic is as follows:

First the abnormal returns are standardised through the estimated standard deviation by;

$$SAR_{i,\tau} = \frac{AR_{i,\tau}}{S(AR_i)} \tag{5.5}$$

Where: $SAR_{i,\tau}$ represents the estimated standard deviation, $AR_{i,\tau}$ the abnormal returns of security *i* during time τ and $S(AR_i)$ represents the standard error of day *i*.

We then need to estimate the standard deviation of the time series of abnormal returns throughout the event window period to produce an unbiased estimate of the standard deviation, which is as follows:

$$\hat{\sigma}AR_i^{\,2} = \frac{\sum AR_{i,\tau}}{T-d} \tag{5.6}$$

Where: T Represents the number of days outside of estimation period, d represents the degrees of freedom and in our case since the market model is utilised d = 2.

In order to address the event window abnormal returns is an out of sample prediction, the standard error is corrected by the forecast error as follows:

$$S(AR_i) = \hat{\sigma}AR_i \sqrt{1 + \frac{1}{T} + \frac{(R_{m,\tau} - \overline{R_{M,Est}})^2}{\sum_{Est\ min}^{Est\ max}(R_{m,\tau} - \overline{R_{M,Est}})^2}} \tag{5.7}$$

Where: $R_{m,\tau}$ represents the return on the market and $\overline{R_{M,Est}}$ is the average of the market return during the estimation period.

The standardised abnormal returns are then cumulated over time which is as follows:

$$CSAR_i(\tau_1, \tau_2) = \sum \frac{AR_{i,\tau}}{S(AR_i)} \tag{5.8}$$

Where: $CSAR_i(\tau_1, \tau_2)$ Symbolizes the cumulated standardised abnormal returns throughout time period.

The average of the cumulated standardised abnormal returns is then computed in relation towards number of events:

$$\overline{CSAR}_{(\tau_1,\tau_2)} = \frac{1}{N}\sum CSAR_i(\tau_1, \tau_2) \quad (5.9)$$

Where: $\overline{CSAR}_{(\tau_1,\tau_2)}$ is the average of the cumulated standardised abnormal returns throughout time period with *N* signified as the number of events.

The standard deviation of the averaged cumulated standardised abnormal returns is then estimated of the event window:

$$S(\overline{CSAR}) = \sqrt{\frac{1}{N(N-1)}\sum(CSAR_i(\tau_1, \tau_2) - \overline{CSAR}_{(\tau_1,\tau_2)})^2} \quad (5.10)$$

Where: $S(\overline{CSAR})$ Represents the standard deviation of the averaged cumulated abnormal returns.

The test statistic of the standardised cross-sectional is calculated as follows:

$$T_B = \frac{\overline{CSAR}_{(\tau_1,\tau_2)}}{S(\overline{CSAR})} \quad (5.11)$$

Where: T_B Signifies the Test statistic of Boehmer et al (1991).

Further to the standardised cross-sectional test we also employ the nonparametric test of Cowan (1992) generalized sign test. This is based on the ratio of cumulative abnormal returns across the event period window, with the proportion of positive abnormal returns are the null hypothesis of 0.5. The generalized sign test statistic is calculated as follows:

$$T_{GS} = \frac{p_0^+ - p_{Est}^+}{\sqrt{p_{Est}^+(1-p_{Est}^+)/N}} \quad (5.12)$$

Where: T_{GS} Signifies the test statistic of the generalised sign test, p_0^+ illustrates the ratio of positive CARs over the event window, p_{Est}^+ is the estimated positive CARs over the event window period and N denotes the number of events considered.

5.3.2.2 SUR Methodology

In order to derive a more accurate understanding of the financial crisis we apply a multivariate regression model (MVRM), which is based on a system of seemingly unrelated regressions (SUR) as introduced by Zellner (1962). This approach has been utilised by many event based studies such as Cornett and Tehranian (1990), Madura, Tucker and Zarruk (1991) and Kabir and Hassan (2005). The approach is aimed to reduce the event clustering that was evident during the height of the financial crisis, where we witnessed significant news event filtering through within days apart of each other, which induced vast levels of volatility. All the variables are to be transformed into their natural log form as well achieve stationarity via Augmented Dickey-Fuller and Phillips-Perron tests, this will enable us to reduce the noise within the data as much as possible. The SUR approach takes into account the heteroskedasticity across the equation and contemporaneous correlations between the disturbances and takes the following form:

$$R_{it} = \alpha_i + \beta R_{mit} + BOND_t + LIBOR_t + REPO_t + \sum_{n=1}^{n} \theta_{it} D\_BOE_t + \theta_{it} D\_GOV_t + +\theta_{it} D\_USGOV_t + \theta_{it} D\_FED_t + \theta_{it} D\_EUROGOV_t + \theta_{it} D\_ECB_t + \theta_{it} D\_IMFO_t + \varepsilon \quad (5.13)$$

Where: R_{it} is denoted as the daily logged returns of institution *i* on day *t*, βR_{mit} denoted as the market model for institution *i* on day *t*. $BOND_t$ captures the daily return of UK 10-year Government Bond on day *t*, $LIBOR_t$ capture the one month LIBOR rate on day *t*, $REPO_t$ represents the one month repurchase rate by the BoE on day *t*. θ_{it} represents the abnormal returns of institution *i* on day *t* D_BOE_t, D_GOV_t, D_USGOV_t, D_FED_t, $D\_EUROGOV_t$, D_ECB_t and D_IMFO_t represent the dummy variables to capture announcements made by the BoE, UK Government, US Government, Federal Reserve, European Governments, European Central Bank and the International Monetary Fund combined with other major announcements on day *t* with a value of 1 to represent day of announcement, otherwise a value of 0. ε Is denoted as the error disturbance term.

In order to gain a greater understanding of the impact of news on the UK financial sector, more specifically the banking and insurance sectors, we expand equation (13) and include the logged daily CDS spreads as follows:

$$R_{it} = \alpha_i + \beta R_{mit} + CDS_{it} + BOND_t + LIBOR_t + REPO_t + \sum_{n=1}^{n} \theta_{it} D\_BOE_t + \theta_{it} D\_GOV_t + \theta_{it} D\_USGOV_t + \theta_{it} D\_FED_t + \theta_{it} D\_EUROGOV_t + \theta_{it} D\_ECB_t + \theta_{it} D\_IMFO_t + \varepsilon \quad (5.14)$$

Where: CDS_{it} represents the credit default swap spread of institution *i* on day *t*.

5.3.2.3 Further Examination

To confirm the strength of results generated, we apply the generalised auto-regressive conditional heteroskedastic (GARCH) models as proposed by Bollerslev (1986). Firstly, we assess whether the banking institutions daily logged stock returns hold ARCH effects, once this is proven, we utilise the GJR-GARCH model proposed by Glosten, Jagannathan and Runkle (1993). The model allows positive and negative fluctuations in returns to impact differing conditional volatility, which enables us to examine the leverage effect, whereby we are able to measure shocks such as news as volatility increases with the announcement of "good" and "bad" events. The methodology for this section follows that of Kim and In (2002), via the adoption of the GJR-GARCH with the addition of a new variable for robustness purposes:

Mean:

$$lnR_{it} = \alpha_0 + \beta R_{mit}[\varepsilon_{t-1}] + LIBOR_t + REPO_t + CDS_{it}[\varepsilon_{t-1}] + \epsilon \quad (5.15)$$

Variance:

$$h = \alpha_0 + \alpha b_{t-1}^2 + \alpha b_{t-1}^2 b_{t-1<0} + \alpha \delta_{t-1} + \lambda_1 |\theta_{it} D\_BOE[\varepsilon_{t-1}]| + \lambda_2 |\theta_{it} D\_GOV[\varepsilon_{t-1}]| + \lambda_3 |\theta_{it} D\_USGOV[\varepsilon_{t-1}]| + \lambda_4 |\theta_{it} D\_FED[\varepsilon_{t-1}] + \lambda_5 |\theta_{it} D\_EUROGOV[\varepsilon_{t-1}] + \lambda_6 |\theta_{it} D\_ECB[\varepsilon_{t-1}] + \lambda_7 |\theta_{it} D\_IMFO[\varepsilon_{t-1}] + \lambda_7 |\theta_{it} D\_BANKS[\varepsilon_{t-1}] + \epsilon \quad (5.16)$$

Where: ln R_{it} represents the logged daily stock returns of institution *i* on day *t*, βR_{mit} denotes the market model for institution *i* on day *t*. α Represents a constant parameter, *b* holds a residual value and δ denotes the GARCH element within the model. $\alpha b_{t-1}^2 b_{t-1<0}$ Captures the leverage effect. D_BANKS Is a dummy variable to capture the abnormal returns concerning the banking sector announcements.

5.3.3 Descriptive Statistics

5.3.3.1 UK Banks Descriptive Statistics

When examining the standard deviation within Table 1 with respect to the UK banking sector, we exhibit the abnormal returns on Government and BoE announcements deemed to be most volatile among the dummy variables. This in turn may lead to speculation from the data that announcements concerning government and the BoE news had the greatest impact towards the financial markets causing the greatest shocks. Conversely, from a glance we can expect the dummy variables concerning ECB and IMF/Other announcements deemed to be less volatile and therefore have a lesser impact towards the stock prices against the UK banking sector, suggesting investors anticipated such events. The greatest volatility is found within the Libor and Repo rates as well as Government Bond prices and CDS swaps. This is to be expected due to the volatility/uncertainty experienced during the outbreak of the financial crisis, however further analysis will confirm this. Negative Skewness in all dummy variables bar the Federal Reserve, which exhibit a positive Skewness and therefore naturally suggest a positive impact is expected, however all dummy variables are leptokurtic. Positive Skewness is found within the Libor and Repo rates which exemplify a platykurtic distribution. Finally, we must note Jarque-Bera test suggest all variables considered are not normally distributed.

Table 1: Descriptive Statistics UK Banking Sector

	Mean	Max	Min	St. Dev.	Skew.	Kurtosis	J-B	PP	ADF
RET	-0.0011	0.5495	-1.0957	0.0373	-2.4877	85.2642	3763981	-106	-23.389
ER	-0.0003	0.1262	-0.1246	0.0147	-0.1324	10.8967	34595.28	-125	-17.555
BOND	1.2631	1.7134	0.3639	0.3328	-0.9789	2.9478	2824.284	-132	-39.193
LIBOR	0.4509	1.9095	-0.7070	1.0638	0.2363	1.1543	2672.584	-132	-131.54
REPO	0.2888	1.7830	-0.8916	1.1298	0.2913	1.1496	2770.85	-146	-30.813
CDS	0.0020	4.0351	-4.0291	0.2745	-0.5550	92.0941	4396217	-327	-25.176
BANKS	-0.0001	0.0682	-0.5399	0.0068	-68.9083	5242.1100	1.52E+10	-115	-115.3
BOE	-0.0002	0.2731	-1.0858	0.0120	-60.8961	5193.3190	1.49E+10	-115	-115.32
ECB	0.0000	0.0677	-0.1549	0.0025	-39.2085	2583.7110	3.69E+9	-115	-115.3
EUGOV	-0.0002	0.0761	-0.5399	0.0089	-43.0235	2233.8750	2.76E+9	-107	-28.173
FED	0.0001	0.1916	-0.2091	0.0039	8.4749	1593.4810	1.40E+9	-117	-78.67
GOV	-0.0002	0.2731	-1.0858	0.0132	-48.3099	3758.8070	7.82E+9	-116	-26.622
IMFO	0.0000	0.0709	-0.0791	0.0018	-4.5314	1098.8790	6.66E+8	-115	-115.33
USGOV	0.0000	0.1423	-0.1726	0.0041	-5.5184	698.4361	2.68E+8	-115	-24.587

5.3.3.2 Insurance Companies Descriptive Statistics

When examining the standard deviation within Table 2 with respect to the UK insurance sector, we exhibit the abnormal returns on Government and BoE announcements deemed to be most

volatile among the dummy variables. This may suggest that announcements concerning government and the BoE news had the greatest impact towards the financial markets causing the greatest shocks. The greatest volatility is found within the Libor and Repo rates and CDS swaps, which also produces negative Skewness and therefore expect negative results. Platykutic distribution is also found within Libor, Repo and Bond with CDS spreads experiencing a mesokurtic distribution. Positive Skewness in all dummy variables bar the BoE and US Government announcements, which exhibit a negative Skewness and therefore naturally suggest a negative impact, is expected within those two dummies. The commonalities within all variables are found to be non-normally distributed, which is accredited to the Jarque-Bera results as well as all variables enjoying stationarity via Augmented Dickey-Fuller and Phillips-Perron tests.

Table 2: Descriptive Statistics UK Insurance Sector

	Mean	Max	Min	St. Dev.	Skew.	Kurtosis	J-B	Prob.	PP	Prob.	ADF	Prob.
RET	0.0001	0.2643	-0.4060	0.0253	-0.2363	18.62	1.80E+5	0.00	-144.202	0.00	-60.69	0.00
ER	0.0001	0.1567	-0.1543	0.0158	-0.1505	15.29	1.11E+5	0.00	-141.84	0.00	-20.67	0.00
BOND	1.2631	1.7134	0.3639	0.3328	-0.9789	2.95	2.82E+3	0.00	-4.66	0.00	-4.74	0.00
CDS	4.4131	7.9015	1.7492	1.1391	-0.3368	3.08	1.57E+2	0.00	-89.93	0.00	-59.34	0.00
LIBOR	0.4509	1.9095	-0.7070	1.0638	0.2363	1.15	2.67E+3	0.00	-132.01	0.00	-131.54	0.00
REPO	0.2888	1.7830	-0.8916	1.1298	0.2913	1.15	2.77E+3	0.00	-146.23	0.00	-30.81	0.00
BOE	0.0000	0.1256	-0.3550	0.0044	-44.0284	3577.28	9.41E+9	0.00	-132.92	0.00	20.033	0.00
ECB	0.0000	0.0940	-0.0254	0.0010	53.9795	4426.30	1.44E+10	0.00	-132.96	0.00	-132.96	0.00
EUGOV	0.0000	0.1051	-0.1023	0.0025	2.7328	851.84	5.31E+8	0.00	-133.46	0.00	-69.67	0.00
FED	0.0000	0.0873	-0.0315	0.0018	31.4579	1300.33	1.24E+9	0.00	-133.47	0.00	-36.51	0.00
GOV	0.0000	0.2185	-0.1025	0.0036	14.5008	1158.32	9.83E+8	0.00	-136.35	0.00	-27.09	0.00
IMFO	0.0000	0.0667	-0.0335	0.0010	32.1760	2044.29	3.07E+9	0.00	-132.96	0.00	-132.96	0.00
USGOV	0.0000	0.1914	-0.1505	0.0030	-0.0522	1592.21	1.86E+9	0.00	-132.98	0.00	-34.594	0.00

5.3.3.3 Finance Companies Descriptive Statistics

Turning our attention towards the standard deviation within Table 3 with respect to the UK finance companies sector, we find the most volatile variables are found to be Libor, Repo and Bond prices, which are all platykurtic. With Libor and Repo rates deemed to be positive, while bond prices are negative due to casual observations from Skewness. With respect to the dummy variables positive Skewness is found in all bar BoE announcements, which indicates that a negative result is expected. However, the commonality is leptokurtic distribution is found in all dummy variables. Furthermore, with respect to governmental news it is found to be the most volatile among the dummy variables as they experience greatest standard deviation. One commonality within all variables is the non-normality distribution, which is accredited to the Jarque-Bera results as well as all variables enjoying stationarity via Augmented Dickey-Fuller and Phillips-Perron tests.

Table 3: Descriptive Statistics UK Finance Companies

	Mean	Max	Min	St. Dev.	Skew.	Kurtosis	J-B	Prob.	PP	Prob.	ADF	Prob.
RET	-0.0002	0.1680	-0.2746	0.0241	-0.1589	9.17	22460	0.00	-149.45	0.00	-65.04	0.00
ER	-0.0002	0.0965	-0.0971	0.0125	-0.1289	10.41	32403	0.00	-155.58	0.00	-21.56	0.00
BOND	1.2631	1.7134	0.3639	0.3328	-0.9789	2.95	2259	0.00	-5.33	0.00	-5.63	0.00
LIBOR	0.4509	1.9095	-0.7070	1.0638	0.2363	1.15	2138	0.00	-3.94	0.00	-3.55	0.01
REPO	0.2888	1.7830	-0.8916	1.1298	0.2913	1.15	2217	0.00	-3.95	0.00	-3.99	0.00
BOE	0.0000	0.0800	-0.1139	0.0033	-0.9835	388.42	8.75E+7	0.00	-145.71	0.00	-145.61	0.00
ECB	0.0000	0.0398	-0.1139	0.0015	-30.2316	2557.22	3.84E+9	0.00	-145.61	0.00	-145.61	0.00
EUGOV	-0.0001	0.0498	-0.1216	0.0027	-22.6774	872.20	4.46E+8	0.00	-150.34	0.00	-38.64	0.00
FED	0.0000	0.0849	-0.0454	0.0016	16.0361	1123.66	7.40E+8	0.00	-147.36	0.00	-38.83	0.00
GOV	-0.0001	0.0828	-0.1216	0.0037	-14.2351	499.68	1.46E+8	0.00	-145.65	0.00	-29.56	0.00
IMFO	0.0000	0.0469	-0.0430	0.0010	5.4227	1158.97	7.87E+8	0.00	-145.65	0.00	-145.65	0.00
USGOV	-0.0001	0.0644	-0.1145	0.0025	-17.8709	756.90	3.36E+8	0.00	-145.75	0.00	-51.93	0.00

5.3.3.4 Investment Trusts Descriptive Statistics

From casual observations of Table 4, it is evident within the dependent variable (RET) a negative outcome may occur due to the Skewness illustrating such result, with little volatility experienced. Following this, greatest volatility within the variables is found within the Libor and Repo rates as they experience highest standard deviations. With reference to Bonds, Libor and Repo rates are found to be platykurtic distributed, whereas all other variables are leptokurtic. With regards to the dummy variables, it is clear to see that announcements from the BoE, Federal Reserve and IMF/others are deemed to hold a positive result, whereby all other dummy variables are more likely to produce a negative result as their Skewness sign suggests. Standard deviations within the dummy variables are fairly stable with BoE highest. The commonalities within all variables are found to be non-normally distributed, which is accredited to the Jarque-Bera results as well as all variables enjoying stationarity via Augmented Dickey-Fuller and Phillips-Perron tests.

Table 4: Descriptive Statistics UK Investment Trusts

	Mean	Max	Min	St. Dev.	Skew.	Kurtosis	J-B	Prob.	PP	Prob.	ADF	Prob.
RET	0.0002	0.171	-0.168	0.0163	-0.091	9.018	9.34E+4	0.00	-266.38	0.00	-36.63	0.00
ER	0.0002	0.124	-0.122	0.0117	-0.121	11.500	1.86E+5	0.00	-267.20	0.00	-41.75	0.00
BOND	1.2631	1.713	0.363	0.3327	-0.979	2.947	9.88E+3	0.00	-9.51	0.00	-10.54	0.00
LIBOR	0.4509	1.909	-0.707	1.0638	0.236	1.154	9.35E+3	0.00	-248.44	0.00	-246.33	0.00
REPO	0.2888	1.782	-0.892	1.1297	0.291	1.149	9.70E+3	0.00	-272.33	0.00	-36.88	0.00
BOE	0.0000	0.076	-0.069	0.0018	7.914	574	8.43E+8	0.00	-248.75	0.00	-57.19	0.00
ECB	0.0000	0.043	-0.051	0.0007	-11.239	1900	9.28E+9	0.00	-248.68	0.00	-50.10	0.00
EUGOV	0.0000	0.099	-0.084	0.0017	-3.376	799	1.63E+9	0.00	-254.30	0.00	-29.76	0.00
FED	0.0000	0.078	-0.078	0.0012	19.029	1453	5.42E+9	0.00	-248.76	0.00	-248.74	0.00
GOV	0.0000	0.052	-0.106	0.0017	-19.422	839	1.81E+9	0.00	-249.53	0.00	-42.75	0.00
IMFO	0.0000	0.040	-0.051	0.0006	14.101	1660	7.08E+9	0.00	-248.81	0.00	-248.80	0.00
USGOV	0.0000	0.058	-0.101	0.0015	-7.325	874	1.96E+9	0.00	-248.68	0.00	-248.68	0.00

5.3.3.5 Real Estates Descriptive Statistics

From casual observations within Table 5 it is evident within the dependent variable (RET) a negative outcome may occur due to the Skewness illustrating such result, with little volatility experienced. Following this, greatest volatility within the variables is found within the Libor and Repo rates as they experience highest standard deviations. With reference to Bonds, Libor and Repo rates are found to be platykurtic distributed, whereas all other variables are leptokurtic. With regards to the dummy variables, it is clear to see that announcements from the Federal Reserve and IMF/others are deemed to hold a positive result, whereby all other dummy variables are more likely to produce a negative result as their Skewness sign suggests. The most reactive Skewness is sought to be ECB announcements which experience the highest negative Skewness, suggesting that real estates were most reactive to said news. The commonalities within all variables are found to be non-normally distributed, which is accredited to the Jarque-Bera results as well as all variables enjoying stationarity via Augmented Dickey-Fuller and Phillips-Perron tests.

Table 5: Descriptive Statistics UK Real Estates

	Mean	Max	Min	St. Dev.	Skew.	Kurtosis	J-B	Prob.	PP	Prob.	ADF	Prob.
RET	-0.0002	0.1680	-0.2746	0.0241	-0.1589	9.17	2.25E+4	0.00	-123.07	0.00	-122.343	0.00
ER	-0.0002	0.0965	-0.0971	0.0125	-0.1289	10.41	3.24E+4	0.00	-126.357	0.00	-18.164	0.00
BOND	1.2631	1.7134	0.3639	0.3328	-0.9789	2.95	2.26E+3	0.00	-4.09212	0.00	-4.1624	0.00
LIBOR	0.4509	1.9095	-0.7070	1.0638	0.2363	1.15	2.14E+3	0.00	-118.02	0.00	-117.6	0.00
REPO	0.2888	1.7830	-0.8916	1.1298	0.2913	1.15	2.22E+3	0.00	-131.04	0.00	-27.518	0.00
BOE	0.0000	0.0800	-0.1139	0.0033	-0.9835	388.42	8.75E+7	0.00	-118.8	0.00	-118.8	0.00
ECB	0.0000	0.0398	-0.1139	0.0015	-30.2316	2557.22	3.84E+9	0.00	-118.88	0.00	-118.88	0.00
EUGOV	-0.0001	0.0498	-0.1216	0.0027	-22.6774	872.20	4.46E+8	0.00	-119.54	0.00	-31.136	0.00
FED	0.0000	0.0849	-0.0454	0.0016	16.0361	1123.66	7.40E+8	0.00	-120.41	0.00	-40.804	0.00
GOV	-0.0001	0.0828	-0.1216	0.0037	-14.2351	499.68	1.46E+8	0.00	-119.15	0.00	-15.99	0.00
IMFO	0.0000	0.0469	-0.0430	0.0010	5.4227	1158.97	7.87E+8	0.00	-118.88	0.00	-118.88	0.00
USGOV	-0.0001	0.0644	-0.1145	0.0025	-17.8709	756.90	3.36E+8	0.00	-119.21	0.00	-34.329	0.00

5.4. Results

5.4.1 Event Study Methodology

5.4.1.1 Banks

When assessing the event study methodology applied to the UK banking sector within Table 6 we can quickly draw upon many announcements were prevalent of producing positive and negative effects towards the CAAR. It is evident for the positive effects across a (-5…5) window as this is where we experience greatest significance within the results, that IMF/others announcements yielding a positive statistical significant market shift, as expectedly so via the Boehmer et al (1991) test and t-test. Since the IMF is the lender of last resort on a global level, we can only assume once the news has flooded to the markets that such a bailout will take place, investors can only respond positively to this news. As confidence is restored due to the uncertainty that was present within the markets, ultimately the IMF/others were able to reduce overall volatility. Other positive announcements include UK Government European Government with the US government and ECB incurring positive reaction on the day and (-1...1) event windows, However, no statistical significance materialised within the (-5…5) event window. In regards to the UK Government results, we reject the claims of King (2009), which suggested that the announcements did not benefit shareholders. As our results to a certain extent demonstrate government announcements held a positive impact to the market through positive CAAR with statistical significance via the Boehmer et al (1991) test. On the basis of these announcements being positive it again may reflect IMF/other announcements in terms of restoring confidence within the financial markets during volatile periods in order to bring financial stability.

Conversely, when referring to Table 6 we report negative CAARs from the announcements examined. In particular this is evident across the BoE, FED and US Government through achieving statistical significance within the (-5…5) event window. The respective central banking announcements may have caused greater volatility by confirming the underlying fiscal issues surrounding the financial institutions via injecting liquidity into the system for example. In the case of the US Government across the (-5…5) window, may have caused such a reaction through changes in US law which may have confirmed the deepness of the crisis. Furthermore, through the length of the event window the results suggest the uncertainty was prolonged, which led the markets to price these events negatively on the whole. It also infers that the UK banks did not have enough capital to sustain the financial system given the sizeable actions taken by respective bodies from the UK and US. Other negative

impacted results include the ECB and European Government through (-5…5) and (-1…1) windows, respectively. The negative reaction regarding these results could be due to the UK banks examined having further exposure to European assets, which deteriorated following the sovereign debt crisis of 2010. It is possible investors had confirming news of the faltering positions of institutions as well as respective Euro-area governments as the sovereign debt crisis gained momentum.

Table 6: Banks Overall CAAR Results

Window	CAAR	Pos:Neg	t-test	Prob.	B test.	Prob.	Sign test	Prob.
Bank of England								
(-5...5)	-0.1077	46:54	-0.4943	0.6211	-0.4968	0.6193	-3.4843	0.0005***
(0...0)	0.0772	72:28	1.1746	0.2402	0.9524	0.3409	1.8961	0.0579*
(-1...1)	0.0001	62:38	0.0006	0.9995	-0.0275	0.9781	-0.1733	0.8624
Government								
(-5...5)	0.2589	46:33	1.0815	0.2795	1.0887	0.2763	-1.0039	0.3154
(0...0)	0.1016	51:28	1.4072	0.1594	2.1217	0.0339**	0.1657	0.8684
(-1...1)	0.1093	47:32	0.874	0.3821	1.035	0.3007	-0.7699	0.4413
US Government								
(-5...5)	-0.1683	45:46	-0.7993	0.4241	-1.04	0.2984	-1.7563	0.079*
(0...0)	0.1837	65:26	2.8934	0.0038***	2.2914	0.0219**	2.4991	0.0124**
(-1...1)	0.0805	54:37	0.7321	0.4641	0.7151	0.4745	0.1587	0.8739
Federal Reserve								
(-5...5)	-0.0497	24:26	-0.171	0.8642	-0.4078	0.6834	-1.8914	0.0586*
(0...0)	0.1802	31:19	2.0578	0.0396**	1.9525	0.0509*	0.1386	0.8898
(-1...1)	0.0546	27:23	0.3602	0.7187	0.2354	0.8139	-1.0214	0.3071
European Governments								
(-5...5)	0.1862	30:20	0.6356	0.5251	0.6894	0.4906	-0.8147	0.4152
(0...0)	-0.0887	34:16	-1.0039	0.3154	-1.0398	0.2984	0.3751	0.7076
(-1...1)	-0.1168	29:21	-0.7633	0.4453	-0.7876	0.4309	-1.1122	0.2661
European Central Bank								
(-5...5)	-0.1431	18:20	-0.417	0.6767	-0.5759	0.5647	-1.0216	0.307
(-1...1)	0.0347	22:16	0.1934	0.8467	0.3693	0.7119	0.2844	0.7761
(0...0)	0.0567	25:13	0.5479	0.5837	0.5789	0.5627	1.2639	0.2063
IMF/Other Announcements								
(-5...5)	0.5089	29:22	1.6777	0.0934*	1.7766	0.0756*	-0.475	0.6348
(0...0)	-0.1662	26:25	-1.8172	0.0692*	-0.8183	0.4132	-1.3329	0.1826
(-1...1)	-0.128	21:30	-0.8079	0.4191	-0.6441	0.5195	-2.7628	0.0057***

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

5.4.1.2 Insurance

When assessing Table 7 we can distinguish swiftly the majority of the grouped announcements had an impact of a negative nature. It is clear announcements from the BoE suggest that the measures taken impacted investors outlook towards insurance companies business model. The basis rate cuts and quantitative easing announcements suggest the market reacts to insurance company's investment portfolio, which generally hold long-term assets as

well as high liquid assets such as money market securities. So the market predicted a short-coming within the asset values of long-term bonds, which may be deemed to not yield sufficient returns given, the base rate cuts and the inverse relationship between bond yields and interest rates, therefore generating a negative CAAR. In terms of the UK government impacting the insurance sector, we exhibit positive and negative statistically significant results. The reason may be for this may further validate the announcements of the BoE and investors being aware of the potential losses incurred from their business models as well as their investment portfolios were heavily linked to the banking sector, which received bailouts. However, these results may be due in part because of the event windows as on the day of the announcement for government action the market responded positively. This highlights the government has a strong impact towards restoring confidence during volatile periods through announcements such as nationalizing Northern Rock. There is also negative and positive statistical significance within US announcements in regards to Federal Reserve and Government, which highlights the extent of exposure to the US sub-prime market, UK insurance companies held. When referring to Table 7 our results of USGOV announcements mirrors the UK government announcements in terms of the window lengths and CAAR. We find there is evidence of a positive CAAR on the day of announcements made by the USGOV, which restores confidence into the financial system, securing the future business of insurance firms. When referring to the Federal Reserve we establish a negative CAAR for event window -5 to 5, which mirrors announcement from the Bank of England. Whereby the asset purchasing programme introduced led to a negative reaction by the market as this impacts the investment portfolio due to insurance firms heavily invested within financial markets. Furthermore, European government as well the IMF had negative impact towards the insurance sector, which suggests the high degree of exposure to the sovereign debt crisis were known to shareholders. Furthermore, it highlights the impact of business to insurers with the likelihood of increased claims which may impact their performance and therefore is priced negatively by the marker. However, on a positive note, the ECB's announcement had a favourable effect with statistical significance which, signifies the policy initiatives taken by the ECB assured investors within the insurance sector that their investment portfolio linked to Europe would sustain adequate returns with Mario Draghi prepared to do whatever it takes to keep the Euro. Ultimately, this drove down government yields as well as increased European equity values to which insurance companies investing in such assets have their interests fulfilled by such measures.

Table 7: Insurance Companies Overall CAAR results

Window	CAAR	Pos:Neg	t-test	Prob.	B test.	Prob.	Sign test	Prob.
Bank of England								
(-5...5)	-0.2828	61:69	-1.4935	0.1353	-2.1069	0.0351**	-2.1235	0.0337**
(0...0)	-0.0015	69:61	-0.0269	0.9785	-0.2351	0.8142	-0.7094	0.4781
(-1...1)	-0.0533	67:63	-0.5392	0.5898	-0.7322	0.464	-1.063	0.2878
Government								
(-5...5)	-0.2898	43:56	-1.3592	0.1741	-1.8642	0.0623*	-1.5198	0.1286
(0...0)	0.1323	47:52	2.0581	0.0396**	1.5837	0.1133	-0.7156	0.4742
(-1...1)	0.034	44:55	0.3054	0.7601	0.316	0.752	-1.3188	0.1872
US Government								
(-5...5)	-0.3629	43:67	-1.8238	0.0682*	-2.5926	0.0095***	-1.6931	0.0904*
(0...0)	0.1557	57:53	2.5954	0.0094***	2.0459	0.0408**	0.9809	0.3266
(-1...1)	-0.1193	48:62	-1.1478	0.251	-1.3311	0.1832	-0.7381	0.4604
Federal Reserve								
(-5...5)	-0.5742	21:39	-2.1123	0.0347**	-2.4033	0.0162**	-2.1249	0.0336**
(0...0)	0.0845	31:29	1.0307	0.3027	0.859	0.3903	0.4579	0.647
(-1...1)	-0.0343	29:31	-0.2415	0.8092	-0.2775	0.7814	-0.0587	0.9532
European Governments								
(-5...5)	-0.3429	29:41	-1.3634	0.1728	-1.8849	0.0594*	-0.9416	0.3464
(0...0)	-0.0773	30:40	-1.019	0.3082	-1.4709	0.1413	-0.7022	0.4826
(-1...1)	-0.1101	32:38	-0.8382	0.4019	-1.1141	0.2652	-0.2232	0.8234
European Central Bank								
(-5...5)	0.2588	25:25	0.8583	0.3908	1.2137	0.2249	-0.4544	0.6495
(0...0)	0.2835	31:19	3.1183	0.0018***	1.8537	0.0638*	1.2461	0.2127
(-1...1)	0.1584	27:23	1.0061	0.3144	0.9282	0.3533	0.1124	0.9105
IMF/Other Announcements								
(-5...5)	-0.2332	37:43	-0.9493	0.3425	-1.1382	0.255	-0.7163	0.4738
(0...0)	-0.0093	36:44	-0.1257	0.8999	-0.2366	0.813	-0.9399	0.3473
(-1...1)	-0.2978	27:53	-2.3208	0.0203**	-2.8183	0.0048***	-2.9524	0.0032***

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

5.4.1.3 Finance Companies

From assessing Table 8 we can attempt to understand the reaction of UK finance companies stock prices to announcements, with the vast majority are of a positive nature. Notably, the European government along with specific event windows for BoE, UK government and IMF/others news announcements are however received by finance companies in a negative light, with statistical significance provided within UK government announcements as well as the IMF/others. When referring to the statistically significant negative CAARs we highlight the GOV announcements and IMF. The UK government announcements were received by the market in a negative light possibly due to the economy entering a recessionary period, which may impact the business model of finance companies as they specialise in consumer loans. The reasoning behind this could be as recessionary periods emerged within the economy, productivity declined in the UK, which resulted in higher unemployment and increased the probabilities of default. Therefore, economic conditions impact the performance of the sector,

which investors priced accordingly. With regards to the IMF/others announcements yielding negative results this could suggest the finance companies had exposure to nations which received bailout funding from the IMF and therefore caused the shareholders to seek greater returns elsewhere. This is also enhanced by the announcements made by the European governments, which does suggest they may have been large unknown exposures to the Euro area, possibly in the form of a loan portfolio.

Turning our attention towards the positive changes towards stock prices with BoE announcements, which in turn suggests the market made positive decisions in regards to the finance companies. This may be because the monetary policy utilised by the BoE making credit a cheaper source of finance via reduced rate cuts as well as through high scale quantitative easing. This may in turn have improved the business model of finance companies as cost of finance is reduced, competitive rates can be applied against the banking sector as well as improved earnings within their investment portfolio. This result can be mirrored through the CAAR of the ECB, which also implemented vast measures in order to stimulate economic activity. Furthermore, the positive CAAR result suggests the UK enjoys a close trading relationship with the EU and Eurozone as a whole. Our results also in Table 8 also demonstrates the US government announcements held a statistically significant positive CAAR reaction of 11% for UK finance companies. Announcements such as TARP from the US government signalled to the financial markets with required action in order to restore confidence and prevent the financial system from meltdown. Furthermore, the Federal Reserve also provides a positive reaction towards the finance companies, which also highlights an active presence within the US market, however with no statistical significance.

Table 8: Finance Companies Overall CAAR results

Window	CAAR	Pos:Neg	t-test	Prob.	B test.	Prob.	Sign test	Prob.
Bank of England								
(-5...5)	0.0214	83:85	0.1282	0.898	0.2775	0.7814	-1.911	0.056*
(0...0)	0.1264	109:59	2.5082	0.0121**	2.0506	0.0403**	2.1372	0.0326**
(-1...1)	0.0963	102:66	1.1032	0.2699	1.023	0.3063	1.0472	0.295
Government								
(-5...5)	-0.2972	54:66	-1.5099	0.1311	-2.1799	0.0293**	-2.7654	0.0057***
(0...0)	0.0348	65:55	0.5866	0.5575	0.4545	0.6495	-0.7342	0.4628
(-1...1)	0.0952	68:52	0.9264	0.3542	0.9809	0.3267	-0.1803	0.8569
US Government								
(-5...5)	-0.0076	67:65	-0.041	0.9673	-0.3476	0.7282	-1.2523	0.2105
(0...0)	0.1186	83:49	2.1065	0.0352**	1.9245	0.0543*	1.5544	0.1201
(-1...1)	0.09	74:58	0.9225	0.3563	1.0618	0.2883	-0.0244	0.9805
Federal Reserve								
(-5...5)	0.0984	33:39	0.3883	0.6978	0.4827	0.6293	-1.5202	0.1285
(0...0)	0.1169	43:29	1.5308	0.1258	1.5355	0.1247	0.8476	0.3967
(-1...1)	0.083	40:32	0.627	0.5307	0.6191	0.5359	0.1372	0.8908
European Governments								
(-5...5)	-0.0919	46:38	-0.3928	0.6945	-0.647	0.5177	-0.4432	0.6576
(0...0)	-0.0345	51:33	-0.4893	0.6246	-0.9424	0.346	0.6592	0.5098
(-1...1)	-0.1131	47:37	-0.9255	0.3547	-1.2428	0.214	-0.2227	0.8237
European Central Bank								
(-5...5)	0.4917	37:23	1.7526	0.0797*	2.1966	0.028**	0.9364	0.3491
(0...0)	0.0351	38:22	0.4145	0.6785	0.2297	0.8183	1.1963	0.2316
(-1...1)	0.1128	36:24	0.7697	0.4415	0.8243	0.4098	0.6765	0.4987
IMF/Other Announcements								
(-5...5)	0.0035	53:43	0.0155	0.9876	0.0486	0.9612	1.2285	0.2193
(0...0)	-0.0836	41:55	-1.2329	0.2176	-0.9129	0.3613	-1.2216	0.2219
(-1...1)	-0.2292	41:55	-1.952	0.0509*	-2.2124	0.0269**	-1.2216	0.2219

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

5.4.1.4 Real Estates

When turning our attention towards the results of the real estate sector, we can quickly establish the results were interpreted by the shareholders/market in a negative light. This may be due to the overall exposure the realtors hold within the housing market that subsequently experienced large losses off the back of the sub-prime collapse. We see in Table 9 announcements from the BoE have a negative impact, which suggests the business model concerning the realtor sector is closely related to the banking sector, in terms of their assets held within their investment portfolio. In terms of other central banks having a similar impact, particularly from the IMF as well as the ECB further highlights the exposure the real estate sector held towards other nations in terms of asset holdings, with which the market were able to understand and position themselves accordingly. In regards to the IMF we demonstrate

statistically significance in the -5, 5 event window, which highlights the extent to which the market negatively interpreted the announcements of the European debt crisis to endure an adverse on the UK economy as a whole. In regards to UK Government announcement suggests the investors were aware of the worsening position that the realtors held with their natural attachment to the housing market. As governmental announcements from Europe and USA came to light to the UK markets further confirmed the deepness of the crisis to investors in regards to the realtor sector. With the housing markets crashing simultaneously within Western economies investors sought to reduce their asset holdings within the sector deemed to be attached to these markets. Despite the largely negative outlook for the real estate sector within the UK there was a positive reaction towards the Federal Reserve announcements, which overall suggests the linkages between the US and UK stock markets. It demonstrates the measures implemented by the Federal Reserve to restore confidence, improved the markets outlook on the UK real estate sector.

Table 9: Real Estate Companies Overall CAAR results

Window	CAAR	Pos:Neg	t-test	Prob.	B test.	Prob.	Sign test	Prob.
Bank of England								
(-5...5)	-0.3075	53:59	-1.4965	0.1345	-1.4237	0.1545	-0.724	0.4691
(0...0)	-0.0358	58:54	-0.5778	0.5634	-0.4976	0.6187	0.221	0.8251
(-1...1)	-0.0018	62:50	-0.0167	0.9866	0.1726	0.863	0.977	0.3285
Government								
(-5...5)	-0.3216	34:46	-1.3204	0.1867	-1.7672	0.0772*	-1.7896	0.0735*
(0...0)	-0.061	39:41	-0.8306	0.4062	-1.4239	0.1545	-0.6701	0.5028
(-1...1)	-0.0417	41:39	-0.3275	0.7433	-0.6699	0.5029	-0.2224	0.824
US Government								
(-5...5)	0.1236	45:43	0.5334	0.5937	0.7018	0.4828	-0.4994	0.6175
(0...0)	-0.0487	51:37	-0.6969	0.4858	-0.7594	0.4476	0.7835	0.4333
(-1...1)	-0.0329	48:40	-0.2719	0.7857	-0.4481	0.6541	0.1421	0.887
Federal Reserve								
(-5...5)	-0.1723	24:24	-0.5525	0.5806	-0.8708	0.3838	-1.3333	0.1824
(0...0)	0.1112	31:17	1.1829	0.2369	2.047	0.0407**	0.7245	0.4688
(-1...1)	0.1781	32:16	1.0935	0.2742	1.4271	0.1535	1.0184	0.3085
European Governments								
(-5...5)	-0.3747	26:30	-1.2696	0.2042	-1.5155	0.1296	0.0018	0.9986
(0...0)	0.0196	25:31	0.22	0.8259	1.35	0.177	-0.2661	0.7901
(-1...1)	-0.0759	28:28	-0.4925	0.6224	-0.6453	0.5188	0.5377	0.5908
European Central Bank								
(-5...5)	-0.1055	22:18	-0.305	0.7603	-0.4076	0.6836	-1.3248	0.1852
(0...0)	-0.0869	27:13	-0.8328	0.405	-1.0943	0.2738	0.3326	0.7394
(-1...1)	0.148	30:10	0.8189	0.4128	0.8472	0.3969	1.327	0.1845
IMF/Other Announcements								
(-5...5)	-0.3656	26:38	-1.2696	0.2042	-2.0814	0.0374**	-2.8078	0.005***
(0...0)	-0.0124	36:28	-0.1431	0.8862	-0.9566	0.3388	-0.2755	0.7829
(-1...1)	-0.0499	31:33	-0.3315	0.7403	-0.4044	0.6859	-1.5416	0.1232

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

5.4.1.5 Investment Trusts

From casual observation within Table 10 we begin to understand the reaction investors alleged towards investment trust sector, with the results seemingly illustrating this sector is not held to the same degree as other sectors. Given the nature of investment trusts function within the financial sector, this is to be expected as they are less regulated in comparison to other institutions and therefore have a greater obligation to operate within the best interest of the shareholders. In regards to central banking announcements (BoE, Federal Reserve, IMF and to a certain extent the ECB) we exhibit a positive reaction. This can be plausible as the monetary measures taken such as quantitative easing and decreased base rates, suggest to the investors within trust funds that stocks will be forecasted to increase, which is evident in the stock prices post-crisis era. It also highlights the contagion factor that trusts are exposed to within their investment portfolio as they are holding such funds in different markets which may hold linkages. However, we must note the negative CAAR reactions of the FED, ECB and IMF for event windows -5,5 (and -1,1 for the IMF). This suggests the volatility prior to the announcements had a greater impact towards the performance of investment trusts during periods of heightened volatility, which may have caused investors to relinquish their capital from the investment trust funds, which resulted in negative CAAR. Moreover, we witness a negative reaction in the governmental announcements examined, which suggest the investment trusts were not entirely free from shareholders scrutiny as the losses accumulated by the financial crisis, investors opted to reduce exposure to financial equities. In terms of UK government responses, we find a positive CAAR emerged on the day of the announcements, which demonstrates the importance of government action during periods of heightened volatility to reduce systematic risk. We also provide evidence of a no reaction from the US government announcement towards the investment trusts in the UK, which suggests the high efficiency of the market to digest information and respond appropriately. The same however cannot be said for EU government announcements, whereby we produce a negative CAAR response, which may overall suggest the funds examined had difficulties in their risk management operations. We do however examine frequent statistical significance and rejection of the null hypothesis, which is an issue highlighted within Mackinlay (1997) as the downfall of opting to utilise event study methodology, so the results in Table 10 could very well be interpreted in a negative light and we will get further clarification with the seemingly unrelated regression approach in order to confirm the results.

Table 10: Investment Trusts Overall CAAR results

Window	CAAR	Pos:Neg	t-test	Prob.	B test.	Prob.	Sign test	Prob.
Bank of England								
(-5...5)	0.0115	277:213	5.2088	0***	4.1802	0***	2.9231	0.0035***
(-1...1)	0.0072	288:202	6.2383	0***	4.776	0***	3.9169	0.0001***
(0...0)	0.0038	272:218	5.787	0***	4.7289	0***	2.4713	0.0135***
Government								
(-5...5)	0	183:167	0.004	0.9968	-1.1478	0.2511	0.861	0.3892
(-1...1)	-0.0078	132:218	-6.189	0***	-3.8657	0.0001***	-4.5911	0***
(0...0)	-0.0066	143:207	-9.0187	0***	-4.2192	0***	-3.4151	0.0006***
US Government								
(-5...5)	-0.0004	201:184	-0.1981	0.843	-0.5435	0.5868	0.8476	0.3967
(-1...1)	-0.0017	188:197	-1.6371	0.1016	0.0305	0.9757	-0.4775	0.633
(0...0)	0.0007	204:181	1.131	0.258	1.8421	0.0655*	1.1534	0.2488
Federal Reserve								
(-5...5)	-0.008	94:116	-2.6744	0.0075***	-3.5553	0.0004***	-1.513	0.1303
(-1...1)	0.0046	119:91	2.9631	0.003***	1.5785	0.1144	1.9373	0.0527*
(0...0)	0.0065	121:89	7.2033	0***	3.2794	0.001***	2.2134	0.0269**
European Governments								
(-5...5)	-0.006	118:127	-2.1215	0.0339**	-2.209	0.0272**	-0.5761	0.5646
(-1...1)	-0.0091	99:146	-6.1591	0***	-3.7824	0.0002***	-3.0038	0.0027***
(0...0)	-0.0031	106:139	-3.6356	0.0003***	-2.3222	0.0202**	-2.1094	0.0349**
European Central Bank								
(-5...5)	-0.0181	60:115	-5.8607	0***	-6.0577	0***	-4.1389	0***
(-1...1)	0.0033	92:83	2.034	0.0419**	1.3751	0.1691	0.699	0.4845
(0...0)	0.0003	87:88	0.3057	0.7598	-0.8096	0.4182	-0.0569	0.9546
IMF/Other Announcements								
(-5...5)	-0.0009	159:121	-0.4137	0.6791	0.7018	0.4828	2.2786	0.0227**
(-1...1)	-0.0004	157:123	-0.3182	0.7503	0.0423	0.9663	2.0396	0.0414**
(0...0)	0.0003	171:109	0.4623	0.6438	0.9871	0.3236	3.7129	0.0002***

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

5.4.2 SUR Methodology

5.4.2.1 Banks

Upon undertaking the SUR approach we can establish a significantly improved method of modelling returns surrounding the event announcements. When understanding the dummy variables reacting towards the announcements examined, all banking institutions experience a positive return with the majority of institutions demonstrating statistical significance. The transpiring results aid our understanding of the unfolding news events that gives evidence to investors reacting in a positive manner given the transcendent volatile period. The announcements from the Bank of England and UK Government are found to have restored confidence to the system through the divisive actions demonstrated whether it be from capital injections into the interbank market to ensure lending continues from bank to bank or from the Government nationalising Northern Rock. All of these actions signalled positive moves to

ensure the market was safe and encouraged investment. From casual observation within Table 11, we can quickly establish from the coefficient values that the IMF experienced a highly positive reactive relationship towards the stock prices of the banking sector. In particular this announcement type highlights how the banking sector is operating on a global level with financial markets highly integrated, as bank managers within the UK operating in Western economies, in order to gain sufficient returns for UK banking sector investors. The very fact statistical significance is achieved with high accuracy levels with international announcements i.e. ECB, Federal Reserve, European Governments, US Government and IMF only further enhance the argument of globalisation is present on a banking industrial level. Furthermore, when observing the UK government announcement, all institutions bar Alliance & Leicester experience a positive relationship in terms of explaining the stock price valuation, which is deemed to have positive effects upon the market being made aware of the initiatives taken forward. However, with Alliance & Leicester investors may have anticipated such negative news in the future in regards to the survival of the bank which eventually witnessed a taken-over by Santander. With these relationships established we can further analyse the level of exposures these institutions experienced towards Europe from the perspective of investors via the dummy variable for European Governments are most effective in the smaller banking institutions within the UK (i.e. HBOS, RBS, Alliance & Leicester, Bradford & Bingley).

To fully incorporate institutional exposure to bad debts we must look into the variable of CDS spreads. Within Northern Rock it is evident CDS spreads were incorporated within the stock price as they experience a positive relationship, which highlights investors were able to distinguish between institutions which held bad assets. As Northern Rock's results are not consistent with the theory from Merton (1974), through experiencing a positive relationship between stock returns and CDS spreads, with the result suggesting the CDS spread dictated the stock price. Moreover, we can establish similar relationships among all other institutions experiencing a negative relationship against stock returns. Statistical significance is found among Barclays, RBS, Standard Chartered, Banco Santander and HBOS. This highlights a positive change in equity price reduces the cost of debt through greater financing being led through greater equity value and therefore reduces the reliance on debt financing as given by the CDS. Alliance & Leicester, Bradford & Bingley and to a certain extent HSBC, with their non-significant relationships between CDS spreads and stock prices suggest the former institutions held great exposures to the sub-prime crisis and eventually required bailouts. However, with the latter HSBC this is not true but due to the size of the institution, being an

international bank it was able to cover losses incurred and not require any external bailout funding. Turning our attention towards the Government bond variable we can quickly establish Standard Chartered and Bradford & Bingley experienced a negative correlation to the stock returns. Overall this highlights that their portfolio holdings may not have held as many risk-free assets such as the UK government bond and suggests these institutions held assets with greater risk attached to them.

The repo rate is a rate set by the central bank from which banks borrow in the short-term. It is evident from Table 11 the correlation between repo rates and stock prices is namely negative, which suggests those institutions experiencing such relationships as the repo rates have not contributed towards the pricing of said institutions stock price. Therefore, with the cost of tier 1 capital declining from the BoE for short-term funding, it can be argued these institutions have sourced their funding via other outlets. Conversely, Lloyds Banking Group, Standard Chartered and Alliance & Leicester experience a positive correlation between repo rates and stock prices, which suggests as the repo rates declined these institutions seized the opportunity to increase their funding of repo rates to their capital base. More importantly, the result suggests these institutions possibly experienced short-term liquidity issues within their balance sheets and may not have held adequate levels of capital in order to cover the demand for their deposits, particularly within Lloyds banking group illustrating statistical significance.

In terms of Libor relationships against the stock prices within the banking sector, it is evidently based on an institutional basis, with no generalised relationships arising. Positive association with Libor and stock prices arise within HSBC, RBS, HBOS, Alliance & Leicester and Northern Rock, with negative correlations determined in the rest. In the positive group of institutions, HSBC was the only institution to not receive bailout funding or merged/taken-over by another institution, as the results may be interpreted as the Libor rates contributed towards the pricing of their stock prices. Furthermore, it suggests these institutions were active in the London Interbank market with HSBC suggestively providing liquidity to the other troubled banks. Conversely, with the negatively associated banks, it suggests they were not active within the interbank market, which ultimately led to the infamous credit crunch within the UK, whereby liquidity between institutions were not as active, which led to confidence within the financial system come into question and ultimately led the Bank of England to intervene and provide liquidity to the financial sector and ultimately restore confidence.

Table 11: SUR Banks Results

Variable	HSBC	BARC	LLOY	RBS	STAN	BNC
Intercept	0.0004	0.0004	-0.0003	0.0005	0.0001	-6.45E-05
	(1.3812)	(0.7375)	(-0.4626)	(0.8379)	(0.3693)	(-0.1436)
ER	1.4283	1.2643	1.5344	1.5044	1.1168	1.0002
	(39.3665)***	(29.437)***	(23.478)***	(27.909)***	(41.563)***	(26.21)***
Bond	0.0394	0.1767	0.0564	0.1265	-0.0015	0.1488
	(2.1287)**	(4.5445)***	(1.2931)	(3.2062)***	(-0.0587)	(5.5524)***
Libor	0.0088	-0.075	-0.0926	0.0436	-0.0498	-0.032
	(0.2721)	(-1.1098)	(-1.217)	(0.6341)	(-1.0892)	(-0.6843)
Repo	-0.0004	-0.0036	0.0408	-0.0182	0.0154	-0.0127
	(-0.0495)	(-0.1977)	(1.9781)**	(-0.9754)	(1.2487)	(-1.005)
CDS	-0.0087	-0.0766	-0.1006	-0.0779	-0.0241	-0.0974
	(-1.1575)	(-5.2808)***	(-5.8304)	(-5.4313)***	(-2.4356)**	(-9.6019)***
D_BOE	0.5879	0.8274	0.4982	0.3828	0.8833	0.3651
	(3.6295)***	(8.3745)***	(5.1673)***	(4.2397)***	(5.3149)***	(2.0134)**
D_GOV	0.5893	0.2522	0.5502	0.614	0.1854	0.4849
	(3.9239)***	(1.4672)	(6.3482)***	(6.9573)***	(1.2911)	(2.9868)***
D_ECB	0.3325	0.588	0.6006	0.7369	0.9426	0.941
	(0.7287)	(1.0726)	(2.8679)***	(2.7348)***	(1.257)	(3.5049)***
D_EUGO	0.7664	0.9107	0.7929	0.9649	0.806	0.8045
	(4.7121)***	(5.4761)***	(6.5542)***	(19.771)***	(4.603)***	(4.1617)***
D_FED	0.7286	0.747	0.6103	0.7065	1.034	1.0738
	(5.2928)***	(4.6342)***	(2.6178)***	(5.4452)***	(7.4641)***	(3.9868)***
D_USGO	1.2232	0.9811	0.6413	1.0253	0.9263	0.7276
	(4.7237)***	(11.966)***	(3.8252)***	(6.7612)***	(6.2879)***	(4.277)***
D_IMF	0.7767	0.0017	0.5793	1.2351	1.1145	0.7894
	(3.7261)***	(0.1612)	(1.6728)*	(3.6379)***	(4.8162)***	(3.5031)***
D_HSBC	0.7643	-	-	-	-	-
	(0.7054)	-	-	-	-	-
D_BARC	-	1.0522	-	-	-	-
	-	(6.6653)***	-	-	-	-
R^2 Within	0.59	0.52	0.44	0.67	0.59	0.49

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

Table 11 Continued

Variable	HBOS	AL	BB	NRK
Intercept	-0.0006	-0.0009	-0.0032	-0.0029
	(-0.5412)	(-0.7983)	(-2.4449)**	(-1.3712)
ER	1.3401	1.3277	1.1133	0.6952
	(15.936)***	(13.464)***	(10.796)***	(4.249)***
Bond	0.0438	0.0055	-0.0273	0.5413
	(0.3625)	(0.0389)	(-0.1697)	(1.8678)*
Libor	0.1094	0.1152	-0.2038	0.3536
	(1.2301)	(0.5787)	(-0.948)	(1.1123)
Repo	-0.0019	0.1269	-0.0385	-0.218
	(-0.0286)	(1.1258)	(-0.2834)	(-1.0633)
CDS	-0.0857	-0.0003	-0.0001	0.0014
	(-4.2342)***	(-0.2414)	(-0.0465)	(0.4897)
D_BOE	0.7808	0.8926	0.9309	0.938
	(5.8868)***	(1.1653)	(2.1322)**	(4.1636)***
D_GOV	0.1615	-0.5364	0.7412	1.038
	(1.643)	(-0.6062)	(0.757)	(4.2912)***
D_ECB	0.917	0.479	1.0096	0.2828
	(1.7232)*	(0.5604)	(1.7164)	(0.2697)
D_EUGO	1.0005	1.1186	1.1273	-
	(18.346)***	(2.3633)**	(1.1376)	-
D_FED	0.6652	0.7775	0.0513	0.9319
	(5.023)	(1.1446)	(0.0296)	(1.7245)*
D_USGO	0.4806	0.8038	0.9385	1.0073
	(3.0547)***	(1.7217)*	(0.7916)	(2.0325)**
D_IMF	1.3499	-	-	-
	(2.9216)***	-	-	-
R^2 Within	0.58	0.25	0.19	0.13

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.4.2.2 Insurance Companies

When turning our attention towards Table 12, we can begin to establish positive reactions are found within the announcements among all insurance firms bar Prudential which experiences negative reaction to BoE, European Government and US government announcements, with Legal and General having adverse effect to ECB. The strong positive associations found through the announcements suggest investors found confidence from the respective central banks/governments in order to reduce overall volatility and therefore was priced accordingly by the market. In regards to Prudential, possible reasons for them to be experiencing negative reactions towards certain announcements may be correlated to the scale of which Prudential were exposed to the crisis in many nations. Prudential is by far the most diverse in terms asset portfolio with great market presence globally, which may have led to the negative reactions from which, their investors may have anticipated their declining position as

the crisis unfolded. Overall, in terms of the financial crisis, insurance companies played a big part by facilitating the actions of banks from receiving fees in return to insure the mortgages, from which the results suggest Prudential's investors alleged there to be exposure within UK, Europe and the US. Regarding Legal and General's negative reaction to the ECB suggests the investors were aware to the exposure Legal and General may have possessed towards the Euro-zone.

When delving further into Table 12 we note differing relationships between the CDS spreads among the institutions are exemplified as all the institutions bar RSA endure a negative relationship towards stock prices. This suggests the CDS spreads held an inverse relationship to stock prices toward the majority and therefore did not account for being priced within the asset price by investors. However, the results are consistent with Merton (1974), which could be argued the spreads widened as the stocks prices declined and therefore was priced accordingly by the market. On the contrary to RSA, it experiences a positive relationship to stock prices, which suggests through the market understood the varying levels of risk RSA had undertaken and therefore was a contributor towards the pricing.

Moreover, when investigating the level of government financing effects towards the stock prices of insurance firms, it is clear to see that the majority of insurance firms enjoy a positive relationship towards the pricing bar Old Mutual. The positive associated insurance firms can be interpreted as enjoying a large holding of government bonds with Aviva and RSA enjoying statistically significant relationships. As the price of government bonds declined these institutions in particular invested into such assets, which is a given as insurance firms tend to invest in long-term assets due to the nature of life insurance firms. However in regards to Old Mutual, the slightly inverse relationship suggests the opposite. The decline in government yields was not incorporated within their stock price, which suggests investors were aware of the portfolio holdings of government bonds was not a reason for their stock price to be affected in a slight negative manner.

With regards to Libor and Repo rates there are no distinguished prevalent relationships against the determination of the stock price for insurance firms. When looking closely towards the positive Libor impacts we can speculate, that as lending between the institutions increased, the provided liquidity enabled the insurance companies to earn higher returns on assets within their portfolio, by which investors capitalised upon. However, an inverse relationship suggests the concerning insurance firms, did not affiliate themselves with the inter-bank market and/or

engaged in other longer-term markets by which investors were aware of their portfolio holdings. After establishing the Repo rates relationship, in regards to the positive associations determined, it suggests that Prudential, Old Mutual and Legal & General increased their short-term funding for improved liquidity combined as the markets priced it accordingly. Conversely, Aviva and RSA experienced a negative association in Repo rates to stock prices, which suggests the markets understood these insurance firms, raised finances via other means and not in the short-term.

Table 12: SUR Insurance Companies Results

Variable	**PRU**	**AV**	**OML**	**LGEN**	**RSA**
Intercept	0.0004	0.0004	-6.47E-05	-9.07E-5	-5.55E-5
	(0.853)	(0.8621)	(-0.1256)	(-0.185)	(-0.1231)
ER	0.99	0.9187	1.0068	0.9798	0.8543
	(40.475)***	(36.139)***	(40.01)***	(35.068)***	(22.681)***
Bond	0.0192	0.1236	-0.0004	0.0348	0.0624
	(0.6424)	(4.281)***	(-0.0158)	(1.1988)	(2.8084)***
Libor	0.1105	0.0976	-0.0467	-0.168	-0.0006
	(2.0997)**	(1.9462)*	(-0.8669)	(-3.274)***	(-0.0149)
Repo	0.0325	-0.007	0.009	0.0077	-0.0028
	(2.2888)**	(-0.5191)	(0.6203)	(0.5609)	(-0.2728)
CDS	-0.0306	-0.0605	-0.0431	-0.0369	0.0019
	(-2.2054)**	(-5.0968)***	(-3.41)***	(-2.5465)**	(0.1268)
D_BOE	-1.4935	0.9403	0.7664	0.9224	0.5617
	(-3.0065)***	(17.3)***	(4.517)***	(14.39)***	(3.4685)***
D_GOV	1.9363	0.5893	0.76363	0.8051	0.8398
	(3.2502)***	(4.4826)***	(4.959)***	(10.29)***	(7.133)***
D_ECB	0.7645	0.9271	0.1263	-0.0492	0.5587
	(0.9681)	(1.5115)	(0.2494)	(-0.2161)	(1.0214)
D_EUGO	-0.939	0.6415	0.9834	0.8598	0.9574
	(-1.4256)	(3.4444)***	(6.098)***	(5.8255)***	(4.5854)***
D_FED	0.4419	0.8962	0.98	0.9786	1.1868
	(0.6156)	(1.8126)*	(4.617)***	(5.3374)***	(2.2059)**
D_USGO	-3.1686	0.6844	0.9551	0.9008	0.8878
	(-5.9516)***	(3.1673)***	(6.3003)***	(7.229)***	(3.9046)***
D_IMF	0.8975	0.8899	1.021	1.054	0.9177
	(1.2738)	(0.9658)	(2.7472)	(1.9376)*	(1.5004)
R^2 Within	0.55	0.59	0.54	0.55	0.42

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.4.2.3 Finance Companies

From Table 13 when referring to the dummy variables to capture the different types of announcements, all finance companies illustrate a positive response. This suggests all the measures applied succeeded in restoring confidence and was evidently perceived by investors in a fruitful manner, which overall reduced the increased volatility. To breakdown the different types of announcements, similar to the banking sector, the IMF announcements proved to be very effective in restoring confidence as expected by the perception of investors. With the international lender of last resort essentially acting in a responsive manner, the overall heightened volatility within financial markets ultimately improved confidence to investors and liquidity into the system. Collectively, the central banking announcements held great importance in restoring confidence on a global scale with their swift responses to combat the seeming losses being generated by the finance company sector with which the crisis brought about.

When interpreting the government bond variable within the model, among the finance companies the correlation towards the stock returns is namely a positive one. This overall suggests the cost of tier 1 capital via government bonds aiding the stock pricing of the majority finance companies, which highlights these institutions holdings of finance companies were not of great concern within their investment portfolio. With the few finance companies that experienced a negative association between government bond yields and stock returns, illustrate the great level of exposure these finance companies held within their investment portfolios and also suggest their funding is based around government assets.

With regards to Libor rates interacting towards the stock prices of the finance companies, we can establish from casual observation that namely a positive association arises. In terms of the positively related finance companies, it suggests the decline in Libor aided investors to price those firms with the perceived cost of capital reducing for the banking sector. Therefore may spill-over into the finance company sector in order to maximise performance, as the rhetoric of finance companies is essentially to earn greater margins on issued loans i.e. consumer loans for cars. Conversely, for the negatively associated finance firms in respect to Libor, one may interpret such results as these financial companies seeking to raise finances through other means, possibly through equity capital or competing central banks such as the ECB or Federal Reserve. In terms of repo rates there is a mixed interpretation between the finance companies and ultimately investors will be able to differentiate the costs to respective finance companies. A positive relationship may result due to the costs of short-term funding

being reduced, capital is more readily available than previously, therefore may have a direct relationship towards performance and therefore is priced in by investors, leading to the repo rates dictating a market price. However, many institutions enjoy a negative relationship of repo rates towards the pricing of their stock prices, which may represent the market has distinguished these institutions as not requiring the funding in the short-term basis, which may be deemed as a good indicator of performance as they have a reluctance with utilising credit within the repo market.

Table 13: SUR Finance Companies Results

Variable	ADN	BRW	CBG	EMG	FCAM	IAP	INVP
Intercept	3.65E-7	0.0001	-0.0001	-6.52E-5	-9.88E-5	-0.0001	5.09E-5
	(0.0008)	(0.2271)	(-0.29)	(-0.1037)	(-0.1614)	(-0.2046)	(0.0981
ER	1.0348	1.0648	1.0201	0.9901	1.0343	0.9939	0.9977
	(32.411)***	(16.744)***	(22.294)***	(31.089)***	(17.307)***	(33.348)***	(33.717)***
Bond	-0.0078	0.0430	0.0579	0.0619	-0.0126	0.0607	0.0638
	(-0.3092)	(1.4706)	(2.2688)**	(1.6711)*	(-0.3491)	(2.0163)**	(2.0867)**
Libor	0.0172	-0.0168	-0.1057	-0.0492	0.0055	0.0404	-0.1088
	(0.3848)	(-0.324)	(-2.3431)**	(-0.7506)	(0.0868)	(0.7597)	(-2.0098)**
Repo	0.0044	0.0067	-0.0051	0.0333	-0.0084	0.0172	-0.0053
	(0.3694)	(0.4817)	(-0.4182)	(1.8786)*	(-0.4898)	(1.2008)	(-0.3625)
D_BOE	0.8615	0.9117	0.866	0.8119	0.6836	0.6735	0.8529
	(3.0382)***	(4.0158)***	(6.978)***	(2.7712)***	(3.1528)***	(2.5774)***	(5.0819)***
D_GOV	0.152	0.5109	0.2913	0.2182	0.5733	0.2974	0.1606
	(0.8496)	(2.3647)**	(2.2372)**	(0.6482)	(2.5498)**	(0.9968)	(0.8711)
D_ECB	0.8505	0.9153	0.3999	0.7166	0.3376	0.4532	0.3386
	(1.2117)	(2.689)***	(0.3374)	(1.3434)	(0.9961)	(1.2936)	(0.818)
D_EUGO	0.9295	0.7582	0.8218	0.9773	1.004	0.9982	0.939
	(5.4666)***	(3.0108)***	(4.9514)***	(5.5205)***	(6.481)***	(9.4724)***	(4.6262)***
D_FED	1.0392	0.8137	0.973	0.9943	0.9827	0.9256	0.9771
	(4.8312)***	(1.6361)	(5.4537)***	(2.031)**	(2.2086)**	(3.4802)***	(5.2281)***
D_USGO	0.9465	0.8115	0.7929	0.9124	0.8528	0.968	0.9639
	(5.9893)***	(3.4846)***	(4.8527)***	(3.9487)***	(3.5606)***	(8.4239)***	(7.2474)***
D_IMF	1.0131	1.0295	1.043	0.9985	1.0284	1.0087	0.9869
	(4.0439)***	(2.9916)***	(1.422)	(4.7724)***	(1.5914)	(6.2067)***	(4.3316)***
R^2 Within	0.44	0.18	0.32	0.42	0.20	0.47	0.47

Variable	LSE	PAG	PFG	RAT	SDR
Intercept	0.0001	-0.0003	-4.27E-5	0.0002	-0.0001
	(0.2237)	(-0.4083)	(-0.1109)	(0.4979)	(-0.3899)
ER	0.9826	0.9285	1.0317	1.0824	0.9968
	(28.469)***	(14.438)***	(19.564)***	(16.715)	(41.497)***
Bond	0.0428	0.0683	-0.0162	0.0319	0.0324
	(1.3957)	(1.385)	(-0.7153)	(1.0935)	(1.3435)
Libor	0.0478	-0.2724	-0.0352	-0.0049	0.1095
	(0.8777)	(-3.1169)***	(-0.8778)	(-0.0952)	(2.5607)**
Repo	0.0092	-0.017	-0.0016	0.0021	-0.0179
	(0.632)	(-0.7183)	(-0.1507)	(0.1527)	(-1.5462)
D_BOE	0.253	0.8715	0.9183	0.8858	1.0014
	(1.0381)	(2.6074)***	(3.2881)***	(4.5839)***	(4.8809)***
D_GOV	0.7235	0.4725	0.6978	0.4647	0.0293
	(3.8053)***	(2.6446)***	(1.4715)	(2.8963)***	(0.187)
D_ECB	0.7849	0.9402	0.9368	0.6214	0.8429
	(1.405)	(2.0978)**	(1.4026)	(1.4019)	(2.4741)**
D_EUGO	0.9807	0.7493	1.0015	0.9778	0.9604
	(4.2077)***	(4.0544)***	(5.6766)***	(3.3974)***	(5.7582)***
D_FED	0.9582	0.9005	1.0012	0.9343	0.98
	(3.8791)***	(1.6631)*	(4.3694)***	(3.0979)***	(4.8121)***
D_USGO	0.8642	0.5853	0.9824	0.8892	0.9887
	(6.0208)***	(2.8154)***	(6.668)***	(7.3007)***	(8.5286)***
D_IMF	0.9868	1.0361	1.0097	1.0808	1.0532
	(1.1992)	(5.2707)***	(3.2557)***	(1.3905)***	(1.7694)*
R^2 Within	0.38	0.20	0.24	0.19	0.57

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.4.2.4 Investment Trusts

All institutions enjoy a positive reaction to the announcements with a high degree of statistical significance among the vast majority of investment trusts, with the exception of Alliance Trust and Templeton Emerging Markets Investment Trust, which experience negative reactions to certain announcements as evident within Table 14. Ultimately, one can suggest a key reason for the vast majority of investment trusts experiencing positive reactions towards the news events examined, is namely due to the restoring of confidence within the financial system, which was the aim of the given initiatives. As given the nature of investment trusts business model, which essentially operate in the best interests of enriching shareholders through gaining higher returns from their investment portfolio, which is namely within stock holdings. One can formulate the opinion for Alliance Trust to experience negative returns on UK and European government/central banking announcements based upon their risk management position, whereby their investors possibly understood the higher levels of risk undertaken and therefore priced accordingly. Templeton Emerging Markets Investment Trust negative reaction towards the UK government's policy initiatives suggests there may have been a high degree of exposure to the financial crisis or were not able to manage the induced volatility.

When turning our attention towards the government bond largely a positive relationship is established among the majority of investment trusts. The positive relationship suggests that as the cost of capital has declined the performance aspect of trusts have contributed to the stock prices considerably. By which, the market has been able to price trusts accordingly, as the cost of finance is reduced towards the economy, growth prospects are increased for firms operating from which, investment trusts may hold within their investment portfolio and also benefit from their reduced costs of raising finances. However for those institutions experiencing negative reactions towards declining government yields, one may speculate those institutions are raising finances via other means, which is not accounted for within the stock price. In regards to Libor rates impacting the determined stock prices of the investment trusts, is namely a positive one. This suggests the decreasing Libor rates, overall increased liquidity in the short-term for other sectors of the economy, which can be may be viewed by those shareholders as a positive movement, due to the interest of held by the trusts. Conversely, a negative relationship may arise as a result possibly due to the lesser extent of exposure to UK Libor rates and therefore were not a contributing factor in terms of pricing the investment trust. Repo rates are generally found to have a mixed reaction with investment trusts experiencing positive and negative

relationships towards determining the pricing of their company. One may argue for the positively correlated investment trusts, the relationship arises due to reduced cost of financing in the short-term whereby, banks are then in-turn able to lend further funds to companies, which may drive stock price performance and therefore those investment trust funds benefited from indirectly after holding interest with firms in the economy. However an inverse correlation may arise as the investment fund may hold interests elsewhere, for example investing in other countries and therefore are not impacted by the changes in Repo rates and did not overall contribute the market to price those funds within that light.

Table 14: SUR Investment Trusts Results

Variable	ATST	ASL	BNKR	BRWM	BSET	BTEM	CLDN
Intercept	-0.0005	-0.0001	-5.39E-5	0.0003	7.63E-6	-5.05E-5	-0.0001
	(-0.7287)	(-0.4354)	(-0.2266)	(1.0789)	(0.0312)	(-0.212)	(-0.488)
ER	1.7363	1.0184	1.0075	1.0024	1.0303	1.011	1.006
	(31.337)***	(35.992)***	(45.662)***	(47.069)***	(50.477)***	(42.298)***	(35.984)***
Bond	0.2019	0.0217	0.005	0.0364	0.0075	0.0104	0.0196
	(4.8037)***	(1.3655)	(0.3592)	(1.7247)*	(0.5222)	(0.7464)	(1.2652)
Libor	0.157	-0.0724	0.0589	-0.0748	0.0254	0.0492	-0.0218
	(1.0801)	(-2.5638)**	(2.3746)**	(-1.0144)	(0.9989)	(1.9829)**	(-0.7963)
Repo	-0.0321	0.0032	0.0024	-0.0057	-0.0018	0.0059	-0.0032
	(-0.9298)	(0.4299)	(0.3715)	(-0.5645)	(-0.2688)	(0.889)	(-0.4437)
D_BOE	-0.3834	0.8053	0.8606	0.9676	0.9886	0.9696	0.9424
	(-0.4032)	(5.3985)***	(6.7652)	(4.9607)***	(6.7088)***	(8.1761)***	(6.8442)***
D_GOV	0.2139	0.2638	0.5767	0.2268	0.1197	0.6454	0.9406
	(0.3052)	(1.3362)	(3.6171)***	(1.0306)	(0.5486)	(2.7152)***	(6.5549)***
D_ECB	-1.2481	0.9142	0.7337	0.9232	0.8896	0.1606	0.0555
	(-0.4532)	(4.1061)***	(1.1479)	(1.7479)*	(2.4196)**	(0.3861)	(0.1338)
D_EUGO	-4.0776	1.026	0.9613	0.9609	1.0061	0.961	1.0106
	(-5.1103)***	(4.4668)***	(5.0991)***	(7.7621)***	(7.9774)***	(4.6641)***	(5.4976)***
D_FED	1.8199	0.7674	0.9751	1.0306	0.7791	0.9912	0.9999
	(1.3768)	(1.8074)*	(3.7799)***	(4.7041)***	(1.1995)	(3.2042)***	(3.8319)***
D_USGO	-1.2996	0.7399	0.8464	0.9962	0.9653	0.9753	0.9057
	(-2.7757)***	(3.8479)***	(4.5194)***	(3.8558)***	(3.586)***	(5.9554)***	(5.5419)***
D_IMF	2.4772	1.0369	1.0237	1.0017	1.0473	1.0489	1.017
	(1.4672)	(1.8801)*	(4.3033)***	(1.7759)*	(3.4939)***	(2.6364)***	(1.3339)
R^2 Within	0.43	0.49	0.59	0.61	0.64	0.56	0.49
Variable	**CTY**	**EDIN**	**EFM**	**ELTA**	**FEV**	**FRCL**	**GSS**
Intercept	-7.64E-6	-0.0001	5.04E-5	0.0002	-5.57E-5	-6.92E-5	0.0001
	(-0.0367)	(-0.6315)	(0.169)	(0.6556)	(-0.2318)	(-0.411)	(0.3634)
ER	0.9932	1.0152	1.0028	0.9942	0.9931	0.9932	0.9638
	(59.231)***	(60.116)***	(33.963)***	(20.112)***	(50.398)***	(67.811)***	(16.685)***
Bond	0.0139	-0.0084	0.0037	0.0278	0.0355	0.0037	0.0708
	(1.1415)	(-0.7587)	(0.2148)	(1.308)	(2.5132)**	(0.3786)	(4.3299)***
Libor	0.036	0.0185	0.0045	0.0701	0.0044	0.03	-0.053
	(1.66)*	(0.9331)	(0.1465)	(1.8611)*	(0.1776)	(1.7133)*	(-1.8307)*
Repo	0.0007	-0.0022	-0.004	0.016	-0.0021	0.0074	-0.0031
	(0.1322)	(-0.4204)	(-0.476)	(1.5785)	(-0.3221)	(1.5575)	(-0.4071)
D_BOE	0.8438	0.8865	0.6879	0.868	0.8548	0.8128	0.7752
	(5.5442)***	(6.2437)***	(5.0071)***	(5.6)***	(5.403)***	(8.4843)***	(4.6252)***
D_GOV	0.1035	0.2772	0.6015	0.8301	0.5028	0.0195	0.2302
	(0.5872)	(1.8951)*	(4.3574)***	(6.9884)	(2.3179)**	(0.1583)	(1.2156)
D_ECB	0.5102	0.6208	0.6	0.1907	0.8233	0.4606	0.4572
	(0.9798)	(0.6747)	(1.0659)	(0.4707)	(1.6674)*	(2.0348)**	(1.2038)
D_EUGO	0.973	0.8926	0.9934	0.9372	0.8788	1.0056	0.9723
	(9.2345)***	(6.9486)***	(7.2823)***	(5.625)***	(3.4278)***	(10.467)***	(3.5861)***
D_FED	0.975	0.984	0.9727	1.0717	0.9811	0.9447	0.9864
	(5.5233)***	(7.349)***	(5.1425)***	(2.0573)**	(3.9341)***	(2.9904)***	(3.3112)***
D_USGO	0.5659	0.786	0.6411	0.5601	0.74	0.4485	0.7324
	(2.6633)***	(2.6258)***	(3.5004)***	(2.3273)**	(3.3193)***	(3.1651)***	(3.5252)***
D_IMF	0.9994	1.0238	1.7516	1.011	1.0083	1.0097	0.9636
	(2.0279)**	(5.7799)***	(1.7516)*	(1.8614)*	(1.625)	(2.2116)**	(0.8822)
R^2 Within	0.71	0.72	0.47	0.27	0.64	0.77	0.23

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

Table 14 SUR Investment Trusts Continued

Variable	HRI	JAM	JII	JMG	LWDB	MNKS	MRC
Intercept	1.23E-5	4.04E-5	-2.06E-6	4.18E-5	0.0001	6.72E-5	-8.07E-5
	(0.0463)	(0.173)	(-0.0049)	(0.1476)	(0.6067)	(0.2813)	(-0.3253)
ER	0.9876	0.9861	1.0249	1.0015	0.9931	1.0184	1.0152
	(30.56)***	(36.23)***	(31.95)***	(41.801)***	(50.398)***	(45.72)***	(45.289)***
Bond	-0.0231	0.0155	0.0048	0.0107	0.0355	-0.0221	0.0333
	(-1.4837)	(1.1254)	(0.1977)	(0.6472)	(1.3634)	(-1.5691)	(2.2761)**
Libor	0.0541	0.0412	-0.0117	0.0281	0.039	0.085	-0.005
	(1.9447)*	(1.6812)*	(-0.2693)	(0.9544)	(1.3116)	(3.4117)***	(-0.1962)
Repo	0.0033	0.0069	-0.0067	-0.0005	0.0007	-0.0008	-0.0003
	(0.4513)	(1.0468)	(-0.5765)	(-0.0706)	(0.0927)	(-0.1203)	(-0.044)
D_BOE	0.904	0.8517	0.5213	0.9539	0.4023	0.7911	0.931
	(4.712)***	(4.5712)***	(2.0838)**	(6.7211)***	(2.5278)**	(5.9433)***	(5.5349)***
D_GOV	0.586	0.177	0.5986	0.1414	0.7121	0.4589	0.3137
	(2.1515)**	(0.7021)	(3.1671)***	(0.5773)	(5.0565)***	(3.1344)***	(1.6066)
D_ECB	0.9057	0.7492	0.9316	0.6495	0.681	0.4317	0.3431
	(4.829)***	(3.1957)***	(2.0445)**	(0.7674)	(3.0047)***	(0.8776)**	(0.4276)
D_EUGO	0.9854	1.0122	0.9683	0.9992	0.9754	0.9784	0.9686
	(10.745)***	(6.1451)***	(7.037)***	(5.3597)***	(6.0778)***	(7.9444)***	(6.1745)***
D_FED	0.9286	0.7169	0.9729	0.9948	0.945	1.0117	0.9477
	(3.5648)***	(1.8837)*	(4.24)***	(4.9422)**	(6.5023)***	(4.5786)***	(4.6254)***
D_USGO	0.9832	0.8576	0.9049	0.979	0.7373	0.9638	0.8101
	(5.0129)***	(3.6539)***	(6.7348)***	(6.648)***	(4.3316)***	(6.9993)***	(3.1325)***
D_IMF	0.9926	0.9769	1.0311	1.0062	1.036	0.9707	1.0306
	(4.8978)***	(1.8641)*	(2.2171)**	(2.3493)**	(2.001)**	(2.4108)**	(3.6179)***
R^2 Within	0.44	0.49	0.43	0.56	0.50	0.60	0.60

Variable	MRCH	MUT	MYI	PCT	PLI	PNL	RCP
Intercept	4.01E-5	1.28E-6	-5.38E-5	2.62E-5	-5.94E-5	-0.0001	6.13E-5
	(0.1612)	(0.0051)	(-0.2267)	(0.1028)	(-0.2465)	(-0.6982)	(0.183)
ER	1.0291	1.0061	0.9959	1.0146	1.0362	1.0397	1.064
	(50.96)***	(44.52)***	(40.79)***	(37.28)***	(46.89)***	(26.98)***	(27.39)***
Bond	0.0183	0.0232	0.0102	-0.0047	0.0018	-0.0358	0.0062
	(1.2524)	(1.5689)	(0.7347)	(-0.3134)	(0.1292)	(-3.8451)***	(0.3178)
Libor	0.044	0.0401	0.0403	0.0278	0.006	-0.0015	0.088
	(1.695)*	(1.5326)	(1.632)	(1.0488)	(0.2389)	(-0.0958)	(2.5218)**
Repo	-0.0032	-0.0019	-0.0058	0.004	-0.0001	-0.0015	0.0026
	(-0.4572)	(-0.273)	(-0.8737)	(0.5685)	(-0.0224)	(-0.3387)	(0.2784)
D_BOE	0.9559	0.8402	0.9482	0.8119	0.826	0.7602	0.9709
	(6.644)***	(7.1159)***	(7.2421)***	(3.3564)***	(4.26)***	(2.9717)***	(5.2968)***
D_GOV	0.4421	0.6087	0.3631	0.6924	0.343	0.2247	0.2716
	(2.9686)***	(4.544)***	(1.5717)	(1.9678)**	(1.8129)*	(1.482)	(1.2139)
D_ECB	0.7628	0.4509	0.9624	0.4023	0.3492	0.6387	0.217
	(1.399)	(0.961)	(0.988)	(1.4794)	(0.6018)	(2.1363)**	(0.1755)
D_EUGO	0.8249	0.9377	0.992	1.0065	0.9906	0.8192	1.0425
	(5.7131)***	(6.4899)***	(7.3518)***	(5)***	(7.8169)***	(5.2533)***	(4.54)***
D_FED	0.954	0.9822	0.9966	0.8215	0.9641	0.9346	1.0402
	(5.6249)***	(7.6383)***	(8.255)***	(2.789)**	(4.2064)***	(5.1752)***	(2.964)***
D_USGO	0.655	0.619	0.9471	0.967	0.9308	0.9752	0.9066
	(3.2137)***	(2.7378)***	(4.4592)***	(5.863)***	(5.1)***	(12.85)***	(5.849)***
D_IMF	1.0652	1.037	1.012	0.9998	1.071	0.9779	1.098
	(2.4987)**	(2.7944)***	(1.67)*	(3.519)***	(2.75)***	(1.4763)	(1.5)
R^2 Within	0.65	0.60	0.56	0.49	0.60	0.40	0.34

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

Table 14 SUR Investment Trusts Continued

Variable	SCIN	SMT	TEM	TMPL	TRY	WTAN	WWH
Intercept	1.95E-5	0.0001	5.28E-7	6.80E-7	1.05E-5	6.97E-6	-8.91E-5
	(0.0937)	(0.7025)	(0.0019)	(0.0027)	(0.0343)	(0.0409)	(-0.4037)
ER	1.0085	1.0072	0.9835	1.0197	1.0484	1.0098	1.06
	(50.46)***	(49.21)***	(51.16)***	(48.23)***	(36.83)***	(59.63)***	(26.97)***
Bond	0.0158	0.022	0.0114	0.0069	-0.0036	0.0153	-0.0053
	(1.2889)	(1.4841)	(0.7195)	(0.477)	(-0.202)	(1.5236)	(-4.118)***
Libor	0.0853	0.0826	0.046	0.0407	0.0508	0.0588	0.0308
	(3.9325)***	(3.1358)***	(1.65)*	(1.5879)	(1.5965)	(3.3087)***	(1.3401)
Repo	-0.0027	0.0092	0.0035	0.0016	-0.0021	-0.0001	-0.0097
	(-0.4606)	(1.29)	(0.4696)	(0.2335)	(-0.2534)	(-0.029)	(-1.564)
D_BOE	0.8795	0.8575	0.9479	0.6574	0.8705	0.8464	0.9723
	(6.0597)***	(5.8413)***	(6.366)***	(4.043)***	(6.8212)***	(5.3525)***	(4.333)***
D_GOV	0.4885	0.2489	-0.228	0.5779	0.745	0.3058	0.075
	(2.7015)***	(1.4616)	(-0.993)	(3.9824)***	(6.417)***	(1.8071)*	(0.3313)
D_ECB	0.6176	0.7923	0.6897	0.7101	0.197	0.9593	0.9784
	(1.0348)	(2.0013)**	(1.5787)	(1.7)*	(0.649)	(0.54)	(2.33)**
D_EUGO	1.0013	0.9797	1.0099	0.893	0.457	0.9635	1.011
	(5.887)***	(6.9727)***	(6.816)***	(4.823)***	(2.619)***	(5.2524)***	(8.674)***
D_FED	0.9767	1.0252	0.9904	0.9859	0.9707	1.0179	1.002
	(4.3973)***	(4.1983)***	(7.8367)***	(6.667)***	(5.176)***	(11.27)***	(3.474)***
D_USGO	0.9337	0.9995	0.8563	0.6537	0.9614	0.8976	0.9829
	(4.9687)***	(6.7147)***	(5.9893)***	(2.9)***	(4.29)***	(7.54)***	(7.375)***
D_IMF	1.0894	0.9572	1.0018	1.0662	0.9814	1.0796	0.9945
	(2.1382)**	(1.7511)*	(2.6304)***	(2.2852)**	(1.524)	(2.479)**	(3.052)***
R^2 Within	0.64	0.63	0.66	0.62	0.49	0.72	0.36

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.4.2.5 Real Estates

Turning our attention towards Table 15, we can quickly establish all the real estate firms experienced positive reactions in terms of announcements made. Overall this enables us to determine the announcements fulfilled their purpose in the eyes of investors within the real estate sector, as investors sought after stability following vast levels of volatility. Similar to other financial sectors, where the interpretation from the market highly sought the IMF to be most effective in reducing volatility and restoring confidence to the financial system as the model suggests greatest responsiveness is illustrated.

In terms of the government bond yields, overall the model suggests there is a positive relationship among the vast majority of real estate companies within our sample. In regards to the realtors, which enjoy a positive relationship towards government bonds, suggests the pricing of government funds has a contribution towards the pricing of their stock. From this knowledge, the results suggests the market is aware of their financial portfolio positions as

holding increasing amounts of risk-free assets, highlights further stability and therefore reduced value at risk. Conversely, a negative relationship can suggest that the government bonds did not in fact contribute towards the pricing of their stock pricing. It also highlights as the yields decreased of the government, in particular British Land Company and Shaftesbury sought after higher yielding investments as determined by the market.

When interpreting Libor reactions from the realtor sector it is evident that a positive relationship arises towards the pricing of these companies, with the exception found in Savills, which highlights an inverse relationship. The induced positive relationship may arise as lending within the inter-bank market increased as the rates declined, led to increased liquidity for the banks to in-turn provide liquidity to other financial sectors such as the real estate sector, which may have led enriching their investment portfolios. Conversely, for Savills this is not the case, which suggests finances may have been raised by other means possibly through equity and therefore experienced an inverse relationship towards Libor rates.

The Repo Rates within Table 15 suggest the majority of realtors experience an inverse relationship towards the contributing factors of their stock price, with the exception of Building Land Company and Hammerson. The interpretation of the inverse relationship suggests the Repo-rates did not contribute towards the market valuation of their stocks, furthermore confirming the notion as short-term rates declined, the real estate sector largely invested in longer-term maturity assets. Conversely, for Building Land Company and Hammerson took advantage of the decreased repo rates with their investors highlighting such relationship within their valuation of asset pricing.

Table 15: SUR Real Estates Results

Variable	LAND	BLND	HMSO	SHB	SGRO	DLN	SVS	DJAN
Intercept	0.0004	0.0001	0.0003	0.0001	0.0003	0.0002	1.01E-5	0.0002
	(1.076)	(0.435)	(0.782)	(0.275)	(0.707)	(0.503)	(0.0184)	(0.434)
ER	1.0583	1.066	1.0556	1.1221	1.067	1.036	1.0699	0.9731
	(33.4)***	(33.4)***	(30.7)***	(26.1)***	(26.9)***	(27.3)***	(18.5)***	(13)***
Bond	0.0207	-0.0041	0.0159	-0.0308	0.0371	0.0046	0.0199	0.075
	(0.9171)	(-0.171)	(0.64)	(-1.248)	(1.223)	(0.1792)	(0.6155)	(2)**
Libor	0.1077	0.0918	0.144	0.057	0.061	0.0088	-0.0256	0.245
	(2.692)***	(2.12)**	(3.28)*	(1.318)	(1.14)	(0.193)	(-0.448)	(3.6)***
Repo	-0.0085	0.0017	0.002	-0.0212	-0.0137	-0.0061	-0.0059	-0.023
	(-0.789)	(0.145)	(0.173)	(-1.796)*	(-0.946)	(-0.496)	(-0.3835)	(-1.31)
D_BOE	0.8099	0.9368	0.939	0.861	0.8826	0.626	0.7113	0.5937
	(5.121)***	(7.81)***	(7.53)***	(4.22)***	(6.59)***	(3.73)***	(3.8)***	(2.54)**
D_GOV	0.6952	0.813	0.2705	0.3896	0.3407	0.2164	0.6207	0.513
	(6.0764)***	(6.75)***	(1.65)*	(2.375)	(2.34)**	(1.273)	(3.55)***	(2.18)**
D_ECB	0.4878	0.6304	0.5221	0.577	0.3218	0.3775	0.8847	0.46
	(0.451)	(1.784)*	(1.35)***	(1.257)	(0.771)	(1.151)	(1.825)*	(1.561)
D_EUGO	0.5672	0.645	0.882	0.7822	0.8271	0.903	1.0106	0.9421
	(3.07)***	(3.19)***	(5.4)***	(4.64)***	(4.39)***	(5.4)***	(2.86)**	(3.4)***
D_FED	0.9171	1.0329	0.923	1.028	0.9895	0.938	0.8151	1.0345
	(1.4956)	(3.53)***	(3.75)***	(3.204)**	(2.92)***	(4.99)***	(2.29)**	(2.45)**
D_USGO	0.6842	0.9341	0.784	0.9283	0.7961	0.547	0.7596	0.9386
	(3.948)***	(3.88)***	(4.06)***	(4.45)***	(4.55)***	(2.953)***	(2.6)***	(3.5)***
D_IMF	1.1036	0.8874	0.8974	1.1462	0.9	1.0152	1.026	1.0258
	(2.664)***	(1.349)	(2.36)**	(1.676)*	(1.66)***	(1.82)***	(2.92)***	(1.5)***
R^2 Within	0.44	0.44	0.41	0.31	0.35	0.36	0.20	0.15

t-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.4.3 GJR-GARCH Methodology

It was found after extensive ARCH-effects testing on Royal Bank of Scotland that there were no signs of ARCH-effects present within the data and no heteroskedasticity, therefore cannot proceed with GJR-GARCH modelling methodology. A reason for this may be because markets fully understood Royal Bank of Scotland's position following the part-nationalization from the UK government and therefore was priced accordingly, therefore leading to no ARCH-effects and a homoscedastic dataset.

From Table 16 when interpreting the results upon the UK banking sector, a clear picture is depicted, in terms of the leverage effect. We experience large statistical significance within many of the institutions interpreting the overall announcements as "good" news bar HSBC and Lloyds Banking Group interpreting as "bad" news. One could argue HSBC may have interpreted the news announcements in a negative manner due to the institution not requiring

any assistance but possibly due to the market and levels of uncertainty they were operating within leading investors to interpret the negativity towards HSBC as they provided further liquidity to financially distressed institutions. On the other hand Lloyds' shareholders may have responded overall in a negative manner due to various factors such as being part-nationalized the market may have scrutinised Lloyds Banking Group further as a result.

When interpreting the dummy variables reactions in comparison to the previous methodologies applied, we notice significant differing outcomes. To begin with our new variable (Banks) witnesses significant negative reactions towards all banks bar HSBC, which can be largely considered as the unaffected bank due to the size of their operations. The negative reaction highlights investors traded on the knowledge of increased borrowing costs as downgrades were implemented by rating agency bodies, as well as respond negatively towards the fines, respectively. Moreover, there are discrepancies with the interpretation of the news announcements in regards to the SUR technique and GJR-GARCH, from which to a certain extent can be said towards all announcements. Stronger results are heavily evident within the SUR approach. However, it can be said the GJR-GARCH approach may be more accurate as the BoE announcements brought a decline in the asset prices of the banking sector with statistical significance as the market interpreted the induced volatility as the central bank confirmed the underlying issues to the market. When investigating the other key announcements such as the IMF which, according to the GJR-GARCH methodology, had relatively no effect and therefore may have been already foreseen by the market and priced accordingly. The same could also be said towards the Government announcement, which suggests there was no surprise to the market that the government implemented such policy initiatives in order to save the financial system. With respect to announcements from the EU and US, we generally see a positive reaction by the UK market which, further enhances the evident linkages between the banking system in the UK, EU and US.

When interpreting the CDS variable we establish quickly the results are conflicting again with the SUR approach undertaken previously, from which we can suggest the market predicting the fallout of Northern Rock and Bradford & Bingley. Since their CDS spread variable is positively correlated against their respective stock returns. On the other side of the spectrum, all the other institutions experience a negative correlation towards their stock returns with a high degree of significance. Ultimately, this highlights the inverse relationship the other institutions held regarding the widening of spreads and a declining stock price which is an

accurate assessment for the turbulent period under examination. Therefore, we can suggest the market was able to distinguish their exposure levels to sub-prime debt.

In regards to the Government bond variable, all institutions enjoy a positive correlation towards their stock returns, which conflicts earlier results of before and highlights the negatively correlated institutions in the SUR technique did in fact hold a sufficient sum of government bonds within their portfolio. In regards to the Libor rates, we can note the positively correlated institutions are all that received funding, merged with another bank and Barclays whom were found guilty of manipulating Libor rates, in order to portray a better picture of the health of their balance sheet. The positive relationship establishes the extensive use of the inter-bank market for those concerned institutions, whereby the market was able to price that information into their stock returns. The repo rates suggest a negative relationship arises, namely to the troubled institutions and Banco Santander (which took over Alliance & Leicester and Bradford & Bingley). This highlights their need for capital on the short-term basis, which was required in order to meet reserve ratio requirements to cover depositor's money and prevent bank run.

Furthermore, unfortunately heteroskedasticity is found within Standard Chartered modelling using the GJR-GARCH technique. When using other techniques such as ARCH (1,0), GARCH (1,1) and EGARCH techniques the outcomes are the same in regards to heteroskedasticity and autocorrelation present within the model and also affecting other institutions when placing them under similar ARCH family models. A rational explanation for such an occurrence is it's possible the financial markets priced Standard Chartered accordingly. As the financial crisis took a firm grip losses from Standard Chartered institution were limited due to low exposure levels to the US sub-prime market and therefore markets, more importantly investors held little concern towards Standard Chartered.

Table 16: GJR-GARCH UK Banks Results

Variable	HSBC	BARC	LLOY	BNC	STAN*	HBOS	AL
Intercept	0.0003	-0.0002	-0.0002	-0.0002	-0.0001	0.0002	-0.0003
	(1.49)	(-0.563)	(-0.86)	(-0.618)	(-0.509)	(0.596)	(-0.567)
ER	1.2849	1.1265	1.197	1.0227	0.942	1.1278	1.0256
	(49.59)***	(35.86)***	(29.86)***	(29.21)***	(45.73)***	(31)***	(19.83)***
Bond	0.0616	0.1996	0.1896	0.1272	0.0456	0.0251	0.1163
	(5.204)***	(8.0278)***	(7.161)***	(5.351)***	(2.607)***	(0.4959)	(1.4968)
CDS	-0.0003	-0.055	-0.034	-0.0644	-0.026	-0.0173	-0.0001
	(-0.0703)	(-6.704)***	(-4.376)***	(-9.975)***	(-3.29)***	(-2.236)**	(-0.2618)
Libor	-0.0359	0.0271	0.134	-0.0772	-0.026	0.0414	0.2
	(-0.824)	(0.3741)	(1.977)**	(-1.066)	(-0.444)	(0.4262)	(2.0134)**
Repo	0.0025	0.0254	0.0169	-0.0043	0.0105	-0.0516	-0.088
	(0.335)	(1.8977)*	(1.081)	(-0.4048)	(1.0527)	(-1.127)	(-2.663)***
Variance	1.63E-06	2.54E-06	2.19E-06	2.73E-06	1.74E-05	5.10E-0	4.25E-06
	(4.08)***	(4.137)***	(4.7779)***	(3.834)***	(7.947)***	(3.701)***	(7.835)***
b_{t-1}^2	0.089	0.0392	0.1092	0.0551	0.1481	0.2409	-0.0217
	(7.082)***	(3.938)***	(8.398)***	(4.964)***	(6.581)***	(6.538)***	(-16.33)***
$b_{t-1}^2 b_{t-1<0}$	-0.0349	0.0443	-0.0171	0.0336	0.096	0.0502	0.0513
	(-2.5436)**	(3.585)***	(-1.0344)***	(2.677)***	(3.264)***	(1.0575)	(7.75)***
GARCH-1	0.9122	0.9319	0.8984	0.9154	0.7425	0.765	0.9728
	(76.25)***	(127.6)***	(116)***	(95.12)***	(39.34)***	(38.1)***	(223.7)***
BOE	-0.0011	-0.0013	-0.0016	0.0025	-0.0017	-0.0119	-0.1289
	(-1.4323)	(-0.4489)	(-0.7892)	(1.0312)	(-0.478)	(-0.741)	(-12.17)***
ECB	-0.0078	0.016	-0.0025	0.0077	0.0079	0.0271	0.129
	(-1.959)**	(1.3014)	(-0.409)	(1.206)	(0.3216)	(1.108)	(9.622)***
EURGOV	-0.0127	-0.012	-0.0618	-0.026	0.0127	0.0176	-0.008
	(-2.215)**	(-1.0037)	(-2.918)***	(-2.862)***	(1.127)	(1.219)	(-0.478)
FED	0.0128	0.0054	0.0559	0.0295	0.0288	-0.0066	-0.0067
	(1.6193)	(1.0753)	(3.589)***	(3.48)***	(1.802)*	(-0.306)	(-0.7288)
GOV	0.0053	0.0126	0.0009	0.0062	0.0014	0.0105	0.1136
	(3.1828)***	(1.179)	(0.4428)	(1.395)	(0.512)	(0.631)	(5.614)***
USGOV	-0.0087	-0.0204	-0.0086	0.0007	-0.017	-0.0045	0.0124
	(-1.98)**	(-3.192)***	(-2.337)**	(0.2045)	(-3.091)***	(-0.6)	(1.811)*
IMF	0.0008	6.01E-05	-0.0059	-0.011	0.0021	0.2763	-
	(0.4919)	(0.9342)	(-2.087)**	(-2.44)***	(1.147)	(1.158)	-
HSBC	-0.1036	-	-	-	-	-	-
	(-2.307)**	-	-	-	-	-	-
BARC	-	0.0034	-	-	-	-	-
	-	(0.3841)	-	-	-	-	-
BANKS	0.0017	-0.0041	-0.0015	-0.0003	-0.0007	-0.1605	0.0138
	(0.9729)	(-1.47)	(-5.06)***	(-0.165)	(-0.159)	(-0.9786)	(0.2306)
R^2	0.54	0.42	0.28	0.44	0.51	0.18	0.22

Z-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

Table 16 GJR-GARCH UK BANKS Continued

Variable	BB	NRK	RBS*
Intercept	-0.0003	6.66E-6	NA
	(-0.6375)	(0.0084)	NA
ER	1.1754	0.8741	NA
	(23.04)***	(14.64)***	NA
Bond	0.1346	0.134	NA
	(1.748)*	(1.4072)	NA
CDS	0.0004	0.0012	NA
	(0.4653)	(1.3937)	NA
Libor	-0.1518	0.0705	NA
	(-1.4048)	(0.4004)	NA
Repo	-0.0203	-0.0512	NA
	(0.3814)	(-0.9646)	NA
Variance	1.4E-5	1.85E-5	NA
	(3.7662)***	(8.18)***	NA
b_{t-1}^2	0.2217	0.0172	NA
	(5.251)***	(0.9433)	NA
$b_{t-1}^2 b_{t-1<0}$	0.3376	0.0825	NA
	(4.334)***	(4.1705)***	NA
GARCH-1	0.7109	0.8503	NA
	(29.5)***	(50.03)***	NA
BOE	-0.065	-0.428	NA
	(-1.284)	(-2.887)***	NA
ECB	0.0504	0.0395	NA
	(1.0136)	(0.4127)	NA
EURGOV	0.1086	-	NA
	(0.2616)	-	NA
FED	-0.08	-0.0634	NA
	(-1.5633)	(-1.8183)*	NA
GOV	0.015	-0.0731	NA
	(0.4725)	(-1.9066)*	NA
USGOV	0.0173	0.5472	NA
	(1.8993)*	(5.6325)***	NA
BANKS	-	-	NA
	-	-	NA
$\mathbf{R^2}$	0.17	0.04	NA

Z-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance.

5.5. Conclusion

When referring back to our set hypotheses in Section 2, extensive hypothesis testing is carried with the summary of results depicted in Table 17. Regarding the first hypothesis, which aimed to understand whether market participants were able to distinguish the risk exposure between banking institutions, overall we cannot reject the null hypothesis. We interpret the result whereby, investors were able to distinguish the risk exposure between institutions according to both the SUR and GJR-GARCH methodologies. Whether the CDS spreads were widening against the financially distressed banks or narrowed for the low-exposure banks, investors were able to determine the future outcomes. Referring to the second hypothesis, whereby Bank of England initiatives had a greater impact than UK Government announcements towards the banking sector can be rejected. Therefore, the Government reactions to the unfolding crisis were just as pivotal to the banking sector as much as the monetary policy responses. When referring back to the third hypothesis which concerned the non-banking institutions, across all sectors there is a collective acceptance of the null hypothesis. Whereby, announcements from Western economies and IMF had a more significant effect on non-banking institutions than the combined announcements of the UK Government and the Bank of England. This acceptance of hypothesis overall highlights the how integrated financial systems are in the modern age, where the presence of globalisation is prevalent. In regards to the last hypothesis, we established a conflicted results in terms of different methodologies producing differing outcomes. Whereby, the SUR approach enabled us to not rejecting the null hypothesis as it stands, which also would reaffirm the major central bank's main aim of reducing market volatility via the markets lender of last resort. Conversely, with the GJR-GARCH approach we reject the null hypothesis and accept the alternative where the major central banks did not induce a positive effect towards the banking sector. This possibly highlights the market investor of the banking sector did anticipate the news from the respective international central banks and therefore as news came into fruition, there was no effect on the stock returns.

To conclude, we found investors were able to distinguish risk levels between institutions and that government announcements were just as significant as monetary policy actions to the market. Furthermore, we discovered the non-banking institutions are highly integrated to global markets as the announcements from Western economies and the IMF have a stronger effect within the UK than combined with announcements from the Bank of England and Government. We also contribute to the literature through suggesting the banking sector is

impacted by announcements from other central banks such as the Federal Reserve, ECB and the IMF. We do however call upon the academic community to further the research in order to confirm or reject our findings and gain greater understanding of the UK financial system.

Table 17: Hypotheses Summary

Hypotheses	**Banks**	**Finance**	**Insurance**	**Trusts**	**Real Estate**
H1:	SUR-DNR	-	-	-	-
	GJR-DNR	-	-	-	-
H2:	SUR-Reject	-	-	-	-
	GJR-Reject	-	-	-	-
H3:	-	DNR	DNR	DNR	DNR
	-				
H4:	SUR-DNR	-	-	-	-
	GJR-Reject	-	-	-	-

*DNR- Do not reject Null hypothesis, SUR- SUR method, GJR- GJR-GARCH method

CHAPTER 6

Assessing The Effect of Regulation Changes On The Stock Price and Volatility of UK Financial Institutions

6.1. Introduction

Following the deepest financial crisis since the great depression, governments, regulators and central bankers have attempted to restore shattered trust through increasing regulation in order to bring confidence to the financial markets. The deterioration in the financial system from the crisis of 2008 in the UK has hindered economic prosperity and is yet to fully recover from the losses amassed. The initial monetary response from the Bank of England and government sought short-term stability, however these measures do not cure the long standing underlying issues from which the financial institutions created essentially. What the financial crisis highlighted more so than anything, is how reliant the real economy is on financial markets operating efficiently and effectively. This is in order to oversee the continuous transfer of funds from surplus to deficit units to access capital. When funds flowing within the inter-bank markets steeply declined as uncertainty over the future existence of certain financial institutions increased as losses amassed from certain institutions. Overall, this caused a large disruption to the flow of funds within the financial system as businesses/users of funds suffered liquidity issues in operating on a day-to-day basis. With all the events that unfolded during the crisis period, the public's perception of the financial institutions naturally declined along with their integrity, which gave rise to the Turner Review in 2009. The overall recommendation supported the concept of increasing regulation within the financial sector due to the significant role they play in modern society. Recent research from committee's and academics alike have given rise to reform acts such as the Turner review and Vicker's report in the UK, Dodd-Frank Act in the US, reforms and levy's in Germany, the concept of "too big to fail" in Switzerland as well as the creation of European Stability Mechanism from the Eurozone. All of these reforms in their respective nations have arisen in order to produce greater stability as Moshirian (2011) has pointed to reduction in excessive risk taking by financial managers through global regulatory standards through such bodies such as the Bank for International Settlement (BIS) and to become an internationally integrated financial system, which may produce further stability going forward.

Schwert (1981) identified the practical use of using financial market data to capture the effects of regulatory changes towards the market as all new information is relevant and therefore priced into assets upon its release. This study paved the way for further studies to embody this approach, with Binder (1985) expanding the methodological approaches set out by Schwert (1981). Most papers we have come across since illustrate the impact of regulatory changes in different light for example Ediz et, al (1998) and Mora and Logan (2012) studied the impact of regulation held towards the banking sector's capital requirements. Furthermore, other studies such as Bhattacharya and Daouk (2002) investigate the impact regulatory changes concerning insider trading laws has towards the markets. Bhattacharya and Daouk (2002) came to the conclusion enforcement of insider trading laws decreased the cost of equity. Spiegel and Yamori (2003) measure the effect of two regulatory reforms in Japan on bank equity values, the Stabilization laws (1998) of the Financial Reconstruction Act and the Rapid Recapitalization Act. Larcker et, al (2011) investigated the market reaction to regulatory changes pertaining to corporate governance. To their contribution, they discover an insignificant reaction to events correlating to the regulation of executive pay. However, on average they did find a negative relation between abnormal returns on the days of these events, with the higher the CEO compensation leading to a higher negative reaction. Cumming, Johan and Li (2011) contributed to the literature by showing the impact of the Markets in Financial Instruments Directive (MiFID) ruling for insider trading. Whilst utilising a multivariate regression model, they are able to conclude trading rules are positively associated with velocity and negatively associated with volatility and bid-ask spreads, which contribute towards greater liquidity. Schäfer et, al (2015) shed light towards the reforms taken place in 4 major financial systems, through analysing the reaction of stock market returns as well as CDS spreads of banks during the post crisis period solely. Schäfer et, al (2015) come to the conclusion the Vicker's reform produced a strong positive impact towards the CDS spreads but only modest changes in the equity prices of the banking sector in the UK. Following this discussion towards the literature we identify the gap, which does not entail the impact of regulatory change towards the financial sector within the UK. We hope to contribute to the literature through extending a more vigorous regulation change event study towards the UK financial sector equity prices. The contribution would be of great concern to the UK regulators as well as other international bodies the research covers. This is due to regulatory bodies understanding their power they possess to impact equity markets, which can be detrimental in maintaining stability within the financial markets. Moreover, the research would be of interest to investors as they navigate

their financial decisions around times of regulatory change in particular of equity market participants.

Naturally, this gives rise to our main aim, which is to identify the impact regulatory changes held towards the UK financial sectors indices from pre-crisis to post-crises. Further to this we aim to discover which regulatory bodies have the greatest impact to the market as well as if it is welcomed due to the stability/transparency regulation aims to achieve. In order to answer the above we utilise the event study methodology (MacKinlay (1992)) and EGARCH methodology Nelson (1991), which will determine the initial impact towards the market. One would expect that increased regulation post crisis period would aid the theory the market welcomes such stances and therefore would be reflected within a positive reaction from the market. The reforms taken place are to help bring a healthier financial system, which can in turn lead to an enhanced economic activity as financial markets are able to operate at an efficient level. Additionally, we wish to understand if the market is efficient in terms of pricing new information. We implement a VAR GJR-GARCH model we wish to comprehend if there is evidence illustrating a transmission of information from the regulatory bodies to the stock market prior to the regulation change.

This then fulfils the necessity to carry out this research as it is vital to understand how the UK financial system operates in terms of how the market reacts to such measures taking place. For example, if the public perception towards the financial sector is deemed to be acting over-aggressively within their operations. This then can in-turn lead to the demise of the financial system as we witnessed back in 2008, as a means to avert such scenarios repeating increased regulation announcements should be exhibited through a positive return on equities. Conversely, if the market does not agree with the measures taken by the respective regulatory bodies, then a negative return in the equity markets will prevail naturally.

The results obtained from this study highlight three key findings whereby, firstly there is a negative response towards the banking equity prices from the Vickers Report. This was a key reform introduced by the Independent Committee in order to aid economic stability within the UK as well as avert future financial crisis periods. Furthermore, to aid this finding we also found that the market had prior knowledge of regulatory announcements surfacing through pricing their positions accordingly. Lastly, we find evidence of announcements relating to capital standards within the banking and insurance sectors held a negative equity return for investors. This suggests the risk-return hypothesis is ever-present within the market as the

capital standard requirement reforms restrict the overall performance from taking excessive risk, which brings stability but may alter future revenues.

The layout of this chapter is as follows; Section 2 reviews the literature, 3 details the hypotheses set, 4 illustrates the methodological approach, 5 analyses the results and Section 6 concludes the chapter.

6.2. Review of the Literature

Determining the effects of regulatory changes has towards asset prices in financial markets can be traced back as far as Schwert (1981) and Binder (1985). In particular Schwert (1981) argues that utilizing stock market data is the most appropriate measurement to capture the impact regulation has on markets. As stock markets are efficient in terms of pricing in all relevant information as soon as it is available, this therefore provides an accurate platform to capture the perception of regulatory changes. Moreover, when addressing the issue of volatility spill-overs we go back to the original work of Engle (1982). Through the introduction of the ARCH model, this takes into consideration several features of financial data, such as disturbances, which may be serially uncorrelated and show volatility clustering. The ARCH approaches also take into consideration the heavily tailed distribution exhibited by the unconditional distribution. Further to the ARCH methodology there comes the introduction of the generalized version by Bollerslev (1986, 87), which enabled further variations of ARCH/GARCH models. This gave rise to the formulation of the leverage effect included within the EGARCH model by Nelson (1991) as well as the GJR-GARCH model including the leverage effect by Glosten et, al (1993). Susmel and Engle (1994) delved into the linkages between financial markets from New York and London by utilising financial news on an hourly basis to capture whether there were effects or causalities between the two markets.

The next strand of literature we introduce, which is of relevance is Wagster (1996), which aimed to measure the wealth effect of shareholders of international banks with the introduction of the Basle Accord. The Basle Accord primary objectives were to reduce the risk of international banking system and to minimize competitive inequality that arises from differences in domestic-level regulation standards. Further to this, Japan was experiencing a funding-cost advantage, which enabled the Japanese banking sector to lend more than 33% of global lending during the 1980s, which eventually led to their banking crisis due to their high degree of risk-taking. Wagster (1996) examined the weekly rate of return against both domestic

market indexes and the MSCI World Index for large internationally active banks in 7 countries in relation to the Basel I announcements. This was applied through a multivariate regression model as per Cornett and Tehranian (1990). Wagster (1996) found that Japanese bank shareholders gained an additional 31.63% of wealth as compared to their developed counterparts and further concluded that the new regulations were to adequate to control such large banks.

Most papers we have come across since illustrate the impact of regulatory changes in different light for example Ediz et, al (1998), Mora and Logan (2012) and Tapia (2012) studied the impact of regulation held towards the banking (utilities for Tapia (2012)) sector's capital requirements. Whilst these research articles have some relevance, they take a different focus more toward the impact on the balance sheet rather than the market reaction towards the regulatory changes. Furthermore, other studies such as Bhattacharya and Daouk (2002) investigate the impact regulatory changes concerning insider trading laws has towards the markets. Bhattacharya and Daouk (2002) examined 103 countries all over the world but took a strong focal point towards Europe as the investigation period includes a time where the European Union was formed. In order to bring the monetary union, regulation had to be developed which applies to all member nations and must implement the European Community Insider Trading Directive. Furthermore, the purpose of their research questioned whether the existence and enforcement insider trading laws impacts the cost of equity. The theory behind the research is that with regulations in place to control white-collar crimes such as insider trading the cost of equity should decline as investors participation should be increased, which can create market depth. Bhattacharya and Daouk (2002) utilise the international capital asset pricing model (ICAPM) in order to capture the insider trading laws impact. Bhattacharya and Daouk (2002) go on to find that the establishment of insider trading laws do not account for a reduction in the cost of equity. However, it not until the law is enforced whereby the cost of equity declines, with the developed nations enforcing the law on more occasions.

Spiegel and Yamori (2003) focussed on the Japanese banking sector in regards to regulatory changes occurred in Japan. Spiegel and Yamori (2003) in terms of methodological approach utilised the OLS regression estimation of bank portfolio returns. They found that large banks regulatory advantages were diminished by the Financial Reconstruction Act and the Rapid Recapitalization Act (1998), which affected large banks and trust bank groups portfolios significantly and priced negatively on announcements studied by the market. However, following these announcements, it benefited smaller regional banks as abnormal

returns on these events proved to be significantly negatively related to bank size, as measured by total assets. As well as the Rapid Recapitalisation Act (1998) was perceived by investors to benefit the weaker banks within the Japanese system and thus improved their performance as a result of regulation implemented.

The next strand of literature looks into the market reaction to corporate governance regulation Larcker, Ormazabal and Taylor (2011). The aim of the paper was to consolidate all the regulatory announcements by the SEC, state of Delaware and government officials towards limiting executive pay and capture the reaction to such statements/laws passed. Their desired method proceeded with an event study methodology, utilising the abnormal returns and regressing against the announcements in study. They find an insignificant reaction to events relating to regulation of executive pay. Once examining cross-sectional variation in the markets reaction, there is evidence of a negative relation between abnormal returns on the days of regulation change. Furthermore, the higher the CEO's compensation package, the more negative the reaction. The results are conclusive and consistent with the literature in terms of a value maximizing view of current pay practices and with the argument of capping executive pay results in less efficient contracts whilst negatively impact shareholder wealth. Other results collected from the cross-sectional variation in the markets reaction there is strong evidence that abnormal returns are increasingly negative for firms larger institutional block-holders.

Cumming, Johan and Li (2011) examined the impact of market integrity rules on the performance of equity market places. Their main focus differs in many ways as they examined the effect regulation changes held towards liquidity as represented by velocity, volatility and bid-ask spread. However, they recognised the importance of the MiFID regulation, which they expanded upon within their paper through utilising a multivariate analyses to examine the impact held towards liquidity. Cumming, Johan and Li (2011) isolated the regulation change through examining pre and post announcement impact, from which they discover an incremental increase of 8.7% in velocity. This highlights the convertibility of assets into cash is good for the market as it encourages trading as well as increasing efficiency through regulation. Their results also report a statistically significant decline in volatility at the 5% and 1% level as well as decreasing the bid-ask spreads in Europe significantly by 6 basis points. Essentially, Cumming, Johan and Li (2011) demonstrate within their study the positive impact increased regulation has towards financial markets, which ties in with the theory that market participants are more willing to trade as information is increased and prices are fair.

Schäfer et, al (2015) study is the closest to our study and therefore give more focus to this paper. Schäfer et, al (2015) address the issue of whether reforms have had any measureable effects towards the market. Their study analyses the changes in equity prices as well as CDS spreads in order to capture the market reaction to news of regulation changes from the US, UK, Germany and Switzerland. In particular the Volcker law reforms, the Vickers report, Germany reforms and the too big to fail regulation in Switzerland were examined through a SUR capacity as stated by Zellner (1962). Schäfer et, al (2015) results reveal that the public perception of no changes have occurred after the crisis does not do justice to the various efforts of regulators to create a stable environment. After all, their results highlight at the national level financial markets did react to the structural reforms. For the Volcker rule in the US exhibited a decrease in the US investment banks and an increase in CDS spreads towards the commercial banks. Schäfer et, al (2015) come to the conclusion the Vicker's reform produced a strong positive impact towards the CDS spreads but only modest changes in the equity prices of the banking sector in the UK. Overall the study illustrates the reforms and regulatory changes reduced bail-out expectations, specifically for the banking sector and lowered equity returns in many cases. Therefore, regulatory bodies were successful in their attempts to reduce overall systemic risk and produce a stable economic environment for the financial sector to operate within. However, Schäfer et, al (2015) do come to the conclusion further that their results are not fully supportive to answer the question "did enough happen?" Therefore we identify a gap within the literature to proceed with our research which will fulfil the question – how did the UK financial sectors react to regulation change and did the market efficiently price the information beforehand?

6.3. Hypotheses

Following the literature we propose testable hypotheses in which to give our research a baseline to draw upon. We focus on three areas; the Vickers' report brought stability to financial sector as via a reduction in volatility, whether the announcements spilled-over into the pricing of their assets prior to the regulation reforms and which type of regulations impacted the financial sectors collectively.

To delve deeper into the Vickers Report, we create a testable hypothesis by which we are determined to confirm or reject results by Schäfer et, al (2015) in terms of the market responding in a similar fashion. It can be hypothesised we will expect to witness a decline in volatility particularly from the banking sector as we take the view; reforms seek to improve widespread stability and reduce systemic risk. Furthermore, we expect with greater stability sought by the Vickers report and with such announcements one can only assume a negative response in the equity market due to the risk-return hypothesis. As the banking sector becomes less risky within their business model, investors and the market alike may process and price this information as negative for future returns.

We also examine whether or not volatility spill-over effects were present from the regulatory bodies prior to the regulation announcements. We therefore examine the market efficiency hypothesis, as markets in theory are efficient, which we expect to yield no spill-overs result prior to the announcement date. As the stocks are correctly priced given the information available to the public, this would confirm the notion markets are efficient. However, if a statistically significant result yields prior, this would suggest that the market has expected regulatory change to be implemented. Therefore, the expectation has been priced into the asset prior to the announcement, which overall highlights inefficiency within the market.

We create a testable hypothesis regarding regulatory changes to higher capital level requirements which includes Solvency II. The expecting result of this change is to witness a decline in the equity prices of the indices concerned by such announcement due to the theory of risk-return. As the market may perceive the financial institutions less risky and therefore is priced into their asset valuation. Furthermore, these announcements heavily impact the sectors on an operational level as shareholders wish to earn greater returns. This poses an issue for managers to deliver such returns whilst respecting the new regulatory requirements of holding excess capital.

6.4. Empirical Approach

6.4.1 Data

The data utilised in this chapter comprises of FTSE 350 index data from the respective financial sectors within the UK; FTSE 350 Banking index, FTSE 350 Insurance index, FTSE 350 Real Estate index, FTSE 350 Investment Companies index, FTSE 350 Finance companies index and the FTSE 100 as a benchmark. We have opted to use daily return data from 01/01/2000 to 31/12/2014 in order to capture the effects of the regulatory changes in a precise manner. All the variables will take the natural log in order to achieve stationarity at level, as well as reduce noise implications produced by trading. Data has been sourced from Bloomberg database, Bankscope and from UK/EU/International regulatory bodies. Table 2 located within the appendix 3 highlights the significant regulatory events we have identified, which will be examined.

Figure 1 below highlights the capital ratios for the banking sector within the UK and their average holdings of capital from 2006-2014. We can see that prior to the financial crisis of 2008, from 2006-2008 we report a decline in the capital held by the banking sector. This was also prior to the increased capital requirements regulations implemented by respective regulators, which have sought to bring stability to the financial sector as they hold the great responsibility of keeping depositors money safe. The increased regulation on the face of it has provided a strong argument to examine the impact this held towards the initial stock market reaction to regulation changes. As Figure 1 demonstrates in the post crisis era, the banking sector exemplifies greater capital being held within their balance sheets. Figure 2 highlights the time series data of the average CDS spreads of UK banks. From figure 2 we gather a coherent image of the banking sectors probability of default via the CDS spreads widening from 2008 onwards. The widening of spreads suggest there is a greater probability of the bank defaulting, hence the sudden increase in 2008 at a time where the banking sectors future was highly uncertain due to the losses the banks were producing at the time. As we can see further, since the height of the crisis period we are now experiencing much tighter spreads, which may have been as a result of the increased minimum capital levels imposed.

Figure 1: Capital Ratios in UK Banking Sector

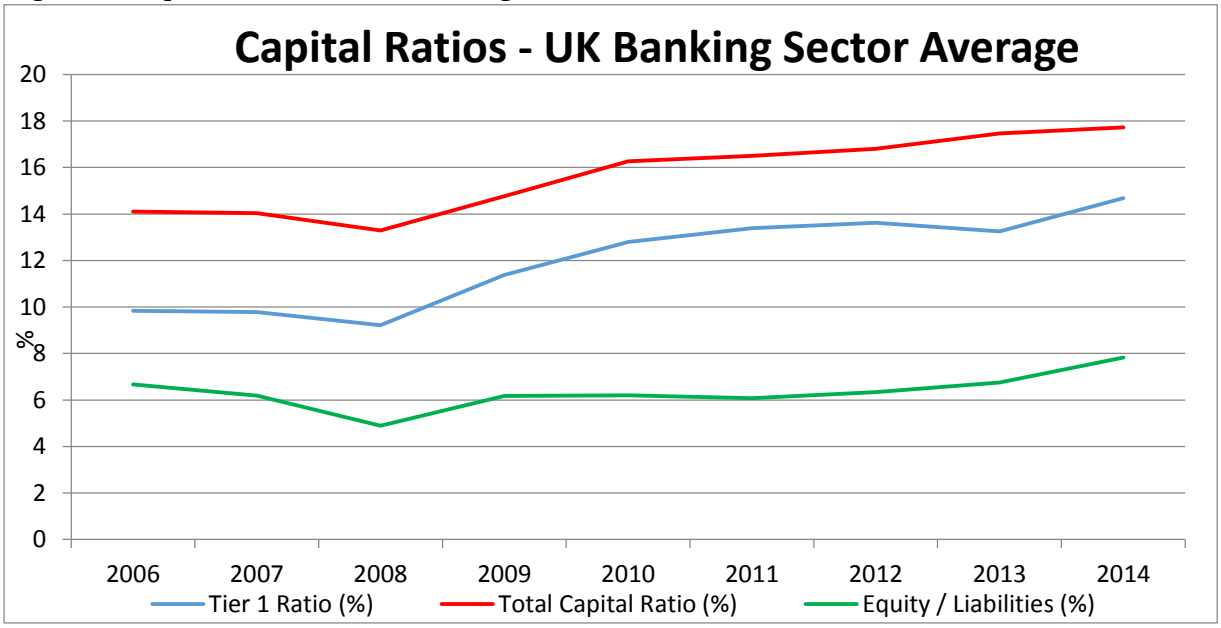
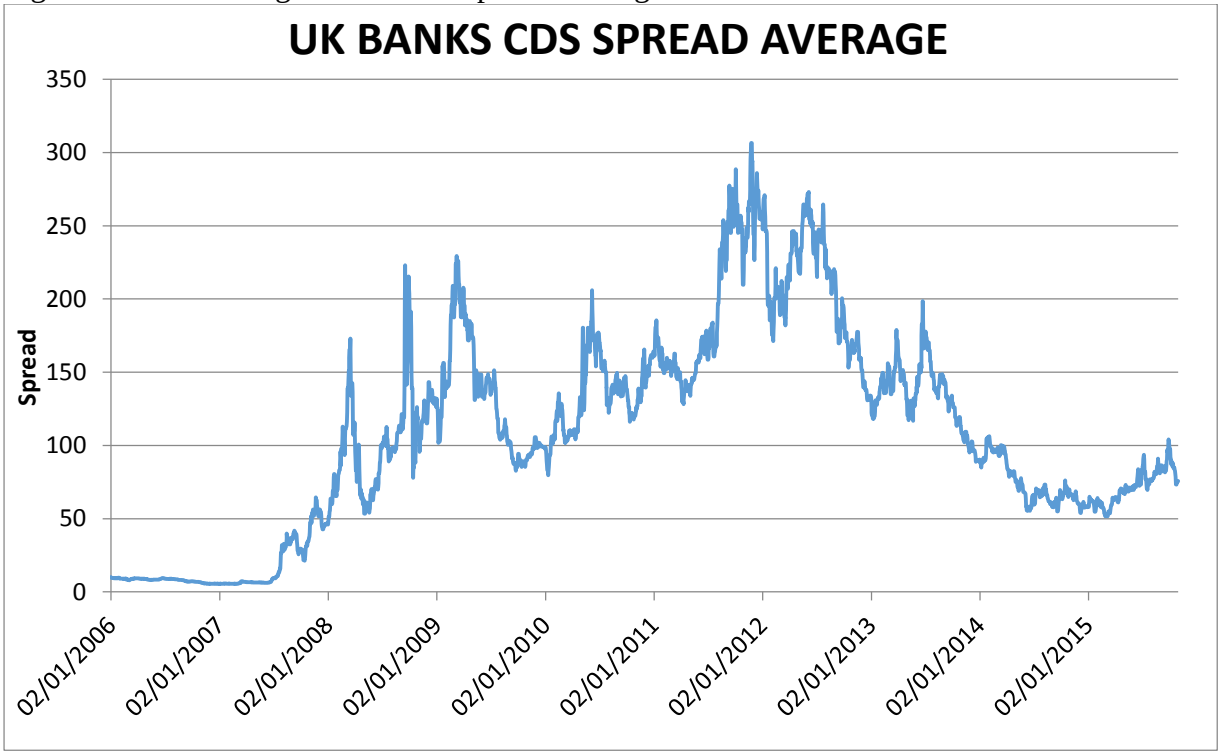


Figure 2: UK Banking Sector CDS Spread Average



6.4.2 Descriptive Statistics

Table 1 below sheds light on the descriptive statistics from which, we identify all variables achieve stationarity at level via the Augmented Dickey-Fuller and Phillips-Perron unit root tests. The Jarque-Bera test illustrates the normality of each variable, with all variables being non-normally distributed as expected with time-series data. All variables enjoy a kurtosis value of greater than 3, which highlights a leptokurtic distribution. This suggests a sharper than normal distribution with values namely concentrated towards the mean, however there is a high probability for extreme values to prevail. The banking sector illustrates the highest kurtosis value of 14.2604, which suggests greatest volatility, as confirmed by the standard deviation value of 0.0186. This can be explained through excessive volatility periods the crisis caused as well as due to the regulatory changes firmly aimed directly at the banking sector. This corresponds with the volatility time series data we calculate, which further reiterates the notion the banking sector experiences the greatest volatility in comparison to the other sectors. The insurance sector follows with a kurtosis value of 12.4603, which suggests, this sector endures high levels of volatility also. However in terms of standard deviation (0.0154) it ranks third. Given our data analysis in the previous section, unfolding regulatory events is evidently impacting the insurance sector via Solvency II. Furthermore, the insurance sector fulfils the view of Skewness of stock price variables are all left skewed distributed, where most values are concentrated on the right of the mean, with the extreme values to the left. Vice versa is found with all dummy variables, which are right skewed distributed. Whereby, most values are concentrated on the left of the mean with the extreme values to the right. Finally, we can also note the banking sector exhibits the greatest range in the maximum and minimum figures.

Table 1: Descriptive Statistics

	Mean	Max	Min	St. D.	Skew.	Kurt.	J-B	ADF	PP
BANK	-0.0002	0.1882	-0.1698	0.0186	-0.0117	14.2604	20668	-61.714	-61.751
BANK ER	-0.0002	0.1165	-0.1153	0.0152	-0.1563	9.4978	6898	-30.233	-65.845
INSU	0.0000	0.1066	-0.1538	0.0154	-0.5128	12.4603	14760	-60.933	-60.917
INSU ER	0.0000	0.0735	-0.0726	0.0095	-0.1563	9.4978	6898	-30.234	-65.844
INVC	0.0001	0.0884	-0.0843	0.0112	-0.2858	8.7158	5379	-62.601	-62.603
INVC ER	0.0001	0.0730	-0.0719	0.0095	-0.1563	9.4978	6898	-30.234	-65.844
REAL	0.0001	0.0910	-0.1011	0.0142	-0.2002	9.1476	6186	-60.635	-60.607
REAL ER	0.0001	0.0689	-0.0677	0.0089	-0.1563	9.4978	6898	-30.234	-65.844
FIN	0.0001	0.1212	-0.1441	0.0168	-0.3521	9.7799	7573	-60.659	-60.641
FIN ER	0.0001	0.1028	-0.1012	0.0133	-0.1563	9.4978	6898	-30.234	-65.844
BIS	0.0008	1	0	0.0277	36.0694	1302	2.76E+08	-62.570	-62.570
EU	0.0020	1	0	0.0452	22.0455	487	3.85E+07	-65.650	-62.651
FCA	0.0005	1	0	0.0226	44.1928	1954	6.22E+08	-62.554	-62.554
FSA	0.0026	1	0	0.0505	19.7029	389	2.46E+07	-62.682	-62.684
GOV	0.0020	1	0	0.0452	22.0455	487	3.85E+07	-62.650	-62.651
PRA	0.0013	1	0	0.0357	27.9178	780	9.90E+07	-62.602	-62.602
IC	0.0005	1	0	0.0226	44.1928	1954	6.22E+08	-62.554	-62.554

6.4.3 Empirical Methodology

The first approach we undertake follows Mackinlay's (1997) event study methodology approach. Firstly, we estimate the abnormal returns (ARs) through the market model with an estimation period of 100 days prior to the first event window, which will be 20 days prior to the announcement. We use events windows of -/+ 20 days, -/+ 10 days, -/+ 5 days and on the day, this is to examine whether investors knew in advance and priced in the information accordingly prior to the regulation change. This is implemented as follows:

Market model is estimated as:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it} \quad (6.1)$$

Where; β_i = COV(R_i, R_M)/VAR(R_M) and E(ε_{it}) = 0

Once the market model is computed for respective institution, the ARs are then obtained through the differences within actual stock return and the predicted by the market model, which is as follows:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{Mt}) \quad (6.2)$$

The ARs are then cumulated (CARs) over specified time periods concerning the event windows utilised, with the CARs computed as follows:

$$CAR_i(t_1, t_2) = \sum_{t=t1}^{t2} AR_{it} \tag{6.3}$$

Where t_1 and t_2 are the start and end date of considered window periods. The CARs for each event are then aggregated on a cross-section basis for a portfolio of N observations as well accommodate for type of event, with the Cumulative Average Abnormal Returns (CAARs) calculated as follows:

$$CAAR(t_1, t_2) = \frac{1}{N} \sum_{i=1}^{N} CAR\ (t_1, t_2) \tag{6.4}$$

We employ non-parametric hypothesis tests from Boehmer, Musumeci and Poulsen (1991) and Cowan (1992) due to their robustness. As the issues in parametric tests, witness too frequently a rejection in the null hypothesis as increased variance in the stock returns close to the event days may cause unreliable and/or distorted results according to Boehmer, Musumeci and Poulsen (1991) which is also demonstrated in Campbell and Wasley (1993), which provide evidence that nonparametric rank tests provide more reliable inferences in comparison to parametric tests.

We apply the standardised cross-sectional test by Boehmer, Musumeci and Poulsen (1991), which is an extension of Patell (1976) and is a robust approach to event induced variance increase in stock returns. The test statistic produced from the standardised cross-sectional test is examined against a null hypothesis where the cumulative abnormal returns are set to zero. The calculation to gain the test statistic is as follows:

First the abnormal returns are standardised through the estimated standard deviation by;

$$SAR_{i,\tau} = \frac{AR_{i,\tau}}{S(AR_i)} \tag{6.5}$$

Where: $SAR_{i,\tau}$ represents the estimated standard deviation, $AR_{i,\tau}$ the abnormal returns of security i during time τ and $S(AR_i)$ represents the standard error of day i.

We then need to estimate the standard deviation of the time series of abnormal returns throughout the event window period to produce an unbiased estimate of the standard deviation, which is as follows:

$$\hat{\sigma}AR_i{}^2 = \frac{\sum AR_{i,\tau}}{T-d} \quad (6.6)$$

Where: T Represents the number of days outside of estimation period, d represents the degrees of freedom and in our case since the market model is utilised d = 2.

In order to address the event window abnormal returns is an out of sample prediction, the standard error is corrected by the forecast error as follows:

$$S(AR_i) = \hat{\sigma}AR_i \sqrt{1 + \frac{1}{T} + \frac{(R_{m,\tau} - \overline{R_{M,Est}})^2}{\sum_{Est\ min}^{Est\ max}(R_{m,\tau} - \overline{R_{M,Est}})^2}} \quad (6.7)$$

Where: $R_{m,\tau}$ represents the return on the market and $\overline{R_{M,Est}}$ is the average of the market return during the estimation period.

The standardised abnormal returns are then cumulated over time which is as follows:

$$CSAR_i(\tau_1, \tau_2) = \sum \frac{AR_{i,\tau}}{S(AR_i)} \quad (6.8)$$

Where: $CSAR_i(\tau_1, \tau_2)$ Symbolizes the cumulated standardised abnormal returns throughout time period.

The average of the cumulated standardised abnormal returns is then computed in relation towards number of events:

$$\overline{CSAR}_{(\tau_1,\tau_2)} = \frac{1}{N}\sum CSAR_i(\tau_1, \tau_2) \quad (6.9)$$

Where: $\overline{CSAR}_{(\tau_1,\tau_2)}$ is the average of the cumulated standardised abnormal returns throughout time period with *N* signified as the number of events.

The standard deviation of the averaged cumulated standardised abnormal returns is then estimated of the event window:

$$S(\overline{CSAR}) = \sqrt{\frac{1}{N(N-1)}\sum(CSAR_i(\tau_1, \tau_2) - \overline{CSAR}_{(\tau_1,\tau_2)})^2} \quad (6.10)$$

Where: $S(\overline{CSAR})$ Represents the standard deviation of the averaged cumulated abnormal returns.

The test statistic of the standardised cross-sectional is calculated as follows:

$$T_B = \frac{\overline{CSAR}_{(\tau_1,\tau_2)}}{S(\overline{CSAR})} \quad (6.11)$$

Where: T_B Signifies the Test statistic of Boehmer et al (1991).

Further to the standardised cross-sectional test we also employ the nonparametric test of Cowan (1992) generalized sign test. This is based on the ratio of cumulative abnormal returns across the event period window, with the proportion of positive abnormal returns are the null hypothesis of 0.5. The generalized sign test statistic is calculated as follows:

$$T_{GS} = \frac{p_0^+ - p_{Est}^+}{\sqrt{p_{Est}^+(1-p_{Est}^+)/N}} \quad (6.12)$$

Where: T_{GS} Signifies the test statistic of the generalised sign test, p_0^+ illustrates the ratio of positive CARs over the event window, p_{Est}^+ is the estimated positive CARs over the event window period and N denotes the number of events considered.

We delve further into analysing the UK financial spectrum through applying generalised auto-regressive conditional heteroskedastic (GARCH) models proposed by Bollerslev (1986). In order to fully address the issue of heteroskedastic volatility, this originated from the ARCH modelling technique proposed by Engle (1982). Firstly, we assess whether the financial institutions logged index returns hold ARCH effects, once this is proven, we utilise the EGARCH model proposed by Nelson (1991). This model accounts for positive and negative shocks of equal size to have different impacts on volatility (the leverage effect), also EGARCH places no restrictions upon the parameters. This is an important differential in comparison to the traditional GARCH model, as clarity results are produced. The model is implemented as follows:

Mean:

$$lnR_{it} = \alpha_0 + \beta R_{mit}[\varepsilon_{t-1}] + \epsilon \quad (6.13)$$

Variance:

$$\ln h_t = \alpha_0 + \alpha_1(\epsilon_{t-1}/h_{t-1}^{0.5}) + \alpha_2(\lambda_1|\frac{\epsilon_{t-1}}{h_{t-1}^{0.5}}) + \beta_1 \ln h_{t-1} + D_{GOV[\varepsilon_{t-1}]} + D_{FSA[\varepsilon_{t-1}]} +$$

$$D_{FCA[\varepsilon_{t-1}]} + D_{EU[\varepsilon_{t-1}]} + D_{PRA[\varepsilon_{t-1}]} + D_{IC[\varepsilon_{t-1}]} + D_{BIS[\varepsilon_{t-1}]} + \epsilon \quad (6.14)$$

Following Bollerslev's (1987) Log-likelihood function, we apply as follows:

$$\ln L = -\frac{T}{2}\ln(2\pi) - 0.5\sum_{t=1}^{T}\ln h_t - 0.5\sum_{t=1}^{T}\epsilon_t^2/h_t^2 \quad (6.15)$$

Where: $\ln R_{it}$ represents the logged daily index returns of sector *i* on day *t*, βR_{mit} denotes the market model for sector *i* on day *t*. α_n Represents coefficient parameter**.** The leverage effect is accounted within the EGARCH model. If $\frac{\epsilon_{t-1}}{h_{t-1}^{0.5}}$, is positive, the effect of the shock on the log conditional variance is $\alpha_1 + \lambda_1$. If $\epsilon_{t-1}/h_{t-1}^{0.5}$ is negative, the effect of the shock on the log conditional variance is$-\alpha_1 + \lambda_1$. The following dummy variables take the value of 1 to represent regulation announcement, otherwise remain 0. $D_{GOV[\varepsilon_{t-1}]}$ captures the effects of government (GOV) regulation, $D_{FSA[\varepsilon_{t-1}]}$ the Financial Services Authority (FSA) regulation, $D_{FCA[\varepsilon_{t-1}]}$ highlights the Financial Conduct Authority (FCA) regulation announcements, $D_{EU[\varepsilon_{t-1}]}$ from the European Union (EU), $D_{PRA[\varepsilon_{t-1}]}$ from the Prudential Regulation Authority (PRA), $D_{IC[\varepsilon_{t-1}]}$ captures the Independent Commission (IC), $D_{BIS[\varepsilon_{t-1}]}$ gathers the effects of the Bank for International Settlements (BIS) and ϵ is the error term.

In order to determine whether investors were able to predict in-coming regulation changes beforehand we apply a multivariate vector autoregressive (VAR) GJR-GARCH, which has been utilised in more recent studies such as Rahim et, al (2009). The multivariate VAR GJR-GARCH model is a combination of the VAR methodology popularized by Sims (1980) and the GJR-GARCH was introduced by Glosten et, al (1993), which is an extension of Bollerslev (1986). This methodology will highlight whether there was evidence of transmission of information in the trading days leading up to regulation changes implemented. We follow Binder (1985) in the sense of using dummy variables with a value of 1, 10 days prior to the announcement up until the day of announcement, otherwise 0 is allocated. If we find significance within the lags of the dummy variables, essentially this informs us the market priced in the announcement on day n in the lead up to the regulation change and highlights a transmission of information within the financial markets. We apply the multivariate VAR GJR-GARCH model through a diagonal vech process, which enables us to account for heteroskedasticity as well as autocorrelation. The model utilised in this study utilises equation 15 in the previous model and is demonstrated as follows:

$$R_{i,t} = \beta_{i,0} + \beta_{i,1}R_{i,t-1} + \beta_{i,2}R_{i,t-2} + \cdots + \beta_{i,10}R_{i,t-10} + \beta_{i,11}\beta R_{m,t-1} + \beta_{i,12}\beta R_{m,t-2} + \cdots + \beta_{i,20}\beta R_{m,t-10} + \beta_{i,21}DUM_{i,t-1}^{BIS} + \beta_{i,22}DUM_{i,t-2}^{BIS} + \cdots + \beta_{i,30}DUM_{i,t-10}^{BIS} + \beta_{i,31}DUM_{i,t-1}^{EU} + \beta_{i,32}DUM_{i,t-2}^{EU} + \cdots + \beta_{i,40}DUM_{i,t-10}^{EU} + \beta_{i,41}DUM_{i,t-1}^{FCA} + \beta_{i,42}DUM_{i,t-2}^{FCA} + \cdots + \beta_{i,50}DUM_{i,t-10}^{FCA} + \beta_{i,51}DUM_{i,t-1}^{FSA} + \beta_{i,52}DUM_{i,t-2}^{FSA} + \cdots + \beta_{i,60}DUM_{i,t-10}^{FSA} + \beta_{i,61}DUM_{i,t-1}^{GOV} + \beta_{i,62}DUM_{i,t-2}^{GOV} + \cdots + \beta_{i,70}DUM_{i,t-10}^{GOV} + \beta_{i,71}DUM_{i,t-1}^{IC} + \beta_{i,72}DUM_{i,t-2}^{IC} + \cdots + \beta_{i,80}DUM_{i,t-10}^{IC} + \beta_{i,81}DUM_{i,t-1}^{PRA} + \beta_{i,82}DUM_{i,t-2}^{PRA} + \cdots + \beta_{i,90}DUM_{i,t-10}^{PRA} + \varepsilon \quad (6.16)$$

$$Vech(h_t) = \alpha_1 + \alpha_2\varepsilon_{t-1}\varepsilon_{t-1} + \alpha_3\varepsilon_{t-1}\lambda_{1,t-1} + \alpha_4\tau_{t-1} \quad (6.17)$$

Equation (16) illustrates the VAR where: $R_{i,t}$ represents the daily returns on index *i* at time *t*, $\beta_{i,0}$ is the coefficient parameter, $R_{i,t-n}$ is the lagged returns of index *i* at lag *–n*. $\beta R_{m,t-n}$ illustrates the lagged market model expected returns. $DUM_{i,t-n}^{BIS}$ is a dummy variable to capture the announcement from the Bank for International Settlements Committee, $DUM_{i,t-n}^{EU}$ is a dummy variable to capture EU regulatory changes, $DUM_{i,t-n}^{FCA}$ captures the regulatory announcements from the Financial Conduct Authority, $DUM_{i,t-n}^{FSA}$ is for the Financial Services Authority, $DUM_{i,t-n}^{GOV}$ is from the Government, $DUM_{i,t-n}^{IC}$ captures the Independent Committee, $DUM_{i,t-n}^{PRA}$ highlights the Prudential Regulation Authority changes and ε is an error term. In equation 17, the $Vech(h_t)$ can be described as the conditional covariance variance equation for the index at time *t*, α_1 is a constant parameter, α_n is a coefficient, $\varepsilon_{t-1}\varepsilon_{t-1}$ captures the product of lagged errors. $\varepsilon_{t-1}\lambda_{1,t-1}$ confirms whether imminent regulation changes incur asymmetric spill-over effects or not, and τ_{t-1} capture the GARCH effects.

We perform the model again however, convert the dependent variable of returns on the index to the volatility of the index sector, which is as follows in equation 18.

$$\sigma_{i,t} = \beta_{i,0} + \beta_{i,1}R_{i,t-1} + \beta_{i,2}R_{i,t-2} + \cdots + \beta_{i,10}R_{i,t-10} + \beta_{i,11}\beta R_{m,t-1} + \beta_{i,12}\beta R_{m,t-2} + \cdots + \beta_{i,20}\beta R_{m,t-10} + \beta_{i,21}DUM_{i,t-1}^{BIS} + \beta_{i,22}DUM_{i,t-2}^{BIS} + \cdots + \beta_{i,30}DUM_{i,t-10}^{BIS} + \beta_{i,31}DUM_{i,t-1}^{EU} + \beta_{i,32}DUM_{i,t-2}^{EU} + \cdots + \beta_{i,40}DUM_{i,t-10}^{EU} + \beta_{i,41}DUM_{i,t-1}^{FCA} + \beta_{i,42}DUM_{i,t-2}^{FCA} + \cdots + \beta_{i,50}DUM_{i,t-10}^{FCA} + \beta_{i,51}DUM_{i,t-1}^{FSA} + \beta_{i,52}DUM_{i,t-2}^{FSA} + \cdots + \beta_{i,60}DUM_{i,t-10}^{FSA} + \beta_{i,61}DUM_{i,t-1}^{GOV} + \beta_{i,62}DUM_{i,t-2}^{GOV} + \cdots + \beta_{i,70}DUM_{i,t-10}^{GOV} + \beta_{i,71}DUM_{i,t-1}^{IC} + \beta_{i,72}DUM_{i,t-2}^{IC} + \cdots + \beta_{i,80}DUM_{i,t-10}^{IC} + \beta_{i,81}DUM_{i,t-1}^{PRA} + \beta_{i,82}DUM_{i,t-2}^{PRA} + \cdots + \beta_{i,90}DUM_{i,t-10}^{PRA} + \varepsilon \quad (6.18)$$

Where; $\sigma_{i,t}$ denotes the standard deviation of the index sector *i* at time *t*, which captures the volatility and all other variables are kept the same in equation 16 and 17.

6.5. Analysis

6.5.1 Event Study Methodology

We begin to decipher the results by referring to Table 3, which highlight the event study methodology. In relation towards the banking sector in the UK, Table 3 signifies namely negative responses from the various regulatory bodies examined. The CAAR found within the FSA regulatory announcements is firstly negative and a statistically significant result via the Boehmer test statistic and sign test. We note the statistical significance is found on the day of the announcement and the banking sector index reportedly declined, which suggests overall the market did not welcome intervention from the FSA and therefore deterred investors from the banking sector. With the regulatory impact on the day suggests also there is a further safety buffer, which may hinder future profits, therefore is reflected with a decline in index value. Moreover, announcements from the FSA also negatively impacted the finance company sector with statistical significance achieved in all other financial sectors.

The market responses from FCA regulation were mainly negative as Table 3 advocates. Statistical significance is found within the finance companies and investment trust sectors, which experienced negative and positive associations respectively via the t-test. The response towards reform of the FSA into the FCA was found to be a positive change in regards to the finance company sector by the market given their operations. The change in governing body conformed to public opinion at a timely manner, which would bring further clarity to the market in particular for finance companies and as a result the market welcomed this reform. On the other hand with respect to the investment trust sector, Table 3 reports a heavy negative reaction from the market. The market was able to distinguish interestingly between sector and their market operation, which for investment trusts is investing within financial markets, primarily in equities. This suggests the market foresaw induced future volatility as reforms are likely to hit the equity market and overall profitability for investment trusts.

EU announcements are found to have mixed reactions from different sectors as Table 3 highlights statistical significance with the insurance and real estate sectors found to yield negative reactions, whereas the investment trusts sector is a positive one. The EU announcements towards the insurance and real estate sectors signalled to the market reduced risk and overall volatility, which investors sought that would affect their overall profitability and therefore led to a declined risk premia. Conversely, with investment trusts we find a positive reaction by the market, which led to an increased demand for their equity index and

therefore pushed an appreciation in the asset value. The market reacted within this manner as a result of improved regulation by the EU towards this sector as well as improved market conditions, which are favourable for investors i.e. MiFiD. Therefore the performance of investment trusts is directly impacted by such regulation as equity appreciation is likely to improve.

When interpreting the results concerning government announcements, referring to Table 3, we see a mixture of statistically significant reactions. Positive responses are exemplified within the investment trusts, real estate and finance company sectors. Whereas, negative reactions are found within the banking and finance company sector. The market perceived there to be a negative reaction from the banking sector index as the announcements primarily attack their increase in levy taxes as well as banking reforms acts. From which can be interpreted by the market to impact their overall profitability as future forecasted returns are to be decreasing as their tax bill rises, which declines demand for investors to hold banking stocks. In terms of the investment trust and real estate sectors, there is an evident appreciation in the value of their indices, which may be attributed to the reforms targeted to improve regulation. This then signals to the market further clarity to these sectors, which encourages investment and increases demand for purchasing equity within the sectors concerned and therefore creates an upward pressure on asset value.

With respect to the Prudential Regulation Authority, all sectors enjoy a dominant positive reaction towards their regulation announcements as Table 3 highlights. The announcement all sectors share with the PRA is regarding their creation and to be regulated by the Bank of England. This regulation impact caused the market to welcome the new development, which brought the expectation of further clarity and as a result demand to purchasing equities within the UK. Furthermore, statistical significance is achieved within all sectors via the Boehmer test statistic and sign test. In regards to the banking and insurance sectors we closely review their results, as they are monitored more closely due to their significant impact on the economy. The PRA announcements towards the banking sector are namely aimed towards the credit requirement directive, which aims to reduce failure within the banking sector through requiring institutions' to be able to cover their risk exposure. Overall, the response from the banking sector is a positive one, which enhances the notion that the market welcomed the news as the increased stability towards the banking sector enables the overall economy to function securely, which increases future growth prospects as a result. Regarding the insurance sector, the PRA announcements are concentrated towards Solvency

II, which aims to harmonise insurance regulation as well as alleviate concerns of risk through implementing higher minimum capital levels. The overall positive response towards these announcements suggests the market welcomed the regulations, which generated greater demand and confidence within the insurance sector and therefore caused an upward pressure on the index values of the insurance sector.

Results surrounding the Independent Committee from Table 3 report all sectors produce a statistically significant negative reaction from the Vickers Report. The ring-fencing reforms against the banking sector in particular reduces their risk exposure by separating the investment management side from the traditional banking services they provide, which essentially reduces their size and overall performance. Overall, the Independent Committee were successful in their attempts to reduce volatility, which is reflected in the equity prices of the index as the market learned their future fate. In turn, the result accepts the hypothesis set and confirms the results of Schäfer et, al. (2013). Moreover, with regards to announcements from the BIS we gather negative statistical significance towards the banking sector. This highlights the markets' negative reception of this information due to issues shareholders hold with the operation within banking, whereby the preference is to as little capital as possible for shareholders – in theory.

Table 3: Event Study Methodology Results

Banks	**Window**	**CAAR**	**Pos:Neg**	**t-test**	**Prob.**	**Boehmer et,al**	**Prob.**	**Sign test**	**Prob.**
FSA	(-20...20)	-0.1898	03:07	-0.097	0.9227	-0.5119	0.6087	-0.0258	0.9794
	(-10...10)	-0.0939	05:05	-0.0671	0.9465	-0.6256	0.5315	1.3495	0.1772
	(-5...5)	-0.3681	02:08	-0.3635	0.7163	-0.3191	0.7497	-0.7134	0.4756
	(0...0)	-0.3185	00:10	-1.0429	0.297	**-1.8508**	**0.0642**	**-2.0887**	**0.0367**
FCA	(-20...20)	-0.2343	01:01	NA	NA	NA	NA	NA	NA
	(-10...10)	2.438	02:00	NA	NA	NA	NA	NA	NA
	(-5...5)	0.5511	02:00	NA	NA	NA	NA	NA	NA
	(0...0)	0.9223	02:00	NA	NA	NA	NA	NA	NA
EU	(-20...20)	2.424	06:02	1.3915	0.1641	1.4381	0.1504	0.9076	0.3641
	(-10...10)	0.9654	06:02	0.7743	0.4387	1.0267	0.3046	0.9076	0.3641
	(-5...5)	0.2547	05:03	0.2822	0.7778	0.8688	0.385	0.1882	0.8507
	(0...0)	-0.0136	04:04	-0.0499	0.9602	0.0257	0.9795	-0.5313	0.5952
PRA	(-20...20)	0.0043	02:03	0.212	0.8321	0.2197	0.8261	-0.5093	0.6105
	(-10...10)	0.018	04:01	1.2388	0.2154	1.6391	0.1012	1.2802	0.2005
	(-5...5)	0.0147	03:02	1.3964	0.1626	**1.6586**	**0.0972**	0.3854	0.6999
	(0...0)	0.0039	03:02	1.2326	0.2177	1.6339	0.1023	0.3854	0.6999
BIS	(-20...20)	0.6232	02:01	0.2038	0.8385	0.3562	0.7217	-0.9177	0.3588
	(-10...10)	-0.1532	01:02	-0.07	0.9442	-0.1018	0.919	**-2.5521**	**0.0107**
	(-5...5)	0.0229	01:02	0.0145	0.9884	-0.0173	0.9862	**-2.5521**	**0.0107**
	(0...0)	-0.2274	02:01	-0.4762	0.6339	-0.8002	0.4236	-0.9177	0.3588
GOV	(-20...20)	-1.5998	02:06	-0.9416	0.3464	-0.868	0.3854	**-1.9291**	**0.0537**
	(-10...10)	-0.3801	03:05	-0.3126	0.7546	-0.2605	0.7945	-1.2113	0.2258
	(-5...5)	-1.534	02:06	**-1.7431**	**0.0813**	-1.4702	0.1415	**-1.9291**	**0.0537**
	(0...0)	-0.3997	04:04	-1.5065	0.1319	-0.7059	0.4802	-0.4935	0.6217
IC	(-20...20)	-0.011	00:02	-0.2591	0.7956	**-4.1462**	**0**	-1.4683	0.142
	(-10...10)	0.031	02:00	1.0192	0.3081	1.4385	0.1503	1.3621	0.1732
	(-5...5)	-0.0013	01:01	-0.0581	0.9537	-0.4063	0.6845	-0.0531	0.9577
	(0...0)	0.0058	02:00	0.8724	0.383	**47.6871**	**0**	1.3621	0.1732
Insurance	**Window**	**CAAR**	**Pos:Neg**	**t-test**	**Prob.**	**Boehmer et,al**	**Prob.**	**Sign test**	**Prob.**
FSA	(-20...20)	-0.0409	03:07	**-1.8727**	**0.0611**	-0.7927	0.4279	-1.2746	0.2024
	(-10...10)	-0.0092	05:05	-0.5878	0.5567	0.1456	0.8842	-0.0097	0.9922
	(-5...5)	-0.0258	04:06	**-2.283**	**0.0224**	-0.8597	0.39	-0.6422	0.5208
	(0...0)	-0.0009	04:06	-0.2535	0.7999	-0.1951	0.8453	-0.6422	0.5208
FCA	(-20...20)	-0.0123	00:01	-0.3234	0.7464	NaN	NaN	-1.0313	0.3024
	(-10...10)	-0.0146	00:01	-0.5362	0.5919	NaN	NaN	-1.0313	0.3024
	(-5...5)	0.0082	01:00	0.414	0.6789	NaN	NaN	0.9697	0.3322
	(0...0)	-0.0023	00:01	-0.3914	0.6955	NaN	NaN	-1.0313	0.3024
EU	(-20...20)	-0.4866	03:03	-0.1945	0.8458	-0.2713	0.7861	-1.2124	0.2254
	(-10...10)	0.3899	04:02	0.2178	0.8276	0.4726	0.6365	-0.3013	0.7632
	(-5...5)	0.3429	04:02	0.2646	0.7913	0.6289	0.5294	-0.3013	0.7632
	(0...0)	-0.6467	03:03	**-1.6552**	**0.0979**	-1.0644	0.2872	-1.2124	0.2254
PRA	(-20...20)	0.9659	05:02	0.4463	0.6554	0.7331	0.4635	0.377	0.7062
	(-10...10)	0.5068	04:03	0.3272	0.7435	0.6459	0.5183	-0.4135	0.6793
	(-5...5)	1.2957	04:03	1.2332	0.2175	**2.1119**	**0.0347**	-0.223	0.8235
	(0...0)	0.0517	05:02	0.1528	0.8785	**2.4217**	**0.0154**	0.377	0.7062
IC	(-20...20)	0.0106	01:01	0.3523	0.7246	0.2865	0.7745	0	1
	(-10...10)	0.0432	02:00	**1.9967**	**0.0459**	**2.7337**	**0.0063**	1.4142	0.1573
	(-5...5)	0.0154	01:01	0.9853	0.3245	0.7196	0.4718	0	1
	(0...0)	-0.0046	00:02	-0.9739	0.3301	**-1.8467**	**0.0648**	-1.4142	0.1573
GOV	(-20...20)	3.0156	02:01	0.8345	0.404	0.9	0.3681	0.0455	0.9637
	(-10...10)	2.0432	02:01	0.7901	0.4295	0.9602	0.337	0.0455	0.9637
	(-5…5)	1.5271	02:01	0.8159	0.4146	1.2931	0.196	1.2594	0.2079
	(0...0)	0.0498	02:01	0.0883	0.9296	0.9666	0.3338	0.0455	0.9637

Table 3 Continued.

Investment Trusts									
	Window	**CAAR**	**Pos:Neg**	**t-test**	**Prob.**	**Boehmer et,al**	**Prob.**	**Sign test**	**Prob.**
FSA	(-20...20)	-1.2668	06:08	-0.9868	0.3238	-1.175	0.24	-1.3183	0.1874
	(-10...10)	-0.7014	07:07	-0.7634	0.4452	-0.9663	0.3339	-0.7725	0.4398
	(-5...5)	-0.8721	04:10	-1.3115	0.1897	-1.595	0.1107	**-2.4099**	**0.016**
	(0...0)	0.396	10:04	**1.9753**	**0.0482**	1.468	0.1421	0.8649	0.3871
FCA	(-20...20)	-8.6935	00:01	-1.2402	0.2149	NaN	NaN	-0.3993	0.6897
	(-10...10)	-6.1818	00:01	-1.2322	0.2179	NaN	NaN	-0.3993	0.6897
	(-5...5)	-7.6332	00:01	**-2.1023**	**0.0355**	NaN	NaN	-0.3993	0.6897
	(0...0)	-0.1735	00:01	-0.1585	0.8741	NaN	NaN	-0.3993	0.6897
EU	(-20...20)	0.0065	04:03	0.4473	0.6547	-0.0867	0.9309	0.3547	0.7228
	(-10...10)	-0.0008	02:05	-0.0795	0.9366	-0.4781	0.6326	-1.1572	0.2472
	(-5...5)	0.0072	06:01	0.9647	0.3347	1.2877	0.1979	**1.8666**	**0.062**
	(0...0)	0.0011	04:03	0.4792	0.6318	1.2778	0.2013	0.3547	0.7228
PRA	(-20...20)	4.0518	01:00	0.9779	0.3281	NaN	NaN	**2.6458**	**0.0082**
	(-10...10)	1.9462	01:00	0.6563	0.5116	NaN	NaN	**2.6458**	**0.0082**
	(-5...5)	2.1044	01:00	0.9806	0.3268	NaN	NaN	**2.6458**	**0.0082**
	(0...0)	-0.0276	00:01	-0.0427	0.9659	NaN	NaN	-0.378	0.7055
GOV	(-20...20)	-0.6492	01:02	-0.2313	0.8171	-0.4586	0.6465	-0.1345	0.893
	(-10...10)	1.3652	01:02	0.6796	0.4967	0.2603	0.7947	-0.1345	0.893
	(-5...5)	1.1763	03:00	0.8091	0.4185	**5.2907**	**0**	**2.2561**	**0.0241**
	(0...0)	0.0949	02:01	0.2165	0.8286	1.5424	0.123	1.0608	0.2888
IC	(-20...20)	-0.0456	00:02	**-2.69**	**0.0071**	**-6.0266**	**0**	-1.3452	0.1786
	(-10...10)	-0.012	01:01	-0.9864	0.3239	-0.6771	0.4983	0.0708	0.9436
	(-5...5)	-0.0052	00:02	-0.5958	0.5513	-1.0898	0.2758	-1.3452	0.1786
	(0...0)	-0.0022	01:01	-0.815	0.4151	-0.6797	0.4967	0.0708	0.9436
Real Estates									
FSA	(-20...20)	-0.2972	07:06	-0.2209	0.8252	-0.5427	0.5874	-0.5565	0.5779
	(-10...10)	0.0498	07:06	0.0517	0.9587	0.1142	0.9091	-0.5565	0.5779
	(-5...5)	-0.2703	05:08	-0.3879	0.6981	-0.062	0.9506	**-1.6957**	**0.09**
	(0...0)	-0.3062	07:06	-1.4572	0.1451	-0.9906	0.3219	-0.5565	0.5779
FCA	(-20...20)	-4.6245	00:01	-0.8686	0.385	NaN	NaN	-0.4389	0.6607
	(-10...10)	-2.895	00:01	-0.7598	0.4474	NaN	NaN	-0.4389	0.6607
	(-5...5)	-1.5183	00:01	-0.5506	0.5819	NaN	NaN	-0.4389	0.6607
	(0...0)	-0.0204	00:01	-0.0246	0.9804	NaN	NaN	-0.4389	0.6607
EU	(-20...20)	0.6832	03:02	0.2972	0.7663	0.3957	0.6923	0.1105	0.912
	(-10...10)	-1.4522	02:03	-0.8827	0.3774	-1.3654	0.1721	-0.7943	0.427
	(-5...5)	-0.7106	02:03	-0.5968	0.5506	-0.5303	0.5959	-0.7943	0.427
	(0...0)	-0.7517	02:03	**-2.0939**	**0.0363**	-1.0137	0.3107	-0.7943	0.427
PRA	(-20...20)	-0.2189	00:01	-0.0468	0.9627	NaN	NaN	-0.3879	0.6981
	(-10...10)	1.4234	01:00	0.4254	0.6706	NaN	NaN	**2.5782**	**0.0099**
	(-5...5)	2.0894	01:00	0.8627	0.3883	NaN	NaN	**2.5782**	**0.0099**
	(0...0)	-0.0104	00:01	-0.0143	0.9886	NaN	NaN	-0.3879	0.6981
GOV	(-20...20)	4.4208	05:00	**2.1017**	**0.0356**	**2.2117**	**0.027**	1.012	0.3115
	(-10...10)	2.1176	04:01	1.4067	0.1595	**1.8576**	**0.0632**	-0.1786	0.8583
	(-5...5)	2.0345	05:00	**1.8674**	**0.0618**	**3.6452**	**0.0003**	1.012	0.3115
	(0...0)	0.1153	04:01	0.3511	0.7255	1.573	0.1157	-0.1786	0.8583
IC	(-20...20)	-0.0667	00:02	**-1.7037**	**0.0884**	-1.0161	0.3096	-1.45	0.1471
	(-10...10)	-0.0432	00:02	-1.5434	0.1227	-1.4475	0.1478	-1.45	0.1471
	(-5...5)	-0.0228	00:02	-1.1247	0.2607	-1.1505	0.2499	-1.45	0.1471
	(0...0)	-0.01	00:02	-1.6279	0.1036	**-2.1963**	**0.0281**	-1.45	0.1471

Table 3 Continued

Finance Companies	Window	CAAR	Pos:Neg	t-test	Prob.	Boehmer et,al	Prob.	Sign test	Prob.
FSA	(-20...20)	-0.0136	05:04	-0.5919	0.5539	-0.7963	0.4259	0.3641	0.7158
	(-10...10)	-0.0195	04:05	-1.1838	0.2365	-0.6584	0.5103	-0.3026	0.7622
	(-5...5)	-0.0039	04:05	-0.329	0.7422	-0.0269	0.9785	-0.3026	0.7622
	(0...0)	-0.0007	04:05	-0.1935	0.8465	-0.212	0.8321	-0.3026	0.7622
FCA	(-20...20)	0.0281	01:00	0.7595	0.4476	NaN	NaN	1.0473	0.295
	(-10...10)	0.0305	01:00	1.1524	0.2492	NaN	NaN	1.0473	0.295
	(-5...5)	0.0316	01:00	**1.6478**	**0.0994**	NaN	NaN	1.0473	0.295
	(0...0)	0.0052	01:00	0.895	0.3708	NaN	NaN	1.0473	0.295
EU	(-20...20)	0.0133	04:01	0.692	0.4889	0.4878	0.6257	1.4322	0.1521
	(-10...10)	-0.0002	04:01	-0.0118	0.9906	-0.1494	0.8812	1.4322	0.1521
	(-5...5)	0.0001	04:01	0.0103	0.9917	-0.1406	0.8882	1.4322	0.1521
	(0...0)	0.0005	02:03	0.1781	0.8586	0.337	0.7361	-0.3581	0.7203
PRA	(-20...20)	-0.7463	00:01	-0.1526	0.8787	NaN	NaN	-0.4264	0.6698
	(-10...10)	0.6064	01:00	0.1732	0.8625	NaN	NaN	**2.3452**	**0.019**
	(-5...5)	0.1086	01:00	0.0429	0.9658	NaN	NaN	**2.3452**	**0.019**
	(0...0)	0.7894	01:00	1.0334	0.3014	NaN	NaN	**2.3452**	**0.019**
GOV	(-20...20)	-0.0489	01:02	**-2.0145**	**0.044**	**-1.846**	**0.0649**	-0.4914	0.6232
	(-10...10)	-0.0347	00:03	**-1.9988**	**0.0456**	**-8.2326**	**0**	**-1.6475**	**0.0995**
	(-5...5)	-0.0072	01:02	-0.5733	0.5664	**-1.8691**	**0.0616**	-0.4914	0.6232
	(0...0)	0.0066	03:00	**1.7455**	**0.0809**	**4.1593**	**0**	**1.8209**	**0.0686**
IC	(-20...20)	-0.0427	00:02	-1.2042	0.2285	**-1.9534**	**0.0508**	-1.3966	0.1625
	(-10...10)	-0.0165	00:02	-0.6484	0.5167	**-1.7276**	**0.0841**	-1.3966	0.1625
	(-5...5)	-0.013	01:01	-0.7092	0.4782	-0.6924	0.4887	0.0177	0.9859
	(0...0)	-0.0011	01:01	-0.1922	0.8476	-0.5964	0.5509	0.0177	0.9859

Numbers in bold achieved statistical significance at either 1%, 5% or 10% level

6.5.2 EGARCH Methodology Analysis

The EGARCH methodology will enable us to comprehend the results further, due to the greater accuracy it possesses. We can see all sectors share a common element of the leverage effect, whereby there is an overall negative asymmetry effect. This implies all sectors index prices reacted negatively to regulatory news examined, which led to an increase in leverage of the indices due to the reduction in asset value. Consequently, this increases the debt-to-equity ratio which implies the volatility level increased within the sectors as priced by the market, Black (1976). Moreover, we find that all sectors remove ARCH effects, which we can interpret there to be no heteroskedasitcity within the model. Furthermore, we find that there are no signs of autocorrelation, which indicates the effectiveness of modelling time series data we utilised in the study.

Instantly with regards to the banking sector, the prevailing results highlight statistical significance against regulatory announcements from the FSA, FCA and the government. All three bodies indicate the market responded positively, which on the whole suggests the reforms

brought further demand to the banking stocks in particular. It also supports the notion the market wanted regulatory change and increased transparency, which would bring further stability and improved market conditions for investors. With regards to the announcements made from the FSA and FCA in our sample namely focussed on establishing clarity to investors through their acts to prevent insider trading as well as maintaining market integrity. Conversely, we find negative associations with announcements from the BIS, EU, PRA and IC. The announcements were aimed at imposing much stricter regulation such as higher capital levels, separating banking from investment banking, banker's remuneration and many more in order to prevent future crisis periods. The negative returns arise as a result of a declined level of risk to investors due to increased regulation. For example announcements from the BIS, EU and PRA with banks being more capitalised, although brings stability to the wider economy, it reduces the potential future returns for the shareholders of said banks. The perception from the shareholders may be excess capital held has its opportunity cost rather than being converted into assets such as loans. Announcement of the Vickers' report suggests the reforms were to break up the banks operation activities into investment banking and traditional banking otherwise known as ring-fencing regulation. The negative reaction is perceived by the market as a reduction in activities performed by the UK banks will lead to decline in performance and profitability, therefore is priced accordingly. The announcements from the EU (bankers bonus cap) induced a negative reaction from the markets could be due to the banking sector not being able to retain talented staff.

The results from the insurance firms demonstrate statistical significance against all announcements bar the Independent Committee. Announcements from the EU were received by the market in an adverse manner, from which were aimed at namely establishing market standards and implementing CRD towards the insurance sector. The market interpreted the established regulation to adversely affect future profits and therefore participants relinquished their holdings of insurance stocks. This is due to requirement of insurance firms to hold certain levels of capital, which similar to the banking sector may be perceived as an opportunity cost by shareholders. The increased regulation impacts their business operations from limiting the amount of insurance policies they can issue and is also deemed by the sector as less risky and therefore less return for the shareholders. The results concerning the FCA and FSA illustrate negative and positive reactions respectively, which mainly concentrated towards maintaining market integrity as well as stability. With regards to the creation of the FCA, the market implicated the insurance sector due to the instability period of a new regulator would

potentially alter operations for the sector as witnessed by the EU regulations. However, positive associations found within the FSA announcements are found similar to the banking sector. The clarity brought by the FSA to the markets signalled an increased demand for insurance stocks', which ultimately led to their asset value to appreciate. With regards to the government regulation announcements, there is a positive reaction by the market towards the insurance sector. The government introduced financial acts, which brought new standards and overall increased demand for holding stocks, therefore placing an upward pressure on price. The PRA is found to have impacted the insurance sector index price in a negative manner as the market interpreted the new regulations of Solvency II to effect the business operations of insurance firms. The reason for this is due to the insurance firms role in the financial crisis of 2008 as they took considerable risks by insuring the mortgages made by the banks in return for premiums earned. Ultimately, the build-up of exposure to the sub-prime market led to the insurance companies posting losses as a result. Therefore the new regulation imposed towards the insurance is aimed to bring stability as well as clarity to investors, in order to avert future issues with the financial sector. As AIG in the US illustrated how detrimental insurance firms can be to the economy with their bailout being the largest in history. The negative reaction is associated with reducing their risk insolvency level through holding certain levels of capital, which impacts the freedom to which they were able to operate previously. The Independent Committee's announcement did not have any statistical significance towards the insurance sector, which therefore means the market although reacted negatively, did not cause widespread concern towards the sector.

Table 4 reports the results of the investment trust and real estate sectors, from which we can see solely the government announcements held statistical significance. The government announcements that related towards to these sectors were general regulation changes which also reformed the taxation of investment trusts and real estate companies. Overall, the reaction that was witnessed by both sectors was as negatively interpreted by the markets. This is namely due to the nature of increased regulation in sectors that were generally not highly regulated as their responsibility towards the economy is not as high as banks or insurance firms. Therefore once the market learned about the tax regulation reforms against the investment trusts and realtors, this ultimately impaired their future profitability, which led to a sell-off in these stocks by the market.

We now turn our attention towards the finance companies, whereby we the regulatory announcements from EU, FSA and IC yield statistically significant results. Regulatory changes by the EU adversely impacted the stock prices of the finance company sector. We establish the reason for this may be due to MiFID II, which may have led to the market to believe this impacts their operations in funding as they primarily raise funds in the capital markets. Therefore this signalled to the market negative future returns is plausible, which led to a greater supply in the finance sector stocks and eventually placed a downward pressure on asset value. The regulatory announcements from the FSA and the IC indicate a positive response by the market. The underlying message this sent was that prices grew as increases in demand towards the finance company sector, which resulted in the stability sought by the FSA and IC.

Table 4: EGARCH Methodology Results

	Banks	**Insurance**	**Trusts**	**Finance**	**Real Estates**
Constant	-0.0001	0.0001	0.0000	0.0001	0.0003
	(-1.3125)	(1.2088)	(1.278)	(1.1355)	(2.6093)***
ER	0.7197	0.9724	0.9718	1.0014	0.8364
	(103.5366)***	(64.5811)***	(123.994)***	(96.101)***	(62.521)***
Intercept	-0.0839	-0.2224	-0.1703	-0.1145	-0.1395
	(-9.4435)***	(-13.0901)***	(-10.358)***	(-8.3935)***	(-10.332)***
$\epsilon_{t-1}/h_{t-1}^{0.5}$	0.0844	0.1504	0.1114	0.0881	0.1060
	(12.8444)***	(19.958)***	(13.149)***	(11.7666)***	(12.792)***
$\lambda_1\lvert\frac{\epsilon_{t-1}}{h_{t-1}^{0.5}}$	-0.0223	-0.0252	-0.0406	-0.0171	-0.0171
	(-5.2709)***	(-4.6732)***	(-6.451)***	(-3.3804)***	(-3.3604)***
GARCH	0.9980	0.9880	0.9920	0.9952	0.9935
	(1539.304)***	(624.2563)***	(721.182)***	(875.313)***	(844.93)***
BIS	-0.0631	-	-	-	-
	(-0.3472)	-	-	-	-
EU	-0.0069	-0.3879	-0.2102	-0.2747	0.1048
	(-0.0546)	(-1.9197)*	(-1.4668)	(-1.7922)*	(0.9873)
FCA	0.3616	-1.7093	-0.6049	0.4079	-0.5048
	(2.0241)**	(-2.5032)**	(-1.3522)	(1.1692)	(-0.9835)
FSA	0.2419	0.7371	0.1363	0.7173	0.0561
	(3.5474)***	(7.9502)***	(1.1875)	(7.7217)***	(0.7071)
GOV	0.3689	0.5413	-0.5644	-0.1711	-0.4149
	(3.6318)***	(3.1241)***	(-2.397)**	(-0.7026)	(-3.1018)***
IC	-0.1562	-0.4527	0.0595	0.4474	-0.4627
	(-0.5591)	(-1.4426)	(0.2096)	(3.4596)***	(-1.2379)
PRA	-0.0407	-0.3434	-0.5144	-0.4843	-0.4144
	(-0.2471)	(-2.3144)**	(-0.5724)	(-1.2427)	(-1.0746)
$\mathbf{R}^2$	0.611	0.385	0.718	0.629	0.384

Z-Statistic in parenthesis; *** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

6.5.3 VAR-GJR-GARCH Methodology Analysis

Within this methodological approach we begin to understand if the market was able to price in the information prior to its release. The model utilised has no ARCH effects and therefore controls for heteroskedasitcity as well as there being no presence of autocorrelation. Automatically from Table 5 we find statistically significant evidence from all sectors that the markets had prior knowledge of regulatory changes observed within our sample. We find that volatility spill-over effects are present within all sectors as well as against most announcement types. Overall, the results from Table 5 suggest we reject null hypothesis and accept the alternative. Seeing as there is evidence of volatility spill-over effects highlights inefficiencies within the market and therefore rejects the theoretical perspective that the stock prices reflect all knowledge. We can comment further upon the results in Table 5 as we find there is a positive leverage effect with statistical significance among the insurance, investment trust and finance company sectors. This overall suggests that news is positively received by the stock markets, which we elaborate further by mentioning the positive leverage effect is associated with the past return and future volatility return. This overall implies there will be an appreciation in the value of stock, which then corresponds to a declined debt-to-equity ratio. However, with the results concerning the finance company sector we find that announcements from the FSA, GOV and PRA we can elaborate further as there is no prior significant results. This suggests the market did not anticipate changes from these bodies towards the finance company sector. This analogy also applies towards the insurance sector in relation towards the IC, investment trust with regards towards the FSA and PRA as well as the realtor sector with the GOV, IC and PRA.

Table 5: VAR-GJR-GARCH Methodology Stock returns Results

Variable	Banks	Insurance	Trusts	Finance	Realtors
Returns -1	**0.0682*** **	0.0276	**-0.1063*** **	**0.0437* **	0.0056
Returns -2	**-0.0861*** **	0.0104	-0.0121	0.0302	0.0025
Returns -3	0.0358	-0.0085	0.0218	0.0214	0.0319
Returns -4	-0.0326	0.0142	-0.0222	-0.0218	**-0.0535*** **
Returns -5	-0.0204	-0.0082	0.0114	0.0228	-0.0099
Returns -6	**-0.0534** **	0.0089	0.0394	-0.0170	0.0074
Returns -7	**-0.0681** **	-0.0038	-0.0433	0.0186	**-0.073*** **
Returns -8	-0.0142	0.0241	0.0324	0.0087	-0.0278
Returns -9	**0.05** **	-0.0201	0.0037	**0.0564** **	**0.0393* **
Returns -10	-0.0072	0.0269	-0.0410	-0.0182	-0.0315
ER -1	**-0.0653*** **	-0.0281	**0.1627*** **	0.0179	**0.0691*** **
ER -2	**0.0496** **	-0.0435	0.0322	-0.0259	**0.0424* **
ER -3	**-0.0956*** **	**-0.0681** **	-0.0116	-0.0410	**-0.0756*** **
ER -4	**0.0688*** **	-0.0081	0.0564	0.0359	**0.1099*** **
ER -5	-0.0281	-0.0229	-0.0202	**-0.0515* **	-0.0083
ER -6	0.0125	-0.0132	-0.0409	-0.0041	**-0.0606** **
ER -7	**0.1017*** **	0.0241	0.0452	-0.0004	**0.0993*** **
ER -8	**0.0397* **	-0.0478	-0.0204	-0.0200	0.0391
ER -9	-0.0249	0.0185	-0.0013	-0.0432	**-0.0495** **
ER -10	-0.0185	-0.0260	0.0412	0.0045	0.0272
BIS -1	0.0019	-	-	-	-
BIS -2	0.0033	-	-	-	-
BIS -3	-0.0026	-	-	-	-
BIS -4	-0.0110	-	-	-	-
BIS -5	**0.0171** **	-	-	-	-
BIS -6	**-0.0129* **	-	-	-	-
BIS -7	0.0060	-	-	-	-
BIS -8	-0.0002	-	-	-	-
BIS -9	-0.0010	-	-	-	-
BIS -10	0.0023	-	-	-	-
EU -1	-0.0017	0.0007	0.0016	0.0006	-0.0013
EU -2	0.0012	0.0058	-0.0017	0.0029	0.0027
EU -3	0.0022	**-0.0096** **	0.0014	0.0015	0.0030
EU -4	**-0.0097*** **	0.0005	**-0.0052*** **	**-0.0127** **	**-0.0067** **
EU -5	0.0015	0.0036	0.0028	0.0046	-0.0041
EU -6	**0.007* **	0.0001	0.0018	0.0066	0.0076
EU -7	-0.0060	-0.0049	0.0023	-0.0027	0.0046
EU -8	0.0054	-0.0012	-0.0044	-0.0052	**-0.0077* **
EU -9	-0.0024	0.0052	-0.0020	-0.0020	-0.0022
EU -10	0.0020	0.0007	**0.0035** **	**0.0069** **	0.0049
FCA -1	-0.0037	-0.0040	0.0019	0.0089	0.0059
FCA -2	0.0071	0.0020	0.0003	-0.0081	-0.0021
FCA -3	-0.0047	0.0012	-0.0008	0.0026	-0.0018
FCA -4	0.0018	0.0101	0.0015	0.0001	0.0005
FCA -5	-0.0062	-0.0028	-0.0019	0.0033	-0.0065
FCA -6	0.0037	-0.0067	-0.0005	0.0001	0.0095
FCA -7	0.0022	0.0013	0.0018	-0.0026	0.0022
FCA -8	0.0093	-0.0107	-0.0035	0.0014	-0.0074
FCA -9	**-0.0232*** **	**0.0203*** **	-0.0036	-0.0120	-0.0058
FCA -10	**0.0149*** **	**-0.0103*** **	**0.0067*** **	**0.0114*** **	**0.0088*** **
FSA -1	0.0035	**0.0052** **	-0.0017	-0.0016	-0.0018
FSA -2	0.0016	-0.0043	0.0021	0.0015	0.0021
FSA -3	0.0032	-0.0023	-0.0007	0.0014	0.0010

Table 5 Continued

Variable	Banks	Insurance	Trusts	Finance	Realtors
FSA -4	**-0.0156*** **	0.0031	0.0008	0.0017	**-0.005** **
FSA -5	**0.0094*** **	0.0041	-0.0023	-0.0047	**0.0079*** **
FSA -6	-0.0029	**-0.0068** **	0.0031	0.0049	0.0000
FSA -7	0.0029	0.0027	-0.0030	-0.0056	-0.0054
FSA -8	0.0016	0.0002	0.0030	0.0074	**0.0048** **
FSA -9	0.0010	0.0052	-0.0009	-0.0014	0.0004
FSA -10	-0.0047	**-0.0052** **	0.0005	-0.0018	**-0.0036** **
GOV -1	-0.0028	-0.0014	-0.0038	0.0002	-0.0013
GOV -2	0.0042	-0.0006	0.0027	0.0059	0.0014
GOV -3	**-0.0107***	-0.0008	-0.0017	-0.0126	-0.0054
GOV -4	0.0092	0.0062	0.0022	0.0069	0.0043
GOV -5	**0.0124***	-0.0063	-0.0024	-0.0027	0.0000
GOV -6	**-0.0178*** **	0.0105	-0.0004	0.0102	-0.0002
GOV -7	0.0048	-0.0067	0.0080	-0.0040	0.0047
GOV -8	-0.0016	**0.0078** **	-0.0104	-0.0052	-0.0068
GOV -9	**-0.0102***	-0.0003	**0.011***	0.0042	0.0070
GOV -10	**0.0121*** **	**-0.0084*** **	-0.0079	0.0001	-0.0052
IC -1	0.0056	-0.0014	-0.0081	-0.0081	0.0008
IC -2	-0.0155	0.0003	0.0098	0.0052	-0.0122
IC -3	0.0207	0.0111	0.0032	0.0121	0.0127
IC -4	-0.0009	-0.0053	-0.0035	-0.0024	0.0049
IC -5	-0.0273	0.0042	-0.0071	-0.0101	-0.0197
IC -6	0.0233	-0.0076	0.0054	-0.0011	0.0119
IC -7	0.0284	0.0123	0.0136	0.0216	0.0264
IC -8	**-0.041** **	-0.0122	-0.0181	-0.0172	-0.0249
IC -9	0.0054	0.0007	0.0094	0.0071	-0.0078
IC -10	-0.0010	-0.0019	**-0.008957**	**-0.0124** **	0.0010
PRA -1	0.0002	0.0037	-0.0014	-0.0042	0.0015
PRA -2	-0.0002	**-0.0066***	0.0015	0.0073	0.0029
PRA -3	**0.0111***	-0.0014	0.0018	-0.0007	-0.0048
PRA -4	**-0.0098***	0.0014	0.0038	0.0048	0.0071
PRA -5	-0.0001	0.0004	-0.0037	-0.0049	-0.0026
PRA -6	0.0013	0.0023	-0.0040	-0.0011	-0.0071
PRA -7	0.0006	-0.0001	-0.0022	-0.0085	0.0047
PRA -8	-0.0035	0.0038	0.0067	0.0121	0.0052
PRA -9	0.0073	-0.0043	-0.0050	-0.0018	-0.0083
PRA -10	-0.0055	-0.0008	0.0014	-0.0029	0.0055
C	-0.0002	0.0003	0.0002	0.0002	0.0001
Intercept	**0.0001*** **	**0.0001*** **	**0.0001*** **	**0.0001*** **	**0.0001*** **
$\boldsymbol{\varepsilon_{t-1}\varepsilon_{t-1}}$	**0.0902*** **	**0.0349*** **	**0.0142***	**0.0157** **	**0.0773*** **
$\boldsymbol{\varepsilon_{t-1}\lambda_{1,t-1}}$	0.0001	**0.0745*** **	**0.1389*** **	**0.1205*** **	0.0001
GARCH	**0.9091*** **	**0.9178*** **	**0.8992*** **	**0.9067*** **	**0.9172*** **
$\mathbf{R^2}$	0.041	0.013	0.019	0.013	0.027

Coefficients in bold achieved statistical significance with *** indicating 1% level significance; ** indicating 5% level significance; * indicating 10% level significance

In Table 6 we report the volatility of regulation responses, which further confirm the results in the previous section from Table 5. We find in Table 6 there is prior announcement volatility within the markets present surrounding the financial sectors. Our results suggest there was a presence of prior volatility in respect of impending regulatory news as the statistical significance found within each of the sectors against respective bodies. We do however, have

conflicted results within the volatility of the sectors, which does suggest the market priced the information correctly at the time and raises arguments. The insurance sector shows evidence of prior volatility against all regulatory body announcements within the index. Furthermore, the results from the trusts, finance company and realtor sectors all confirm prior results against the PRA as well as the finance companies and trusts confirming the GOV and IC also. The additional results show no statistical significance found by the FCA as well as EU from the real estate sector, finance companies and investment trust sector respectively. This raises the arguments against the previous results, which does suggest the market accurately priced the information and did not anticipate regulatory changes. Another argument one could highlight is the announcement window lags utilised within the study may have not been large enough to capture the changes of when the markets priced the information. However, by lengthening the windows this simultaneously increases the chances of event clustering.

Table 6: VAR-GJR-GARCH Methodology Volatility Results

Variable	Banks	Insurance	Trusts	Finance	Realtors
Volatility -1	**0.3008*** **	**0.3317*** **	**0.3191*** **	**0.2951*** **	**0.3638*** **
Volatility -2	0.0168	-0.0149	0.0013	0.0195	**-0.0452** **
Volatility -3	**0.0365** **	**0.0542*** **	**0.0616*** **	**0.0431** **	**0.0961*** **
Volatility -4	**0.0892*** **	**0.0601*** **	**0.0602*** **	**0.0356** *	0.0269
Volatility -5	**0.0598*** **	**0.0531*** **	**0.0621*** **	**0.0821*** **	**0.0815*** **
Volatility -6	0.0098	0.0195	-0.0037	0.0169	**0.0795*** **
Volatility -7	**0.0745*** **	**0.0755*** **	**0.0581*** **	**0.0547*** **	**0.0318** *
Volatility -8	**0.0758*** **	**0.0358** **	**0.0293** *	0.0296	**0.0383** **
Volatility -9	0.0167	0.0087	**0.0502*** **	**0.0459*** **	**0.0522*** **
Volatility -10	**0.0917*** **	**0.0898*** **	**0.053*** **	**0.0568*** **	**0.0311** *
ER -1	**-0.7981*** **	**-0.553*** **	**-1.1759*** **	**-1.7552*** **	**-1.1765*** **
ER -2	**-0.6904*** **	**-0.6936*** **	**-0.9696*** **	**-1.2612*** **	**-0.9147*** **
ER -3	**-0.5842*** **	**-0.3421** *	**-1.0442*** **	**-0.9566*** **	**-1.1108*** **
ER -4	**-0.4962*** **	**-0.8739*** **	**-0.5871*** **	**-0.7352*** **	-0.2426
ER -5	**-0.4964*** **	**-0.4621*** **	**-0.2938** *	**-0.6621*** **	-0.2689
ER -6	**-0.2545** *	**-0.4166** **	-0.2181	**-0.3676** **	**-0.5863*** **
ER -7	-0.2059	0.1582	**-0.3063** *	-0.1287	0.1273
ER -8	**-0.4009*** **	**-0.5361*** **	**-0.4711*** **	**-0.5575*** **	-0.2002
ER -9	-0.1013	-0.1087	-0.1716	-0.1814	**-0.3239** *
ER -10	-0.2020	0.0387	-0.1912	0.2299	-0.1098
BIS -1	-0.0256	-	-	-	-
BIS -2	0.0181	-	-	-	-
BIS -3	0.0506	-	-	-	-
BIS -4	-0.1796	-	-	-	-
BIS -5	0.1592	-	-	-	-
BIS -6	0.0417	-	-	-	-
BIS -7	0.1085	-	-	-	-
BIS -8	**-0.1654** **	-	-	-	-
BIS -9	-0.0618	-	-	-	-
BIS -10	0.0643	-	-	-	-
EU -1	0.0167	-0.0090	0.0066	-0.0103	-0.0128
EU -2	-0.0536	0.0489	-0.0128	-0.0144	0.0322
EU -3	0.0453	-0.0226	0.0312	0.0493	0.0099
EU -4	**-0.0682** **	-0.0498	-0.0106	-0.0249	0.0089
EU -5	**0.0777*** **	0.0239	-0.0084	-0.0135	-0.0349
EU -6	-0.0379	-0.0114	-0.0095	-0.0225	-0.0040
EU -7	0.0231	0.0051	-0.0044	0.0111	0.0651
EU -8	0.0091	-0.0089	0.0098	0.0646	-0.0018
EU -9	0.0012	-0.0040	-0.0267	-0.0572	**-0.0816** *
EU -10	-0.0141	0.0143	0.0252	0.0136	0.0355
FCA -1	-0.0356	-0.0320	0.0132	-0.0859	-0.0570
FCA -2	-0.0433	0.0157	-0.0183	0.0675	0.0553
FCA -3	**0.1187** **	0.0417	0.0050	-0.0059	0.0193
FCA -4	-0.0221	0.0435	0.0020	0.0186	-0.0235
FCA -5	-0.0070	-0.0449	-0.0201	0.0019	0.0032
FCA -6	-0.0340	-0.0214	0.0148	-0.0244	0.0105
FCA -7	-0.0550	0.0212	0.0086	0.0131	-0.0396
FCA -8	**0.1909*** **	-0.0637	0.0045	0.0182	0.0263
FCA -9	**-0.1078** **	0.0937	-0.0622	-0.1414	-0.0316
FCA -10	-0.0266	-0.0536	**0.0337** *	**0.0971** **	0.0285
FSA -1	-0.0083	0.0248	0.0147	0.0144	-0.0148
FSA -2	-0.0078	-0.0482	-0.0196	0.0162	-0.0043
FSA -3	-0.0056	**0.0643** **	-0.0130	**-0.1019** **	-0.0152

Table 6 Continued

Variable	Banks	Insurance	Trusts	Finance	Realtors
FSA -4	0.0353	-0.0342	0.0094	**0.0864****	**0.0311****
FSA -5	**-0.0423***	-0.0375	0.0097	-0.0332	0.0149
FSA -6	0.0137	-0.0083	0.0073	0.0149	-0.0090
FSA -7	0.0242	0.0385	-0.0046	-0.0073	-0.0109
FSA -8	-0.0429	0.0276	-0.0259	-0.0473	-0.0236
FSA -9	0.0365	**-0.0883****	-0.0001	0.0393	0.0218
FSA -10	-0.0137	**0.0873*****	0.0166	0.0190	0.0059
GOV -1	-0.0081	-0.0413	**0.0734****	0.0058	0.0213
GOV -2	-0.0025	-0.0851	**-0.0997***	0.0499	-0.0517
GOV -3	-0.0029	**0.1063****	-0.0269	-0.0535	0.0409
GOV -4	0.0122	0.0680	0.0727	0.0335	-0.0623
GOV -5	-0.0549	-0.0776	0.0300	-0.0390	0.0671
GOV -6	0.0399	-0.0396	-0.0110	0.0502	-0.0434
GOV -7	0.0066	0.0502	-0.0205	-0.0620	0.0803
GOV -8	0.0390	-0.0344	0.0179	0.0230	-0.0472
GOV -9	0.0421	0.0787	0.0054	0.0272	-0.0379
GOV -10	**-0.0686****	-0.0138	-0.0370	-0.0115	0.0322
IC -1	0.1027	0.0207	0.0537	0.0420	0.1089
IC -2	-0.1548	-0.1027	-0.0950	-0.1340	-0.1681
IC -3	0.1585	0.0905	0.1515	0.1219	0.0673
IC -4	-0.0798	-0.0804	-0.1277	-0.0050	-0.0347
IC -5	-0.1349	**0.1625***	-0.0082	-0.0660	-0.0336
IC -6	0.3152	-0.0300	0.0894	0.0245	0.0911
IC -7	**-0.3284***	-0.1604	**-0.1666****	-0.0569	-0.1060
IC -8	0.0356	0.0465	0.0709	**0.1544****	0.1585
IC -9	0.1792	0.0704	0.0434	-0.0247	-0.0677
IC -10	-0.0419	-0.0186	0.0230	-0.0573	0.0058
PRA -1	-0.0110	-0.0344	-0.0061	-0.0187	-0.0331
PRA -2	0.0551	0.0388	-0.0473	-0.0329	0.0009
PRA -3	0.0231	-0.0335	0.0538	0.0170	-0.0351
PRA -4	**-0.0949***	0.0530	-0.0094	0.0533	0.0709
PRA -5	0.0371	-0.0045	0.0246	-0.0301	0.0126
PRA -6	-0.0105	-0.0040	-0.0801	-0.0470	-0.1082
PRA -7	0.0144	-0.0389	0.0278	-0.0586	0.1231
PRA -8	0.0559	0.0176	0.0128	0.0555	0.0083
PRA -9	-0.0661	-0.0267	0.0209	0.0457	-0.0164
PRA -10	0.0040	**0.0428****	-0.0275	-0.0323	-0.0429
C	**0.0348*****	**0.0387*****	**0.0331*****	**0.0507*****	**0.0271*****
Intercept	**0.0002*****	**0.0003*****	**0.0002*****	**0.0004*****	**0.0002*****
$\varepsilon_{t-1}\varepsilon_{t-1}$	**0.1334*****	**0.1536*****	**0.1675*****	**0.1363*****	**0.1589*****
$\varepsilon_{t-1}\lambda_{1,t-1}$	**-0.0474****	**-0.0534****	**-0.0584*****	-0.0145	0.0265
GARCH	**0.8841*****	**0.8481*****	**0.8438*****	**0.8587*****	**0.8365*****
$\mathbf{R^2}$	0.341	0.284	0.282	0.258	0.317

Coefficients in bold achieved statistical significance with *** indicating 1% level significance; ** indicating 5% level significance; * indicating 10% level significance

6.5.4. Robustness

In order to achieve a comprehensive study, we perform further analysis towards the banking and insurance sectors as we investigate the impact regulatory news held against the CDS spreads. We adopt the same approach as Schäfer et, al (2015) by implementing a SUR regression model in order to confirm or reject their results with respect to the Vickers' report held towards UK commercial banks as well as insurance firms. The SUR model, which was first introduced by Zellner (1962) enables us to simultaneously estimate all the regressions of all banks within our sample, which is efficient as well as accounting for heteroskedasticity and autocorrelation within the system. It also enables us to remove the issue of event clustering, through the cross-sectional estimation the model provides us with as expressed by Campbell, Lo and MacKinlay (1998). We use a different set of announcements for the banking sector (can be found in appendix 4 under Table 7) to capture rumours or calls for regulation changes rather actual changes to envision the market response. Furthermore, we include a variable to capture the importance of the Turner's Review, which may be revered by viewers as important factor in calling for regulatory change. We capture the impact of regulatory news events towards the cost of tier 1 capital through the change in CDS spread for the banking and insurance sectors. A widening of the spread would demonstrate the cost of debt increased and would highlight the added risk attached towards the institutions business model. Furthermore, the indication of a widening spread gives rise to an increase in the probability of default as the institution is perceived by the market to be a riskier investment. However a tightening of the spread would indicate the market welcomed the regulatory proposals, which created a stable environment for the banks as well as insurers, which then leads to a lower cost of raising capital. The data we utilise within this section is daily CDS spreads of 7 UK banks and 5 UK insurance firms commencing from 01/01/2009 till 30/10/2015. We take the first difference within all the CDS spreads in order to achieve stationarity, which enables us to make sure the data is not biased and reduces the white noise that may be present in time-series data. The estimation of the SUR methodology towards the banks is proposed as follows:

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{VIC} + DUM_{CON} + DUM_{TUR} + \epsilon$$

...

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{VIC} + DUM_{CON} + DUM_{TUR} + \epsilon \quad (6.19)$$

...

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{VIC} + DUM_{CON} + DUM_{TUR} + \epsilon$$

The estimation of the insurance firms' SUR methodology is proposed as follows with slight changes from equation 19:

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{PRA} + DUM_{TUR} + \epsilon$$

…

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{PRA} + DUM_{TUR} + \epsilon \quad (6.20)$$

…

$$\Delta CDS_{it} = \alpha_0 + DUM_{IC} + DUM_{PRA} + DUM_{TUR} + \epsilon$$

Where: ΔCDS_{it} is the CDS spread of bank *i* on day *t* with Δ being the change in the spread, α_0 is the constant parameter within the model with DUM_{PRA} DUM_{IC}, DUM_{VIC} and DUM_{CON} are dummy variables to capture the news announcements of the Prudential Regulatory Authority, Independent Committee, Vickers' statements, concession statements surrounding ring-fencing and the Turner's Review. ϵ is an error term.

6.5.4.1 Robustness Results

Below in Table 8 we report the results of the SUR regressions, from which we can confirm the results of Schäfer et, al (2015). We find there is a positive reaction from the UK banks in regards to the independent committee with the announcement of the Vickers report. We interpret this result through the tightening of the CDS spreads, as the announcements came to light regarding the Vickers' report. The tightening of the spreads can be linked to a more stable banking sector, which the Vickers' report outlined and is to be implemented by the Government as standard practice. The reaction highlights the market priced into the spreads the new impending regulation changes, will create a stable environment against the banking sector, which cannot attach traditional banking with investment banking. By separating the different banking divisions from one another the theory is that there will be less risk exposure on the balance sheets of the large institutions and therefore will essentially become more stable institutions with the likelihood of default being reduced. In other announcements regarding Sir John Vickers in relation towards the banking sector raised fears of their future positions as it is evident there is a negative association. Although no statistical significance is achieved, all banks still react negatively, which overall highlights the power Sir John Vickers possesses in relation towards the banking sector as well as the market recognising negative noise. With regards to the concession announcements surrounding the ring-fencing of the banking sector, a positive response is the majority of institutions. This highlights the reduced levels of risk these banking institutions face in light of the news, which led to their spreads to tighten.

However, with respect to HBOS (part of Lloyds Banking Group) we find there is statistical significance with the widening of spread. This suggests that the announcement surrounding the ring fencing concessions negatively impacts their ability to raise capital. Moreover, when interpreting our results concerning the Turner Review we find mixed responses among the banks whereby Banco Santander, HBOS, Lloyds Banking Group and Royal Bank of Scotland are found to have a positive response towards the calls for regulation change. The announcements aided these institutions ability to raise funds at a lower cost, which is in line with previous results of increased capital adequacy tightens the spread due to the increased stability sought through regulation. In regards to the other institutions (Barclays, SBC and Standard Chartered) these are namely international banks with exposures worldwide from which, increased calls for regulations aims to reduce the size of these banks along with their risk exposures to global markets. Overall, these claims from the Turners' Review led to the market to widen their CDS spreads possibly due to the increased future uncertainty of the bank, which led to an increased in raising of funds.

Table 9 below highlights the results concerning the insurance sector. We gather strong evidence to confirm previous results in the view of announcements impact the CDS spreads from tightening or a widening. In relation towards the announcements from the IC we find all insurance companies experienced a positive response with RSA being statistically significant in the tightening of CDS spread. This overall, confirms our results in the previous section whereby the equity price response of the IC is a result of reduced risk and therefore reduced expected return. As the CDS spread tightens, this highlights the ability to raise capital at a lower cost and therefore illustrate the positive impact held by the IC. With regards towards the PRA results, we yield mixed responses between the insurance firms in terms of the reaction of CDS spread widening or tightening. Old Mutual Plc (OML) and Legal and General Plc (LGEN) are found to tighten with the positive response of Solvency II. This overall suggests they are already fulfil the regulatory requirements as they are well capitalised and have sound risk management. However, in terms of Aviva Plc (AV), Prudential Plc (PRU) and RSA there is a negative impact, which overall highlights the widening of their CDS spreads. The widening of their spreads suggests that these institutions are not well capitalised as Solvency II comes closer into implementation. Since there is a newly found need for raising capital levels to match risk exposure, this placed an upward pressure towards their cost of financing and overall led to a widening of CDS spreads among these institutions. We shed light upon the announcement of the Turners Review, whereby all insurance firms we examine experience a tightening shift

within their CDS spreads. The tightening of the spread materialised as a result of the conducted review aims to bring clarity to the financial sector. The increased regulation call indicates the future to be increasingly stable and does not jeopardise the economy in any way, which overall restricts the financial sector to absorb less risk and hold more capital. As increasing capital levels are met, this ultimately reduces the default probabilities of the financials and therefore reduces cost of financing.

Table 8: SUR Results Banking Sector

BANK	Variable	Coefficient	t-Statistic
BARC	Intercept	-0.0651	-0.4975
	IC	5.0391	1.2920
	VIC	-0.8921	-0.3233
	CON	0.3336	0.0855
	TUR	-2.4793	-0.4496
BNC	Intercept	0.0153	0.0766
	IC	0.1667	0.0279
	VIC	-3.5526	-0.8412
	CON	0.8797	0.1474
	TUR	1.3684	0.1622
HBOS	Intercept	-0.0399	-0.3302
	IC	6.6929	**1.8603***
	VIC	-0.4886	-0.1920
	CON	-8.1076	**-2.2535****
	TUR	0.7073	0.1390
HSBA	Intercept	-0.0172	-0.2073
	IC	0.9992	0.4032
	VIC	-1.6200	-0.9239
	CON	-0.0948	-0.0382
	TUR	-0.6531	-0.1864
LLOY	Intercept	-0.0428	-0.2921
	IC	14.0758	**3.2267*****
	VIC	-2.4587	-0.7967
	CON	-0.1447	-0.0332
	TUR	0.7292	0.1182
RBS	Intercept	-0.0418	-0.2758
	IC	3.0763	0.6814
	VIC	-1.2752	-0.3992
	CON	0.0403	0.0089
	TUR	0.8733	0.1368
STAN	Intercept	-0.0334	-0.3259
	IC	4.4959	1.4719
	VIC	-1.9861	-0.9190
	CON	0.6064	0.1985
	TUR	-4.1940	-0.9714

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

Table 9: SUR Results Insurance Sector

Insurance Firm	Variable	Coefficient	t-Statistic
AV	Intercept	-0.0387	-0.6485
	IC	1.4102	0.7762
	PRA	-1.0395	-0.9898
	TUR	1.1453	0.4459
LGEN	Intercept	-0.0503	-1.0784
	IC	1.4993	1.0750
	PRA	0.1856	0.2302
	TUR	0.4525	0.2295
OML	Intercept	-0.0530	-1.3631
	IC	0.4630	0.3991
	PRA	0.1540	0.2296
	TUR	0.1891	0.1153
PRU	Intercept	-0.0492	-1.5623
	IC	0.9207	0.9733
	PRA	-0.0308	-0.0563
	TUR	0.4194	0.3136
RSA	Intercept	-0.0201	-0.3379
	IC	2.7751	**1.8216***
	PRA	-0.5246	-0.5955
	TUR	1.8455	0.8572

*** indicates 1% level significance; ** indicates 5% level significance; * indicates 10% level significance

6.6. Conclusion

The significance this study carries is important to many observers, such as central bankers, regulatory bodies, market participants and academics alike. To bring this study to a close, we have enriched the literature through establishing research towards all UK financial sectors in relation to recent regulatory changes, which were introduced due to the losses sustained from the crisis of 2007/8. The financial crisis highlighted widespread issues within the financial sectors to which the public suffered the consequences through large government bailout packages that were required in order to keep the financial system afloat and restore stability. Furthermore, this led to the government and other respective regulatory bodies to take stern action towards the financial sector in terms of increasing regulation from which the public largely demanded. The concluding arguments we provide support the findings by Schäfer et, al (2015) whereby there was a negative response in equity markets from the Vickers report announcement by the Independent Committee. We therefore do not reject our first hypothesis. Our results find a decline in equity prices among the banking sector, which highlights the stability brought by the new reforms and overall reduces the future returns for shareholders and therefore reduces the risk incentive. The future returns of the business are impacted by the

newly imposed reforms as it directly impacts their business model of reducing their investment banking activities, which is a highly profitable area of banking collectively. Furthermore, we enhanced the literature through illustrating the CDS spreads to tighten once the Vickers Report was announced. This also confirms Schäfer et, al (2015) as the reforms restricts the level of risk banks are exposed to.

With regards to our second hypothesis concerning prior volatility spill-overs surrounding impending regulatory change we find there is evidence of prior knowledge of regulatory change and highlights market inefficiency. We find the market priced information of regulatory announcements from every governing body by at least one sector prior to its release. However, we do provide evidence of conflicting results, which overall will require further research into this niche area. Our results are conflicted through the volatility of returns whereby, we discover respective governing announcements are not foreseen by the market and therefore the market maintains a level of efficiency as prices are fair and true.

Finally we conclude our study with the notion that announcements surrounding Solvency II and higher capital level requirements resulted in negative equity returns towards the banking and insurance sectors. The overall interpretation from the reaction is founded from the impact these regulatory reforms hold towards the operations of the banking and insurance sectors. With regards towards the banks this inherently controls their risk exposure levels and therefore restricts their performance as the greater risks taking theoretically lead to greater returns. The same can be argued towards the insurance sector also, as Solvency II has a similar theme to restrict risk taking exposure. These two sectors are seen as the most pivotal to ensuring economic stability and to avert future crisis periods in the future.

CHAPTER 7
Concluding Remarks

7.1 Summary of findings

The current thesis examined the overall performance of UK financial institutions over stable and unstable market conditions. Research aims addressed were set as follows. First, we assessed the determinants of financial performance of UK financial institutions and examined the risk-shifting behaviour patterns of the UK financial institutions over time. Second, we measure the risk profile of UK financial institutions from 2000-2012, and illustrated how the build-up of risk was portrayed through examining beta in comparison to general market movements. Third, we investigated stock price performance of the UK financial institutions during volatile periods and examined market movements in the context of macroeconomic events. Fourth, we assessed the impact regulation held towards various financial sub-sectors. Last, but not least, we objectified to detect whether transmission of information was present within the financial markets surrounding impending regulatory changes.

The current study, is the first study of its kind to set a precedent on determining the key drivers of financial performance among all sectors of UK financial institutions. Previous studies from Smirlock (1985), Molyneux and Thornton (1992), Molyneux and Forbes (1995), Demirgüç-Kunt and Huizinga (1999), Goddard et al. (2004 and 2004b), Kosmidou et al. (2005), and Pasiouras and Kosmidou (2007) and many more concentrated upon the drivers of performance solely on the banking sector. The contribution of our study provides the literature to understand the performance of all UK specific financial institutions during specific periods of the economic cycle and more importantly during periods of financial instability. Furthermore, it provides a baseline for financial institutions to manage financial crisis periods appropriately, through dedicating financial resources to the areas which provide a positive impact towards profitability. This study can be useful for developing investment decisions, as these sectors are considered to be relatively attractive to international portfolio investors, as seen by the works of Fletcher (1995), Leger (1997), Bangassa (1999) and Elyasiani and Jia (2011). The results from Chapter 3 identifies the factors and shows how they drive performance among the UK financial institutions. We find risk-return hypothesis is evident across all sectors bar the insurance sector, which highlights the importance of the risk element undertaken by financial institutions being a key determinant of profitability. In regards to the banking sector

this contribution is in line with Smirlock (1985), Berger (1995), Demirgüç-Kunt and Huizinga (1999), and Abreu and Mendes (2001), which demonstrates a positive and significant relationship with our risk variable (loan-to-deposit ratio).

With regards to the Investment trusts, Real Estate and Finance company sectors, this is a new contribution to the literature, whereby we demonstrated the risk-return hypothesis. We identify the banking sector benefits from operating within a highly concentrated market, which attributes towards overall profitability, this result is in line with Molyneux and Thornton (1992), Demirgüç-Kunt and Huizinga (1999), Goddard et al. (2004 and 2004b), Pasiouras and Kosmidou (2007). This creates an issue for regulators as essentially perfect competition is not present within UK banking sector, whereby the banks will lower costs in order to gain market share from one another, instead the opposite occurs as the banks are essentially colluding with one another to take advantage of the monopolistic conditions that are present in the UK market – This is a further contribution of our study.

Moreover, we find efficiency is present among the insurance, real estate and finance companies sectors. These sectors are able to convert a higher market share into direct contributors towards profitability, which suggests competition has led to greater performance through reducing costs. This is an example of a new contribution to the literature as no study before has considered this aspect from the UK market previously. Our study finds that size does not enhance profitability across the banking, investment trust, real estate and finance companies sectors, which highlights financial companies inability to benefit from economies of scope, with the only exception being the insurance sector, which suggests the insurance sector has been able optimise financial products they offer and benefit from economies of scope. Additionally, we concluded economic conditions do have a vast impact towards determining profitability for the UK financial sectors, as one would expect once economic growth occurs this coincides with greater confidence within the economy with lenders willing to lend and borrowers are encouraged to borrow as the likelihood of default is minimised as growth is present. these findings are in line and complement those from Goddard, et al. (2004a), Kosmidou, et al. (2005) and Pasiouras and Kosmidou (2007).

We further addressed the risk variable in Chapter 3 to assess the risk shifting behaviour patterns from 2000-2012 to capture the pre-crisis, crisis and post-crisis periods. We conclude the banking, insurance and investment trust sectors as expected follow economic growth trends, whereby risk increases during times of prosperity and shifts negatively through economic times

of uncertainty. We found few structural breaks in the real estate sector, however the breaks identified did coincide with the growth and slowdown in the housing markets. Lastly, with regards to the finance company sector, we conclude the market was able to distinguish the risk levels and priced in the information accordingly.

By examining, in Chapter 4, the in-sample and out-sample performance of different approaches (DCC-GARCH, BEKK,GJR-GARCH, Kalman filter etc) we were able to determine and explain the behaviour of risk profile exhibited by each UK financial sector across our sample years, providing so a unique contribution to literature. The literature demonstrates that the beta variable in the CAPM to be time-varying, which we confirmed within our results as every sector does not produce a constant beta. This is in line with research such as Jacob (1971), Blume (1971) Fabozzi and Francis (1978), Alexander and Chervany (1980), Bos and Newbold (1984) and many more. Further to determining the time-varying risk profile of the financial sectors, the results showed the market held the insurance sector to possess the most systemic risk, with the banking sector ranking second overall. This confirms these sectors' held central roles in the build-up to the financial crisis of 2007/8 as given by their increase in risk profile. The rise demonstrates the inability of the sectors being able to manage their risk portfolio as given by the steep rise in systemic risk. Furthermore, we demonstrated over the sample years how the risk profiles of each sector evolved over time. Whether it was linked to an event or underlying economic conditions that the market priced the systemic risk at that given level in time. For example spikes in risk profile linked to 9/11 in all sectors is found as this event induced high levels of uncertainty in financial markets, especially towards the insurance sector due to the exposure held to American markets. Our last finding within this empirical chapter concludes with the most accurate in-sample technique is the rolling regression technique as adopted by Fama and MacBeth (1973) in accordance to the MSE. However, the Kalman filter demonstrates its superiority over other techniques investigated as given by the modified Mariano and Diebold test, which is in line within the literature by Brooks et al., (1998), Mergner and Bulla (2008), Choudhry and Wu (2009) and Zhou (2013).

In Chapter 5 we examined the impact of macroeconomic news events towards the equity prices of all UK financial institutions. By undertaking this research theme we were able to measure the markets reactions to the major events that occurred throughout the crisis. Furthermore, we can understand which initiatives were most impactful in restoring confidence to the markets during periods of heightened distress. Prior to this study there was no study that incorporated all UK financial sectors this research niche, therefore enriching the literature, through utilising

existing event study methodology techniques. Previous studies from literature such as King (2009), Aït-Sahalia et al. (2012), Fratianni and Marchionne (2013), Dumontaux and Pop (2013), Klomp (2013) and Grammatikos et al. (2015) all considered many nations rather than exploring the UK market solely. The first key finding was found was market participants were able to distinguish risk levels among the differing banks. This was exemplified through the CDS spreads as given by the SUR empirical framework applied (from Zellner (1962)), which identified investors priced the CDS spreads differently to Northern Rock in comparison to the rest of the banking institutions. In addition to this we found that the actions of the UK government during the crisis period were just as effective as the Bank of England in restoring confidence to the financial system. This highlights their underlying powers they can exert during times of economic fragility and heightened volatility. Moreover, we were able to demonstrate how integrated the financial markets are through examining the news events from other Western economies and comparing them against domestic announcements events. In the non-bank financial sectors we found an overall greater impact from the Western economies and IMF in comparison to domestic announcements. Furthermore, we provided evidence that the UK banking sector also experiences a positive reaction to other major central banking and IMF announcements. This also reinforces the notion that today's financial markets are globalised.

In Chapter 6, we assessed the effects of regulation changes against the equity prices of the UK financial sectors from utilising existing methods (Event study methodology, MacKinlay (1997), SUR by Zellner (1962) and others). This is the first study of its kind in terms of utilising all UK financial sectors impact of regulatory news events, with which we can gain a greater understanding of how regulation news impacts financial markets, therefore enriching the literature. The only study we can truly gain comparison from is the paper by Schäfer et, al (2015) (concentrated solely on Banks and considered other nations regulatory changes in wake of the financial crisis). We conclude the increased capital requirement regulations from the Bank of International Settlements (Basel Tier III) and Solvency II directly produced negative effect on the returns of equity prices. The regulations directly impact the business models of these particular sectors as it restricts them from taking excessive risk, which is seen by shareholders as reducing the bank or insurance firm from reaching its full potential. This is due to maximising the use of capital to creating loans or underwriting insurance, which overall is related to the risk-return hypothesis. The shareholders interpreted the regulation as a restriction upon risk-taking behaviour and priced it accordingly to their expectation of reduced future

returns. Given the circumstances of which the Vickers report was commissioned to overhaul the current regulation with strong recommendations to which should be implemented, was a significant event and is in line with Schäfer et, al (2015). Once the Vickers report was officially released, the equity prices of the banking sector was found to have negative impact on equity prices. This allowed to confirm the notion shareholders perceived this increased regulation as negative, due to the restriction it places upon the business model of banking and ring fence banking operations. This overall reduces the risk-taking behaviour and creates a more stable atmosphere to avert future crisis periods from materialising. We additional demonstrated a positive effect in the CDS spreads from the Vickers report for robustness purposes. This overall provides sufficient evidence as the CDS spreads tightened as a result of increased regulation, therefore reducing the cost of tier 1 capital. Lastly, we find evidence of transmission of information in regards to impending regulatory changes, whereby the market priced the expectation of regulatory prior to its release. As overall this suggests the market had prior knowledge of impending regulation action to be taken and priced the information into the asset prices somewhat as a result. This can provide evidence of an inefficiency within the market, which may have been exploited. However, we feel this requires additional research from the academic community in order to confirm or reject or results.

7.2 Policy Implications

The current study shows the key variables that are required to be in place to present financial institutions with the opportunity to optimise performance. Whereby, the allocation of resources can be utilised in a manner that creates the financial sectors to prosper and by doing so can aid economic development within the UK. Our findings can aid policy makers' understanding of what determines profitability among the financial sectors of the economy and may be able to develop appropriate and fair regulations to ensure monetary stability is met but also enables the financial sector to optimise performance.

This study also helped to determine the level of systemic risk each sector contains. As a result, this enables us to monitor the risk profile attached to each sector and from the research policy makers and regulators are should directly be able to monitor the risk contained within each sector. By being more informed they are able to enforce tighter restrictions to ensure financial stability is met when heightened beta is experienced and vice versa for when risk is

too low. For the financial institutions' perspective as a result of research conducted, they will be able to manage risk at a more advanced level, which will aid their decision making when pondering upon riskier investment opportunities.

The current thesis also measured the impact of announcements from the Government, Bank of England and other respective organisations/governments to the UK financial sectors' equity prices, namely in a positive manner. The stabilising measures implemented enabled investors of all backgrounds in the market to potentially experience abnormal positive returns. These measures creates an attractive investment environment for investors as the necessary steps to maintain investment within the economy are being exerted in order to reduce systematic risk. From the injections of capital into the banking system, lowering interest rates, nationalising institutions and quantitative easing programs, this portrayed positive news to the market, which enabled the UK to exit official recession by last quarter 2009. It demonstrates the effective policy initiatives undertaken aided the stability of the equity markets in the UK through reducing systematic risk as the respective bodies took necessary action to maintain the financial system.

Last, but not least, we examined how increased regulation reduces risk and therefore reduces return from the markets' perspective. A policy implication brought from increased regulation concerning increased capital requirements as well as ring-fencing banking institutions, is that these regulations impair the business models of the banking and insurance sectors. This causes these sectors increased cost of equity financing as the share prices are reduced as a result because the market has priced the declined future returns into the assets. However, conversely there may be an increased reliance in the future on debt financing for the banking and insurance sector as the resulting actions tightened the CDS spreads, which reduces the cost of tier 1 capital.

7.3 Limitations and other considerations

The research conducted within this thesis presents limitations throughout each empirical chapter. On the overall picture of the thesis we have only covered the surface of financial institutional performance within the UK. We have not concentrated upon other historical financial crisis periods outside of the most recent crisis extensively. This is purely down to relevance and to conduct such research this would require vast resources as well as a much longer time period. A common limitation that occurs throughout the thesis is we were

unable to gather data from private financial institutions due to financial restrictions; private entities are not legally required to make their financial data public. Therefore in order to overcome this obstacle, we excluded all private financial institutions and concentrated on publically listed financial institutions.

Also, a limitation may be we were unable to exhaust more regression modelling techniques due to financial restrictions in gathering data, which may have produced alternative results. However, we produced the best results we could with the resources that were available to us. Moreover, a limitation that we accept was being unable to identify net interest margin and cost-to-income data spanning for the full sample period of 1980-2012, again which was due the limited resources available to gather the data, especially to gather private institutional data.

7.4 Directions for future research

The issues this thesis has covered across the UK financial sectors is only the beginning within the literature concerning such topic in a recent context. Further research could confirm or reject our results/policy implications that have arisen as a result of conducting this thesis. The issue of investigating financial performance can be enhanced from the academic world through including private institutions within the data sample, which may produce further clarity and add another dimension to the field of financial performance. This may present a great opportunity for enriching the existing literature as well as make a contribution to knowledge. With greater understanding of what the determinants of financial institution performance, we can adapt policies implemented which will in theory create greater stability as well as maximise institutional performance. Furthermore, the concept of investigating financial institution performance can be applied to other economies as an opportunity for further research as well as conducting a comparative study. Additionally, the research can be furthered through undertaking different methodologies to what we have applied within this thesis. The additional research may create a different outcome and cause a debate within the context of financial performance literature.

BIBLIOGRAPHY

Abreu, M., and Mendes, V. (2001). Commercial bank interest margins and profitability: evidence for some EU countries. In *Pan-European Conference Jointly Organised by the IEFS-UK & University of Macedonia Economic & Social Sciences, Thessaloniki, Greece, May* (pp. 17-20).

Adrian, T., and Franzoni, F. (2009). Learning about beta: Time-varying factor loadings, expected returns, and the conditional CAPM. *Journal of Empirical Finance*, *16*(4), 537-556.

Aharony, J., and Swary, I. (1996). Additional evidence on the information-based contagion effects of bank failures. *Journal of Banking & Finance*, *20*(1), 57-69.

Ait-Sahalia, Y., Andritzky, J., Jobst, A., Nowak, S., and Tamirisa, N. (2012). Market response to policy initiatives during the global financial crisis. *Journal of International Economics*, *87*(1), 162-177.

Alexander, G. J., and Chervany, N. L. (1980).On the estimation and stability of beta. *Journal of Financial and Quantitative Analysis,15(01),* 123-137.

Allen, F and Gale, D. (1999). Bubbles, Crises, and Policy. *Oxford Review of Economic Policy*. 15 (3), p 9-18.

Altunbas, Y., Evans, L. and Molyneux, P., (2001). Bank ownership and efficiency. *Journal of Money, Credit and Banking*, pp.926-954.

Angbazo, L. (1997). Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. *Journal of Banking and Finance. 21,* p55-87.

Baba, Y., Engle, R. F., Kraft, D. F., and Kroner, K. F. (1990). *Multivariate Simultaneous Generalized ARCH, Department of Economics, University of California at San Diego*. Working Paper.

Bai, J., and Perron, P. (1998). Estimating and testing linear models with multiple structural changes. Econometrica, 47-78.

Bai, J., and Perron, P. (2003). Computation and analysis of multiple structural change models. Journal of applied econometrics, 18(1), 1-22.

Bai, J., and Perron, P. (2003). Critical values for multiple structural change tests. The Econometrics Journal, 6(1), 72-78.

Bangassa, K. (1999). Performance of UK investment trusts: 1980–1994.*Journal of Business Finance & Accounting*, *26*(9-10), 1141-1168.

Banz, R. (1981) The relationship between return and market value of common stocks, Journal of Financial Economics, 9, 3–18.

Berger, A. N. (1995). The profit-structure relationship in banking--tests of market-power and efficient-structure hypotheses. *Journal of Money, Credit and Banking*, *27*(2), 404-431.

Berger, A.N. and Humphrey, D.B., (1997). Efficiency of financial institutions: International survey and directions for future research. *European journal of operational research*, *98*(2), pp.175-212.

Bhandari, L. (1988) Debt/equity ratio and expected common stock returns: empirical evidence, The Journal of Finance, 43, 507–28.

Bhattacharya, U., and Daouk, H. (2002). The world price of insider trading. *The Journal of Finance*, *57*(1), 75-108.

Bikker, J.A. and Hu, H., 2002. Cyclical patterns in profits, provisioning and lending of banks and procyclicality of the new Basel capital requirements. *Banca Nazionale del Lavoro Quarterly Review*, *55*(221), p.143.

Binder, J. (1998). The event study methodology since 1969. *Review of quantitative Finance and Accounting*, *11*(2), 111-137.

Binder, J. J. (1985). Measuring the effects of regulation with stock price data. *The RAND Journal of Economics*, 167-183.

Black, A., Fraser, P., and Power, D. (1992). UK unit trust performance 1980–1989: A passive time-varying approach. Journal of Banking & Finance, 16(5), 1015-1033.

Black, F. (1976). The pricing of commodity contracts. *Journal of financial economics*, *3*(1), 167-179.

Black, L. K., and Hazelwood, L. N. (2013). The effect of TARP on bank risk-taking. *Journal of Financial Stability*, *9*(4), 790-803.

Blake, D., and Timmermann, A. (1998). Mutual fund performance: evidence from the UK. European Finance Review, 2(1), 57-77.

Blume, M. E. (1971). On the assessment of risk. *The Journal of Finance*,*26(1)*, 1-10.

Boehmer, E., J. Musumeci, and A. Poulsen, (1991). Event-study methodology under conditions of event induced variance, *Journal of Financial Economics* 30, 253-73.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of econometrics*, *31*(3), 307-327.

Bollerslev, T. (1987). A conditionally heteroskedastic time series model for speculative prices and rates of return. *The review of economics and statistics*, 542-547.

Bordo, M. Redish, A. and Rockoff, H. (2010). Why didn't Canada have a banking crisis in 2008 (or in 1930, or 1907, or 1893*)? Economic History Association*. (Sept), p 1-33.

Bos, T. and Newbold, P. (1984) An empirical investigation of the possibility of stochastic systematic risk in the market model, Journal of Business, 57, 35–41.

Bourke, P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking & Finance*, *13*(1), 65-79.

Boyd, J. H., and Runkle, D. E. (1993). Size and performance of banking firms: Testing the predictions of theory. *Journal of monetary economics*, *31*(1), 47-67.

Brewer, E., Genay, H., Hunter, W. C., and Kaufman, G. G. (2003). Does the Japanese stock market price bank-risk? Evidence from financial firm failures. *Journal of Money, Credit, and Banking*, *35*(4), 507-543.

Brooks, R. D., Faff, R. W., and McKenzie, M. D. (1998). Time-varying beta risk of Australian industry portfolios: A comparison of modelling techniques. *Australian journal of management,23(1),* 1-22.

Brown, S. J., and Goetzmann, W. N. (1997). Mutual fund styles. Journal of financial Economics, 43(3), 373-399.

Bruner, R and Simms, J. (1987). The International Debt Crisis and Bank Security Returns in 1982, *Journal of Money, Credit and Banking. 19*, p 46-55.

Campbell, C. J., and Wesley, C. E. (1993). Measuring security price performance using daily NASDAQ returns. *Journal of Financial Economics,33*(1), 73-92.

Campbell, J. Y., Lo, A. W., MacKinlay, A. C., and Whitelaw, R. F. (1998). The econometrics of financial markets. *Macroeconomic Dynamics*, *2*(04), 559-562.

Celik, S. (2013).Testing the Stability of Beta: A Sectoral Analysis in Turkish Stock Market. *Journal of Economics & Behavioural Studies*, *5*(1).

Cho, J. H., and Parhizgari, A. M. (2008). East Asian financial contagion under DCC-GARCH. *International Journal of Banking and Finance*, *6*(1), 2.

Choe, H., Kho, B. C., and Stulz, R. M. (1999). Do foreign investors destabilize stock markets? The Korean experience in 1997. *Journal of Financial Economics*, *54*(2), 227-264.

Choudhry, T. (2005). Time-varying beta and the Asian financial crisis: Evidence from Malaysian and Taiwanese firms. *Pacific-Basin Finance Journal*, *13*(1), 93-118.

Choudhry, T., and Wu, H. (2009).Forecasting the weekly time-varying beta of UK firms: GARCH models vs. Kalman filter method. *The European Journal of Finance*, *15*(4), 437-444.

Clinebell, J., Squires, J. and Stevens, J. (1993) Investment performance over bull and bear markets: Fabozzi and Francis revisited, Quarterly Journal of Business and Economics, 32, 14–25.

Collins, D.W., Ledolter, J., and Rayburn, J., (1987). Some further evidence on the stochastic properties of systematic risk. Journal of Business 60, 425–448.

Connor, G., and Korajczyk, R. A. (1991). The attributes, behaviour, and performance of US mutual funds. *Review of Quantitative Finance and Accounting*, *1*(1), 5-26.

Cordella, T., and Yeyati, E. L. (2003). Bank bailouts: moral hazard vs. value effect. *Journal of Financial intermediation*, *12*(4), 300-330.

Cornell, B and Shapiro, A. (1986). The reaction of bank stock prices to the international debt crisis. *Journal of Banking and Finance. 10*, p55-73.

Cornett, M. M., and Tehranian, H. (1990). An Examination of the Impact of the Garn-St. Germain Depository Institutions Act of 1982 on Commercial Banks and Savings and Loans. *The Journal of Finance*, *45*(1), 95-111.

Corsetti, G., Pesenti, P. and Roubini, N. (1999). What caused the Asian currency and financial crisis? *Japan and the world economy*, *11*(3), 305-373.

Cowan, A. R. (1992). Nonparametric event study tests. *Review of Quantitative Finance and Accounting*, *2*(4), 343-358.

Cumming, D., Johan, S., and Li, D. (2011). Exchange trading rules and stock market liquidity. *Journal of Financial Economics*, *99*(3), 651-671.

Cuthbertson, K., Nitzsche, D. and O'Sullivan, N., (2008). UK mutual fund performance: Skill or luck? *Journal of Empirical Finance*, *15*(4), pp.613-634.

Dam, L., and Koetter, M. (2012). Bank bailouts and moral hazard: Evidence from Germany. *Review of Financial Studies*, *25*(8), 2343-2380.

Dell, S. S., and Lawrence, R. (1980). *The Balance of Payments Adjustment Process in Developing Countries* (Vol. 1). Oxford: Pergamon Press.

Demirgüç-Kunt, A., and Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review*, *13*(2), 379-408.

Diaz-Alejandro, C. F., Krugman, P. R., and Sachs, J. D. (1984). Latin American debt: I don't think we are in Kansas anymore. *Brookings Papers on Economic Activity*, *1984*(2), 335-403.

Dickey, D. A., and Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, *74*(366a), 427-431.

Diebold, F. X., and Mariano, R. S. (1995). Comparing predictive accuracy. *Journal of Business & economic statistics*.

Dimson, E. (1979). Risk measurement when shares are subject to infrequent trading. *Journal of Financial Economics*, *7*(2), 197-226.

Djankov, S., Jindra, J., and Klapper, L. F. (2005). Corporate valuation and the resolution of bank insolvency in East Asia. *Journal of Banking & Finance*, *29*(8), 2095-2118.

Dumontaux, N., and Pop, A. (2013). Understanding the market reaction to shockwaves: Evidence from the failure of Lehman Brothers. *Journal of Financial Stability*, *9*(3), 269-286.

Ediz, T., Michael, I., and Perraudin, W. (1998). The impact of capital requirements on UK bank behaviour. *Economic Policy Review*, *4*(3).

Elyasiani, E., and Jia, J. (2011). Performance persistence of closed-end funds.*Review of Quantitative Finance and Accounting*, *37*(3), 381-408.

Enders, T. O. and Mattione, R. P. (1984). *Latin America: The crisis of debt and growth*. Washington, DC: Brookings Institution.

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics*, *20*(3), 339-350.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the Econometric Society*, 987-1007.

Engle, R. F., and Kroner, K. F. (1995). Multivariate simultaneous generalized ARCH. *Econometric theory*, *11*(01), 122-150.

Engle, R. F., and Ng, V. K. (1993). Measuring and testing the impact of news on volatility. *The journal of finance*, *48*(5), 1749-1778.

Englund, P. (1999). The Swedish Banking Crisis: Roots and Consequences. *Oxford Review of Economic Policy. 15* (3), P 80-96.

European Commission (1997). XXVIIth Report on Competition Policy. Brussels, Belgium.

Fabozzi, F. J., and Francis, J. C. (1978).Beta as a random coefficient. *Journal of Financial and Quantitative Analysis,13(01),* 101-116.

Faff, R. W., Hillier, D., and Hillier, J. (2000). Time varying beta risk: An analysis of alternative modelling techniques. *Journal of Business Finance & Accounting,27(5-6),* 523-554.

Fama, E. F., and French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, *47*(2), 427-465.

Fama, E. F., and MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *The Journal of Political Economy*, 607-636.

Felix, D. (1987). Alternative outcomes of the Latin American debt crisis: lessons from the past. *Latin American Research Review*, *22*(2), 3-46.

Fletcher, J. (1995). An examination of the selectivity and market timing performance of UK unit trusts. *Journal of Business Finance & Accounting*,*22*(1), 143-156.

Fortin, R., Goldberg, G. M., and Roth, G. (2010). Bank risk taking at the onset of the current banking crisis. *Financial Review*, *45*(4), 891-913.

Fratianni, M., and Marchionne, F. (2013). The fading stock market response to announcements of bank bailouts. *Journal of Financial Stability*, *9*(1), 69-89.

Fridriksson, I. (2009). The banking crisis in Iceland in 2008. *Central Bank of Iceland*. (Feb), p 1-12.

Fukao, M. (2003). Japan's lost decade and its financial system. *The World Economy*, *26*(3), 365-384.

Garber, P. M. (1990). Famous first bubbles. *The Journal of Economic Perspectives*, *4*(2), 35-54.

Gilbert, R. A. (1984). Bank market structure and competition: a survey. *Journal of Money, Credit and Banking*, *16*(4), 617-645.

Glosten, L. R., Jagannathan, R., and Runkle, D. E. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *The Journal of Finance*, *48*(5), 1779-1801.

Goddard, J., Molyneux, P., and Wilson, J. O. (2004). Dynamics of growth and profitability in banking. *Journal of Money, Credit and Banking*, 1069-1090.

Goddard, J., Molyneux, P., and Wilson, J. O. (2004). The profitability of European banks: a cross-sectional and dynamic panel analysis. *The Manchester School,72*(3), 363-381.

Gorton, G., & Huang, L. (2004). Liquidity, efficiency, and bank bailouts. *The American Economic Review*, *94*(3), 455-483.

Grammatikos, T., Lehnert, T. and Otsubo, Y., (2015). Market perceptions of US and European policy actions around the subprime crisis. *Journal of International Financial Markets, Institutions and Money*, *37*, pp.99-113.

Groenewold, N., and Fraser, P. (1999). Time-varying estimates of CAPM betas. *Mathematics and Computers in Simulation*, *48*(4), 531-539.

Hamilton, J. D. (1994). *Time series analysis* (Vol. 2). Princeton: Princeton university press.

Harvey, Andrew C. (1993) *Time series models*. Vol. 2.

Harvey, D., Leybourne, S., & Newbold, P. (1997). Testing the equality of prediction mean squared errors. *International Journal of forecasting*, *13*(2), 281-291.

Henriksson, R. D. (1984). Market timing and mutual fund performance: An empirical investigation. *Journal of business*, 73-96.

Higgins, M. L., and Bera, A. K. (1992). A class of nonlinear ARCH models. *International Economic Review*, 137-158.

Hoshi, T. and Kashyap, A. K. (2004). Japan's financial crisis and economic stagnation. *The Journal of Economic Perspectives*, *18*(1), 3-26.

Hsieh, D. A. (1989) The statistical properties of daily foreign exchange rates: 1974-1983. *Journal of International Economics, 24*(1), 129-145.

Iannotta, G., Nocera, G., and Sironi, A. (2007). Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance*,*31*(7), 2127-2149.

Jackson, J. (2010). Iceland's Financial Crisis. Congressional Research Service. p 1-10.

Jacob, N. L. (1971). The measurement of systematic risk for securities and portfolios: some empirical results. *Journal of Financial and Quantitative Analysis*, *6*(02), 815-833.

Jaffe, J. F. (1974). Special information and insider trading. *The Journal of Business*, *47*(3), 410-428.

Jans, R. and Otten, R., (2008). Tournaments in the UK mutual fund industry. *Managerial finance, 34*(11), pp.786-798.

Jegadeesh, N. (1990) Evidence of predictable behaviour of security returns, The Journal of Finance, 45, 881–98.

Kabir, M. H., and Hassan, M. K. (2005). The near-collapse of LTCM, US financial stock returns, and the fed. *Journal of Banking & Finance*, *29*(2), 441-460.

Karafiath, I, Mynatt, R and Smith, K. (1991). The Brazilian Default Announcement and the Contagion Effect Hypothesis. *Journal of Banking & Finance*. 15 (1), p 699-716

Ke, Q. (2015). What affects the discount to net asset value in the UK-listed property companies? *Journal of Property Research*, *32*(3), 240-257.

Kho, B. C., and Stulz, R. M. (2000). Banks, the IMF, and the Asian crisis. *Pacific-Basin Finance Journal*, *8*(2), 177-216.

Kim, D. (1993). The extent of nonstationarity of beta. *Review of Quantitative Finance and Accounting*, *3*(2), 241-254.

Kim, S. and In, F., (2002). The influence of foreign stock markets and macroeconomic news announcements on Australian financial markets. *Pacific-Basin Finance Journal*, *10*(5), pp.571-582.

Kim, D., and Santomero, A. M. (1988). Risk in banking and capital regulation. *The Journal of Finance*, *43*(5), 1219-1233.

Kindleberger, C, Aliber, R and Solow, R (2011). *Manias, Panics and Crashes: A History of Financial Crises*. 6th ed. Palgrave Macmillan.

King, M. R. (2009). Time to buy or just buying time? The market reaction to bank rescue packages.

Klomp, J. (2013). Government interventions and default risk: Does one size fit all? *Journal of Financial Stability*, *9*(4), 641-653.

Kobayashi, T., Spiegel, M. M., and Yamori, N. (2006). Quantitative easing and Japanese bank equity values. *Journal of the Japanese and International Economies*, *20*(4), 699-721.

Koehn, M., and Santomero, A. M. (1980). Regulation of bank capital and portfolio risk. *The journal of finance*, *35*(5), 1235-1244.

Kohlert, D. (2010). The determinants of regional real estate returns in the United Kingdom: a vector error correction approach. *Journal of Property Research*, *27*(1), 87-117.

Kosmidou, K., Pasiouras, F., Doumpos, M., and Zopounidis, C. (2006). Assessing performance factors in the UK banking sector: a multicriteria methodology. *Central European Journal of Operations Research*, *14*(1), 25-44.

Kosmidou, K., Tanna, S., and Pasiouras, F. (2005, September). Determinants of profitability of domestic UK commercial banks: panel evidence from the period 1995-2002. In *Money Macro and Finance (MMF) Research Group Conference* (Vol. 45).

Krugman, P. (1999). Balance sheets, the transfer problem, and financial crises. In *International finance and financial crises* (pp. 31-55). Springer Netherlands.

Kyle, S and Wirick, R. (1990). The Impact of Sovereign Risk on the Market Valuation of U.S. Bank Equities. *Journal of Banking and Finance. 14*, p 761-780.

Laeven, L., and Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, *93*(2), 259-275.

Lamy, R, Marr, M and Thompson, R. (1986). The Mexican Debt Crisis, the IMF, and the Efficiency of Bank Share Prices. *Studies in Banking and Finance. 3*, p 203-217.

Lane, T. Ghosh, A. Hamann, J. Phillips, S. Schulze-Ghattas , M. and Tsikata, T. (1999). The East Asian Crisis and Policy Response. Economic Notes by *Banca dei Paschi di Siena SpA. 28* (3), p 255-284.

Larcker, D. F., Ormazabal, G., and Taylor, D. J. (2011). The market reaction to corporate governance regulation. *Journal of Financial Economics*, *101*(2), 431-448.

Leger, L. A. (1997). UK investment trusts: performance, timing and selectivity. *Applied Economics Letters*, *4*(4), 207-210.

Li, L. (2013). TARP funds distribution and bank loan supply. *Journal of Banking & Finance*, *37*(12), 4777-4792.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 13-37.

Lizieri, C., and Satchell, S. (1997). Property company performance and real interest rates: a regime-switching approach. *Journal of Property Research*,*14*(2), 85-97.

Logan, A. (2000). The Early 1990s Small Banks Crisis: Leading Indicators. *Bank of England*, p.130-145.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature*, 13-39.

Madura, J, Tucker, A and Zarruk, E. (1992). Reaction of Bank Share Prices to the Third-World Debt Reduction Plan. *Journal of Banking & Finance*. 16, p 853-868.

Malkiel, B. G. (2007). *A Random Walk Down Wall Street: The Time-Tested Strategy for Successful Investing (Revised and Updated)*. WW Norton & Company.

Mandelker, G. (1974). Risk and return: The case of merging firms. *Journal of Financial Economics*, *1*(4), 303-335.

Markowitz, H. (1952). Portfolio selection. *The journal of finance*, *7*(1), 77-91.

Mergner, S. and Bulla, J., 2008. Time-varying beta risk of Pan-European industry portfolios: A comparison of alternative modelling techniques. *The European Journal of Finance*, *14*(8), pp.771-802.

Merton, R. C. (1972). An analytic derivation of the efficient portfolio frontier. *Journal of financial and quantitative analysis*, *7*(4), 1851-1872.

Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance*, *29*(2), 449-470.

Minsky, H. (1992). The Financial Instability Hypothesis. *Working Paper. 74*, p 1-9.

Minsky, H.P., (1977). The financial instability hypothesis: an interpretation of Keynes and an alternative to "standard" theory. *Challenge*, *20*(1), pp.20-27.

Miyajima, H. and Yafeh, Y. (2007). Japan's banking crisis: An event-study perspective. *Journal of Banking & Finance*, *31*(9), 2866-2885.

Molyneux, P. and Forbes, W. (1995). Market structure and performance in European banking. *Applied Economics*, *27*(2), 155-159.

Molyneux, P., Altunbaş, Y., and Gardener, E. P. (1996). *Efficiency in European banking*. John Wiley & Sons.

Molyneux, P., and Thornton, J. (1992). Determinants of European bank profitability: A note. *Journal of Banking & Finance*, *16*(6), 1173-1178.

Mora, N., and Logan, A. (2012). Shocks to bank capital: evidence from UK banks at home and away. *Applied Economics*, *44*(9), 1103-1119.

Moreno, R. (1998). What caused East Asia's financial crisis? *FRBSF Economic Letter*, (Aug 7).

Moshirian, F. (2011). The global financial crisis and the evolution of markets, institutions and regulation. *Journal of Banking & Finance*, *35*(3), 502-511.

Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica*, *34*, 768-783

Musumeci, J and Sinkey Jr, J. (1990). The International Debt Crisis, Investor Contaigon, and Bank Security Returns in 1987: The Brazilian Experience. *Journal of Money, Credit and Banking*. 22 (2), p 209-220.

Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. *Econometrica: Journal of the Econometric Society*, 347-370.

Norden, L., Roosenboom, P., and Wang, T. (2011). The impact of government intervention in banks on corporate borrowers' stock returns. *Journal of Financial and Quantitative Analysis*, 1-54.

Ortas, E., and Moneva, J. M. (2013). The Clean Techs equity indexes at stake: Risk and return dynamics analysis. *Energy*, *57*, 259-269.

Pallage, S.J., (1991). An econometric study of the Belgian banking sector in terms of scale and scope economies. *Cahiers Economiques de Bruxelles,130*(2), pp.125-143.

Pan, M, Fok, R and Liu, Y. (2007). Dynamic Linkages between Exchange Rates and Stock Prices: Evidence from East Asian Markets. *International Review of Economics and Finance*. 16, p 503-520.

Pasiouras, F., and Kosmidou, K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance*, *21*(2), 222-237.

Pastor, M. (1989). Latin America, the Debt Crisis and the International Monetary Fund. *Latin American Perspectives. 16 (1)*, p 79-110.

Patell, J. M. (1976). Corporate forecasts of earnings per share and stock price behavior: Empirical test. *Journal of accounting research*, 246-276.

Radelet, S. and Sachs, J. (1998). The onset of the East Asian currency crisis.*NBER Working Paper, 6680*.

Rahim, F., Ahmad, N., and Ahmad, I. (2009). Information transmission between Islamic stock indices in South East Asia. *International Journal of Islamic and Middle Eastern Finance and Management*, *2*(1), 7-19.

Reyes, M. (1999) Size, time-varying beta, and conditional heteroscedasticity in UK stock returns, Review of Financial Economics, 8, 1–10.

Rhoades, S. A. (1977). *Structure-performance studies in banking: A summary and evaluation* (No. 92). Board of Governors of the Federal Reserve System (US).

Rhoades, S. A., and Savage, D. T. (1981). The Relative Performance of Bank-Holding Companies and Branch Banking Systems. *Journal of Economics and Business*, *33*(2), 132-141.

Sachs, J. D. and Williamson, J. (1985). External debt and macroeconomic performance in Latin America and East Asia. *Brookings Papers on Economic Activity*, *1985*(2), 523-573

Santoni, G. J. (1987). The great bull markets 1924-29 and 1982-87: speculative bubbles or economic fundamentals?. *Federal Reserve Bank of St. Louis Review*, *69*(9), 16-29.

Saporoschenko, A. (2002). The sensitivity of Japanese bank stock returns to economic factors: An examination of asset/liability differences and main bank status. *Global Finance Journal*, *13*(2), 253-270.

Saunders, A., Strock, E., and Travlos, N. G. (1990). Ownership structure, deregulation, and bank risk taking. *The Journal of Finance*, *45*(2), 643-654.

Schäfer, A., Schnabel, I. and di Mauro, B.W., (2015). Financial Sector Reform after the Subprime Crisis: Has Anything Happened? *Review of Finance*.

Scheinkman, J. A. and LeBaron, B. (1989). Nonlinear dynamics and stock returns. *Journal of Business*, 311-337.

Schoder, S and Vankudre, P. (1986). The Market for Bank Stocks and Banks' Disclosure of Cross-Border Exposure. *Studies in Banking and Finance. 3*, p 179-202.

Schwert, G. W. (1981). Using financial data to measure effects of regulation. *Journal of law and Economics*, 121-158.

Schwert, G. W., and Seguin, P. J. (1990). Heteroskedasticity in stock returns.*the Journal of Finance*, *45*(4), 1129-1155.

Sentana, E. (1990) Quadratic ARCH models: A potential re-interpretation of ARCH models as second order Taylor approximations, Discussion paper (London School of Economics, London).

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, *19*(3), 425-442.

Shin, H. S. (2009). Reflections on Northern Rock: the bank run that heralded the global financial crisis. *The Journal of Economic Perspectives*, *23*(1), 101-120.

Short, B. K. (1979). The relation between commercial bank profit rates and banking concentration in Canada, Western Europe, and Japan. *Journal of Banking & Finance*, 3(3), 209-219.

Shrieves, R and Dahl, D. (1992). The relationship between risk and capital in commercial banks. *Journal of Banking and Finance. 16,* p439-457.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: Journal of the Econometric Society*, 1-48

Slovin, M and Jayanti, S. (1993). Bank Capital Regulation and the Valuation Effects of Latin American Debt Moratoriums. *Journal of Banking and Finance. 17,* p 159-174.

Smirlock, M and Kaufold, H. (1987). Bank Foreign Lending, Mandatory Disclosure Rules, and the Reaction of Bank Stock Prices to the Mexican Debt Crisis. *The Journal of Business*. 60 (3), p 347-364.

Smirlock, M. (1985). Evidence on the (non) relationship between concentration and profitability in banking. *Journal of money, credit and Banking*, *17*(1), 69-83.

Soedarmono, W., Machrouh, F., and Tarazi, A. (2013). Bank competition, crisis and risk taking: Evidence from emerging markets in Asia. *Journal of International Financial Markets, Institutions and Money*, *23*, 196-221.

Spiegel, M. M. and Yamori, N. (2000). The evolution of" too-big-to-fail" policy in Japan: evidence from market equity values. *Pacific Basin Working Paper Series*.

Spiegel, M. M. and Yamori, N. (2003). The impact of Japan's financial stabilization laws on bank equity values. *Journal of the Japanese and international economies*, *17*(3), 263-282.

Staikouras, C., and Wood, G. (2003, June). The determinants of bank profitability in Europe. In European Applied Business Research Conference, Venice (Vol. 913).

Stulz, R. M., Kho, B.C. and Lee, D. (2000). *US banks, crises, and bailouts: From Mexico to LTCM*(No. w7529). National Bureau of Economic Research.

Sullivan, R.J. and Spong, K.R., (2007). Manager wealth concentration, ownership structure, and risk in commercial banks. Journal of Financial Intermediation, 16(2), pp.229-248.

Sunder, S. (1980). Stationarity of market risk: Random coefficients tests for individual stocks. *The Journal of Finance*, *35*(4), 883-896.

Susmel, R., and Engle, R. F. (1994). Hourly volatility spillovers between international equity markets. Journal of International Money and Finance, 13(1), 3-25.

Tan III, J. (1998). Contagion Effects During The Asian Financial Crisis: Some Evidence From Stock Price Data. *Pacific Basin Working Paper Series*. (No. PB98-06).

Tapia, J. (2012). The ‘duty to finance’, the cost of capital and the capital structure of regulated utilities: Lessons from the UK. *Utilities Policy*, *22*, 8-21.

Taylor, L. (1986). Debt Crisis. North-South, North-North and in between. World Debt Crisis: International Lending on Trials. Cambridge: Ballinger.

Treynor, J., and Mazuy, K. (1966). Can mutual funds outguess the market. *Harvard business review*, *44*(4), 131-136.

Unal, H, Kunt, A and Leung, K. (1993). The Brady Plan, 1989 Mexican Debt-Reduction Agreement, and Bank Stock Returns in United States and Japan. *Journal of Money, Credit and Banking*. 25 (1), p 410-429.

Vander Vennet, R. (1998). Cost and profit dynamics in financial conglomerates and universal banks in Europe. *Available at SSRN 160493*.

Wagster, J. D. (1996). Impact of the 1988 Basle Accord on international banks. *Journal of Finance*, 1321-1346.

Ward, C. W., and Saunders, A. (1976). UK unit trust performance 1964–74.*Journal of Business Finance & Accounting*, *3*(4), 83-98.

Whitehead, D. D. (1977). Holding Company Power and Market Performance: A New Index of Market Concentration. Research Department, Federal Reserve Bank of Atlanta.

Wiesner, E. (1985). Latin American debt: lessons and pending issues. *The American Economic Review*, *75*(2), 191-195.

Wiggins, J. (1992) Betas in up and down markets, Financial Review, 27, 107–23.

Woodward, G. and Anderson, H. (2009) Does beta react to market conditions? Estimates of 'bull' and 'bear' betas using a nonlinear market model with an endogenous threshold parameter, Quantitative Finance, 9, 913–24.

Yamori, N. (1999). Stock market reaction to the bank liquidation in Japan: A case for the informational effect hypothesis. *Journal of Financial Services Research*, *15*(1), 57-68.

Zakoian, J. M. (1994). Threshold heteroskedastic models. *Journal of Economic Dynamics and control*, *18*(5), 931-955.

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, *57*(298), 348-368.

Zhou, J. (2013). Conditional market beta for REITs: a comparison of modelling techniques. *Economic Modelling*, 30, 196-204.

Appendix 1 - Announcements

Type	Date	Announcement
Bank of England	13/9/2007, 19/9/2007	Bank of England Capital Injection
	21/4/2008, 17/9/2008	Special Liquidity Scheme
	3/10/2008	UK long-term repo agreement
	08/10/2008	Co-ordinated central bank rate cut
	5/11/2008, 8/1/2009, 5/2/2009	Monetary policy rate cut
	6/8/2009, 7/5/2009, 5/11/2009	Quantitative Easing Extended
	19/01/2009	Bank of England Asset Purchase Program
	5/3/2009	UK Corporation bond market purchases
UK Government	24/11/2008	UK Stimulus Package
	8/10/2008	UK Credit Guarantee Scheme
	3/10/2008	Depositor Insurance
	8/10/2008	UK Bank recapitalization program
	13/10/2008, 26/2/2009, 7/3/2009	Capital injections from UK Government
	19/11/2007, 17/2/2008	Northern Rock nationalization
	19/1/2009	Further injections to RBS
	17/09/2008	Lloyds TSB and HBOS merged into LBG
US Government	18/1/2008, 24/1/2008, 29/1/2008	US Economic Stimulus Act
	14/3/2008, 6/2/2008,10/11/2008	Maiden Lane special purpose vehicles (SPVs) buying impaired assets: Bear Stearns, SPV, AIG
	3/10/2008	US Troubled Asset Relief Programme (TARP)
	14/10/2008	US temporary liquidity guarantee scheme
	28/10/2008	TARP capitalization of nine US banks
	23/11/2008,	Asset guarantees to Citi bank,
	16/1/2009	Asset guarantee to Bank of America
Federal Reserve	12/12/2007, 21/12/2007	U.S. Term auction facility
	16/9/2008	Federal Reserve maintain interest rates
	9/9/2008	Asset-Backed Commercial Paper (ABCP)
	3/3/2009	Term asset backed securities loan facility(TALF)
	18/3/2009	Purchases long-term treasuries and agency debt
European Governments	20/9/2008	Ireland Depositor Insurance
	30/9/2008	Irish Government Guarantee Scheme
	5/10/2008	German Depositor Insurance
	7/10/2008	Spain to buy impaired assets
	13/10/2008	French loans guaranteed
	4/12/2008	French stimulus plan
	14/1/2009	German pact for stability and employment
ECB	12/12//2007	ECB offer dollar funding
	3/7/2008	Policy rates increased
	15/10/2008	ECB's expansion of the collateral framework
	7/5/2009	ECB purchases covered bonds
	26/7/2012	Mario Draghi "Whatever it takes" Speech
IMFO	9/10/2008	HSBC transfer £750m from HK to UK base
	13/10/2008	Barclays reject Government bailout
	31/10/2008	Barclays raise £7.5bn from Abu Dhabi and Qatar
	19/11/2008	Iceland receive $2.1bn bailout from IMF
	2/5/2010	Greece receive €110bn bailout from EU and IMF
	29/11/2010	Ireland receive €22.5bn bailout from IMF
	4/5/2011	Portugal receive €78bn bailout package
	21/02/2012	Greece receive second bailout €130bn
	11/6/2012	Spain receive €100bn bailout from Eurozone

Appendix 1 Continued

Type	Date	Announcement
Banks	7/10/2008	Alliance & Leicester fined £7m for PPI
	5/5/2011	Lloyds set aside £3.2bn for PPI
	5/8/2011	US downgraded by S&P to AA+
	7/10/2011	Lloyds, Santander and RBS downgraded
	19/4/2012	UK downgraded by Fitch
	1/5/2012	Extra £375m and £950m for PPI set aside by Lloyds and RBS
	8/5/2012	HSBC put aside £745m for PPI
	18/5/2012	Santander rating cut
	21/6/2012	RBS, HSBC and Barclays rating cut
	27/6/2012	Barclays admit Libor scandal, fined £290m
	3/7/2012	Bob Diamond resigns Barclays CEO
	5/7/2012	Barclays downgraded

Appendix 2 – Stock Abbreviations and Total Assets

Sector	Stock Listing	Company	Total Assets (As of 2012, £m)
Banking	AL	Alliance & Leicester Plc	111,456 (2009)
	BARC	Barclays Plc	1,488,335
	BB	Bradford & Bingley Plc	49,394.6 (2009)
	BNC	Banco Santander Plc	1,031,579.3
	HBOS	HBOS Plc	719,183(2009)
	HSBA	HSBC Holdings Plc	1,657,762.6
	LLOY	Lloyds Banking Group Plc	934,221
	NRK	Northern Rock Plc	109,321 (2007)
	RBS	Royal Bank of Scotland	1,312,295
	STAN	Standard Chartered Plc	388,156.2
Finance Companies	ADN	Aberdeen Asset Management Plc	4,071.4
	BRW	Brewin Dolphin Holdings Plc	446.2
	CBG	Close Brothers Group Plc	6,355.8
	EMG	Man Group Plc	2,829.1
	FCAM	F&C Asset Management Plc	1,138.8
	IAP	ICAP Plc	81,297
	INVP	Investec Plc	51,550.4
	LSE	London Stock Exchange Group Plc	102,430
	PAG	Paragon Group of Companies Plc	10,037.1
	PFG	Provident Financial Plc	1,686.5
	RAT	Rathbone Brothers Plc	1,137.7
	SDR	Schroders Plc	14,675.1
Insurance	AV	Aviva Plc	314,467
	LGEN	Legal & General Plc	346,301
	OML	Old Mutual Plc	146,962
	PRU	Prudential Plc	307,644
	RSA	Royal Sun Alliance Group Plc	22,785
Investment Trusts	ATST	Alliance Trust Plc	3,211.49
	ASL	Aberforth Smaller Companies Trust Plc	815.4
	BNKR	Bankers Investment Trust Plc	553.2
	BRWM	BlackRock World Mining Trust Plc	1,336.2
	BSET	British Asset Trust Plc	463.1
	BTEM	British Empire Sec. & Gen. Trust Plc	820.7
	CLDN	Caledonia Investments Plc	1,269.7
	CTY	City of London Investment Trust Plc	772.8
	EDIN	Edinburgh Investment Trust Plc	1,186.6
	ELTA	Electra Private Equity Plc	1,248.7
	FEV	Fidelity European Values Plc	622.8
	FRCL	Foreign & Colonial Investment Trust Plc	2,404.2
	GSS	Genesis Emerging Market Fund Limited	691.4
	HRI	Herald Investment Trust Plc	574
	JAM	JPMorgan American Investment Trust Plc	514.9
	JII	JPMorgan Indian Investment Trust Plc	493.1
	JMG	JPMorgan Emerging Markets Inv Trust Plc	694.1
	LWDB	Law Debenture Corporation Plc	514.7
	MNKS	Monks Investment Trust Plc	1,185.5
	MRC	Mercantile Investment Trust Plc	1,297.4
	MRCH	Merchants Trust Plc	528.5
	MUT	Murray Income Trust Plc	466.3
	MYI	Murray International Trust Plc	1,358.6
	PCT	Polar Capital Technology Trust Plc	539

Appendix 2 Continued.

Sector	Stock Listing	Company	Total Assets (As of 2012, £m)
Investment Trusts Continued	PLI	Perpetual Income & Growth Invest. Trust Plc	687
	PNL	Personal Assets Trusts Plc	464.5
	RCP	RIT Capital Partners Plc	2,032
	SCIN	Scottish Investment Trusts Plc	748
	SMT	Scottish Mortgage Investment Trust Plc	2,390
	TEM	Templeton Emerging Market Inv Trust Plc	2,100.9
	TMPL	Temple Bar Investment Trust Plc	665
	TRY	TR Property Investment Trust Plc	651
	WTAN	Witan Investment Trust Plc	1,243
	WWH	Worldwide Healthcare Trust Plc	471
Real Estate	BLND	British Land Company Plc	8,158
	DJAN	Daejan Holdings Plc	1,364.9
	DLN	Derwent London Plc	2,936.4
	HMSO	Hammerson Plc	6,406.2
	LAND	Land Securities Group Plc	10,819.6
	SGRO	SEGRO Plc	4,647.4
	SHB	Shaftesbury Plc	1,855
	SVS	Savills Plc	550.7

Appendix 3

Table 2: Regulation Changes

Regulation Changes			
15/06/2000	Financial Services and Markets Act 2000	GOV	All
01/03/2001	Prudential Regime for Investment Firms	FSA	Investment Trusts
01/04/2001	Code of Market Conduct	FSA	All
01/09/2001	Financial Services Compensation Scheme	FSA	All
13/02/2002	Product Directive Implementation	FSA	Investment Trusts/Real Estates
01/01/2003	Investment companies listing and business conduct rules change	FSA	Investment Trusts/Real Estates
01/08/2003	Implementation of the UCITS Management Directive	FSA	Investment Trusts/Real Estates
01/09/2003	Implementation of Solvency I Directives For Insurers	FSA	Insurance
01/11/2003	Tier 1 Capital for banks	BIS	Banks
01/04/2004	Market Abuse Pre-Hedging Convertible and Exchangeable Bond Issues	FSA	All
01/03/2005	Market Abuse Directive	FSA	All
01/05/2005	Regulatory fees and levies 2005-06	GOV	Banks
01/06/2005	Implementation of Prospectus Directive	FSA	All
01/07/2006	Strengthening Capital Standards 2	FSA	Banks
02/10/2006	Implementation of Transparency Directive	FSA	All
01/12/2006	Prudential Changes For Insurers	PRA	Insurance
01/01/2007	Implementation of the Markets in Financial instruments Directive (MiFID)	EU	All
01/01/2007	Implementation of integrated regulatory reporting (IRR)	FSA	All
21/02/2008	The Banking (Special Provisions) Act	GOV	Banks
01/03/2008	Regulation of Covered Bonds	FSA	All
12/09/2008	FSA Introduction to short-selling ban	FSA	All
12/02/2009	The Banking Act 2009	GOV	Banks
29/04/2009	Alternative investment fund managers directive proposal	EU	Investment Trusts
13/07/2009	UCITS VI Directive	FSA	Investment Trusts/Real Estates
16/09/2009	Credit Requirements Directive (CRD) II Package Adopted By the EU	EU	Banks/Insurance

25/11/2009	Solvency II	PRA	Insurance
17/06/2010	Independent Commission creation (Vicker's)	IC	All
22/06/2010	Bank Levy Increase	GOV	Banks
26/07/2010	Basle Committee agree Leverage ratio	BIS	Banks
27/07/2010	Finance Act 2010	GOV	All
12/09/2010	Basle Tier III	BIS	Banks
29/09/2010	Establishment of the European Systemic Risk Board	EU	All
24/11/2010	Establishment of European Insurance and Occupational Pensions Authority, the EBA and the ESMA – Stress Testing	EU	All
24/11/2010	CRD III Package Adopted	PRA	Banks/Insurance
08/06/2011	Alternative Investment fund managers directive	EU	Investment Trusts
19/07/2011	Finance Act 2011	GOV	All
12/09/2011	Vicker's Report calling for financial reforms	IC	All
14/12/2011	The Investment Trust Tax Regulation	GOV	Investment Trusts/Real Estates
16/11/2011	Solvency II	PRA	Insurance
27/01/2012	UK Bank Regulation Overhaul	GOV	Banks
14/05/2012	EU Bankers' Bonus Cap Proposal	EU	Banks
17/07/2012	The Finance Act 2012 (REITs)	GOV	Real Estates
16/08/2012	European Market Infrastructure Regulation	EU	All
12/09/2012	Solvency II	PRA	Insurance
15/10/2012	Bank of England announce the creation of the Prudential Regulation Authority via Financial Services Act	PRA	All
19/12/2012	FSA gets abolished and replaced by the Financial Conduct Authority	FCA	All
27/06/2013	EU finance ministers reach agreement on the Bank Recovery and Resolution Directive	EU	Banks
01/08/2013	Implementing CRD IV	PRA	Banks/Insurance
12/12/2013	Agreement of Bank Recovery Resolution Directive (BRRD)	FCA	Banks
15/04/2014	MiFID II/MiFIR was adopted by the European Parliament	EU	All
15/05/2014	Recovery Resolution Directive (RRD)	PRA	Banks
28/11/2014	CRD IV Liquidity	PRA	Banks

GOV – Government
FSA – Financial Services Authority
FCA – Finance Conduct Authority
EU – European Union Law
PRA – Prudential Regulation Authority
BIS – Bank for International Settlements
IC – Independent Commission

Appendix 4

Table 7: Announcements for Banking Sector Robustness

Date	Announcement	Type
18/03/2009	The Turner's Review	TUR
17/06/2010	Appointing Commission	IC
18/01/2011	Vickers to break big banks	VIC
12/09/2011	Vickers Report	IC
12/11/2012	Bank reform from Vickers ring-fence	VIC
09/09/2013	Vickers call to double capital standards	VIC
13/01/2014	Banks win Basel Concession	CON
01/07/2015	Vickers reject banks concern	VIC
15/10/2015	Banks win concession	CON

CON – Concessions
IC – Independent Committee
VIC – Sir John Vickers Announcements
TUR – Turner's Review