



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA - UNIVERSITEIT VAN KAAPSTAD

Masters In Investment Management

*THE EFFECT OF FED'S QUANTITATIVE EASING POLICY ON
LISTED COMPANIES AND SECTORS IN SOUTH AFRICA*

Terry Chacha
(CHCTER001)

Prepared under the supervision of **Kanshukan Rajaratnam** and
presented to the Department of Finance and Tax in partial fulfillment
of the requirements for the award of the degree of
Masters in
Investment Management

March 2017

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

Abstract

This paper examines the effect of Quantitative Easing (QE) on listed companies and sectors in South Africa. The unconventional monetary policy carried out by the developed markets had spill over effects in emerging market economies. We focus on the policies performed by the United States. Our interest is to find out whether the QE announcements had any impact on the returns of listed companies and sectors in South Africa.

An exploratory analysis is done on the macroeconomic and financial indicators in SA to provide grounds for doing the analysis on the listed companies. This analysis shows that the exchange rate and portfolio inflows were impacted by QE. However, other local factors were in play in affecting the exchange rate. The shrinkage in the global economic activity affected the Gross Domestic Product (GDP) growth rate. The changes in inflation cannot be attributed to QE. Most of the portfolio inflows were in the bond market and since some were directed to the equity market we proceed to check whether stocks and sectors had abnormal returns as a result.

Our empirical analysis shows that only three companies had significant Cumulative Abnormal Returns (CARs) in the three phases of QE. On the sector front, nine out of the 34 sectors had significant CARs every time QE was announced. A broader classification of these sectors into industries shows that the industries represented are industrials, consumer goods, consumer services and financials. In QE1, the industrials industry and the consumer services industry had negative CARs but in QE2 and QE3, they had positive CARs. The consumer goods industry had positive CARs during the three phases of QE. This research concludes that QE1 had the greatest impact on the Johannesburg Stock Exchange (JSE) and its impact was negative. QE2 had a positive impact on the JSE since most companies and sectors had significant positive CARs. The impact of QE3 on sector abnormal returns was almost neutral.

We also provide an investment strategy on the JSE using various indices for the periods following QE2 and QE3. Out of the 14 indices used, the small caps index is given a higher weighting in both portfolios due to its low risk.

ACKNOWLEDGMENTS

I would like to express my gratitude to my supervisor Associate Professor Kanshukan Rajaratnam for the useful comments, remarks and engagement through the preparation of this thesis. I am grateful for the time and support he provided to ensure that I complete my thesis in good time.

I would also like to thank my family and friends for cheering me through the entire process. To my spouse, Peter Chacha, thank you for your unfailing support and continuous encouragement throughout my studies and through the process of writing my thesis. Finally, I would like to thank baby Kyle for being a good baby and giving me time to concentrate on my studies.

Table of Contents

1. Introduction	7
1.1 Objectives.....	7
1.2 Motivation and contribution of this research	8
1.3 Brief background on QE	9
1.4 Limitations of the study.....	14
1.5 Thesis organisation.....	15
2. Theoretical Overview of Monetary Policy	16
3. Literature Review	19
3.1 Review of Impact of QE in the US	19
3.2 Review of impact of QE in UK.....	24
3.3 Review of Impact of QE in Japan	26
3.4 Review of Impact of QE on the Euro area	27
3.5 Brief Review of Impact of QE in Emerging markets.....	28
3.6 Review of how Monetary Policy affects the Stock Market	32
3.7 Conclusion.....	34
4. Data and Descriptive Statistics	36
4.1 Data	36
4.2 Returns, Adjustments and Biases	37
4.2.1. Event Window Dummy	37
4.2.2. Possible Bias and Solutions	38
4.3 Descriptive Statistics	38
5. Methodology.....	41
5.1 Event study methodology.....	41
5.2 Portfolio Methodology	43
6. Results and Discussion	45
6.1 QE and the Macroeconomy in South Africa	45
6.2 QE and Listed Companies in South Africa	45
6.2.1. Stock-Level Analysis	45
6.2.2. Sector-Level Analysis.....	49
6.2.3. Robust Analysis	57
6.3 Investment Strategy for the JSE.....	58
6.3.1. QE2 Portfolio.....	59
6.3.2. QE3 Portfolio.....	60
7. Conclusion.....	62

References.....	65
Appendix.....	71

List of Tables

Table 1: Dates and nature of the policy announcements	12
Table 2: Summary statistics of the variables	39
Table 3: Sector summary statistics	40
Table 4: Companies with significant CARs in QE1 and QE2.....	48
Table 5 : Companies with significant CARs in QE1, QE2 and QE3.....	48
Table 6: Companies with significant CARs in QE1 and QE3.....	49
Table 7: Cumulative abnormal returns across sectors in QE1.....	50
Table 8: Cumulative abnormal returns across sectors in QE2.....	52
Table 9: Cumulative abnormal returns across sectors in QE3.....	53
Table 10: Summary of the sector results.....	54
Table 11: Benchmark portfolio.....	58
Table 12: QE2 Portfolio.....	60
Table 13: QE3 Portfolio.....	61
Table 14: Stock Names	71
Table 15: Index names	77
Table 16: Cumulative Abnormal Returns QE1 - Companies	85
Table 17: Cumulative Abnormal Returns QE2 – Companies.....	91
Table 18: Cumulative Abnormal returns QE3 – Companies.....	96
Table 19: QE1 Summary statistics.....	101
Table 20: QE2 Summary Statistics.....	102
Table 21: QE3 Summary Statistics.....	102
Table 22: QE1 CARs with extended event window	104
Table 23: QE2 CARs with extended event window	104
Table 24: QE3: CARs with extended event window	105

List of Figures

Figure 1: Federal Reserve Assets by key dates.....	11
Figure 2: Hypothetical transmission channels of QE	13
Figure 3: Event study timeline.....	42
Figure 4: SA quarterly GDP growth (%) and QE dates.....	78
Figure 5: Comparison of quarterly GDP growth for the US and SA.....	79
Figure 6: Month-on-month inflation rates (%) for SA and the US.....	80
Figure 7: Nominal exchange rate and volatility of EM currencies	81
Figure 8: Portfolio investments.....	82
Figure 9: Performance of JSE all share index and S&P 500 index	84
Figure 10: Correlations of the 10-year Treasury bond yields for SA and US	85

List of Abbreviations

BOE – Bank of England

BOJ – Bank of Japan
CARs – Cumulative Abnormal Returns
CDS – Credit Default Swaps
CRSP – Centre for Research in Security Prices
ECB – European Central Bank
EMEs – Emerging Market Economies
Fed – United States Federal Reserve Bank
FOMC – Federal Open Market Committee
FFR – Federal Funds Rate
GDP – Gross Domestic Product
GFC – Global Financial Crisis
GSE – Government Sponsored Enterprises
IMF – International Monetary Fund
JGB – Japan Government Bonds
JSE – Johannesburg Stock Exchange
LSAPs – Large Scale Asset Programmes
MBS – Mortgage Backed Securities
MOVE – Merrill Lynch Option Volatility Estimate
QE – Quantitative Easing
QE1 - Quantitative Easing 1
QE2 – Quantitative Easing 2
QE3 - Quantitative Easing 3
QMEP – Quantitative Monetary Easing Policy
SA – South Africa
SARB – South African Reserve Bank
UK – United Kingdom
US – United States
VAR – Vector Auto Regression
VIX – Volatility Index

1. Introduction

The global financial crisis (GFC) in 2007-2008 has been recorded as the worst financial crisis since the great depression. The entire financial system weakened and large financial institutions collapsed. This triggered massive bailout from national governments to avert a full-blown collapse of the global economy. In addition, central banks around the world pursued an eased monetary policy in which they cut interest rates to near zero to encourage borrowing and leveraging by the private sector. These actions were not as effective as desired. Both consumer and investor confidence continued to drop and the financial markets remained fragile and on a downward trend due to liquidity constraints and uncertainty. It is at this point that the Federal Reserve Bank (Fed) of the United States (US) began to experiment with unconventional monetary measures.

This thesis focuses on quantitative easing (QE), which is an unconventional monetary policy pursued by the Fed in the US, between 2008 and 2014. This was implemented in three phases. The QE programme was initially intended to repair financial markets and enhance liquidity operations through Large-Scale Asset Purchases (LSAPs) of Mortgage Backed Securities (MBS), agency debt, Government Sponsored Enterprises' (GSE) and treasury securities (Labonte, 2014).

The adoption of QE policy by the Fed to stimulate the US economy did not only lead to a flooding of US dollars in the world but also had spill over effects in other nations. This is largely due to globalization of financial markets (Rizky, 2015). There is a growing literature on the relationship between the Fed's QE and the performance of financial markets in emerging and developing economies (see e.g. Joyce et al., 2011; Krishnamurthy and Vissing-Jorgensen 2011; Bhattarai et al., 2015). This paper extends this literature by examining the effects of QE on emerging markets, with a case study of South Africa's listed companies. This is done by examining which sectors were adversely affected and which benefited from the different phases of QE.

1.1 Objectives

The main objective of this study is to examine the response of returns of publicly listed companies and their sectors to the announcement of QE policy. We therefore seek to answer the following questions:

- (i) What is the effect of QE policy on sector returns on the JSE?

- (ii) What would be an appropriate investment strategy for JSE sectors at a time when developed economies are using unconventional monetary policy?

To motivate our study on whether QE announcements had an impact on stock returns, we do an exploratory analysis on whether QE had any impact on the macroeconomy of SA. Establishing the nature of the relationship between the macroeconomy and the stock market is imperative to investors in understanding the stock market dynamics (Olawale et al., 2014). The data used for this analysis should be relevant in quarters during which QE was announced. Where possible we do a correlation between indicators from the USA and SA. The indicators that we use include GDP, CPI, exchange rate, portfolio investments, bond market yields and performance of the stock market indexes.

To assess how the QE policy affected listed companies and the sectors that benefited the most, we create portfolios from different companies in different sectors and observe the trends in returns across the companies and sectors. According to, Peersman and Smets (2005) sectors will be affected differently by the interest rate channel of monetary policy. They came to this conclusion by examining how different sectors were affected by surprises on monetary policy. They also found that sectors more dependent on bank funding are more affected by monetary policy (Peersman & Smets, 2005).

To answer our second question, we use the Markowitz mean-variance model to create a hypothetical portfolio using some of the indices on the JSE. Using this model, we can determine what weights one would allocate to different indices in an optimal portfolio.

1.2 Motivation and contribution of this research

South Africa was among the five countries that were listed as the fragile five. The term ‘fragile five’ was given to these countries since they were highly dependent on foreign investment to finance their growth ambitions. The other countries are Brazil, Indonesia, Turkey and India. The performance of the financial sector in these countries appears to have been influenced by QE. Several studies have been put forward to explain how QE affected the emerging markets, including the fragile five (see Bhattarai et al., 2015; Bowman, Londono & Saprizza, 2014). Most studies however, have concentrated on the impact on the macro economy and not the listed companies. Rizky (2015) is the exception to these as he examines how QE affected listed companies in Indonesia. His focus, however, is on how the listed companies changed their financial strategies. Our study looks at the direct effect of QE policy on returns of listed companies on the JSE. We are interested in both the sectors that gained and those that lost due

to QE policy. We move a step further and provide an alternative investment strategy that could be pursued in light of QE.

In addition, South Africa forms a suitable case study because it has a well-developed financial sector and is considered a regional financial hub by investors looking to diversify in Africa. South Africa is greatly integrated with the global economy. It has suffered currency volatility with a depreciation rate following the withdrawal of QE 3 (Bouraoui, 2015). This provides a suitable set up to determine the impact of all QE events on this emerging market's listed companies.

Finally, our study is among a few others using an event study approach for assessing the effect of QE on the performance of stock markets. Empirical works which show how monetary policy surprises affect stock markets are often confronted by the problem of endogeneity. This is because there is a possibility that stock market developments can cause monetary policy to react. However, Kontonikas, MacDonald and Saggi (2013) point out that when dealing with daily data within an event study, the endogeneity problem should be of less concern. This is because changes in daily asset returns will have less impact on monetary policy. This, in part, explains why this thesis adopts an event study approach.

1.3 Brief background on QE

Monetary policy refers to actions taken by national central banks to influence the supply of money and credit in the economy. This is known as conventional monetary policy. The underlying principal objective of any monetary policy is to attain price stability and to anchor expectations. Price stability in an economy enables corporations to plan their growth, invest in their business and allow the economy to grow at a balanced speed, avoiding an over or undersupply of goods and services.

Monetary policy is implemented using several conventional tools such as interest rates, open market operations and reserve ratios. However, with the cut in interest rates to near zero for most developed economies, unconventional monetary instruments have become popular. One such tool put in place to tackle the impact of the GFC on the US financial markets is QE. QE is when the central bank purchases other types of financial assets from the market, for example, long-term government bonds or MBS, with the aim of increasing the number of liquid assets in the monetary base and lowering interest rates (VoxEU.org, 2016). It is used when conventional monetary policies do not work. During the period following the financial crisis,

the federal funds rate (FFR) were at zero percent and this implied it was not possible to reduce the FFR further (Gertler & Karadi, 2013).

The aim of QE is to stimulate the economic growth of a country. This can be done by purchasing assets or borrowing programs that will lead to an increase in the monetary base. Any programs aimed at improving credit conditions through increasing the monetary base can be referred to as part of QE policy (Fawley & Neely, 2013).

The first-time QE was done was in the 1930s. In April 1932, the Fed conducted large-scale open market operations but this lasted only until July 1932. Another difference to the recent experience was that the fed rate had not reached the zero-lower bound limit and most short-term rates were above 2% (Bordo, 2014). The Bank of Japan (BoJ) was the first to coin this type of monetary policy as quantitative easing in the early 2000s. The primary goal of the policy was to stimulate the economy while stimulating bank lending to fight deflation. QE's transmission channel in Japan included an asset supply channel and a monetary base channel (Voutsinas & Werner, 2011). One year later after QE had begun, BoJ staff Kimura et al., (2002) and Shirakwa (2002) found that QE was not effective and argued that no form of monetary policy was bound to be effective under zero interest rates. Following the financial crisis, the Bank of England (BoE), European Central Bank (ECB) and the Fed adopted QE. The Fed and the BoE concentrated in bond purchases while the BoJ and ECB focused on lending directly to banks.

If QE did not work in Japan, why would the US adopt the same policy? The difference in the definition of QE between the two banks may be a reason. In Japan, QE was defined as the ability of central banks to provide abundant funds (Okina & Shiratsuka, 2004). Their work analyses yield curves, spot and forward rates in which they assume that if monetary policy can successfully influence short and long-term interest rates, then it is effective. Their findings indicate that since long term yields remained low, QE could not dissipate deflationary expectations. On the other hand, Bernanke, Reinhart and Sack (2004) define QE as increasing the central bank's balance sheet. Their work measured effectiveness of the policy by its success in bringing down long-term interest rates. They found positive results for the US but negative results for Japan.

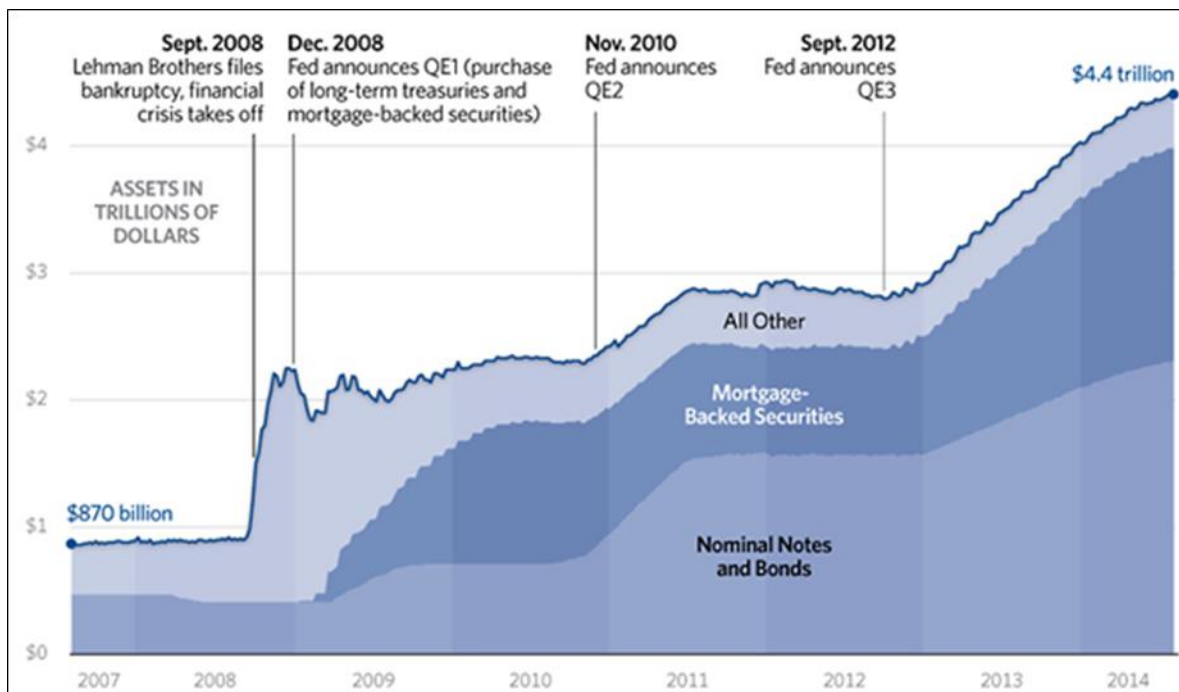
Our study concentrates on the QE done by the Fed since 2008. The first round of QE began in December 2008 and lasted until March 2010. The goal was to lower interest rates and to improve liquidity. To achieve this goal, the Fed purchased MBS worth US \$1.25 trillion, US

\$175 billion in federal agency debt and US \$300 billion of long-term treasury securities (Ricketts, 2011).

To strengthen economic recovery, QE2 began in November 2010 and up until the second quarter of 2011. The Fed hoped to lower interest rates by purchasing US \$600 billion of long-term treasury securities (Ricketts, 2011). Lowering interest rates was intended to spur consumer spending and business investments. QE2 did not fully meet its expectation for achieving the monetary policy goals. Therefore, operation twist was initiated in September 2011. Its goal was to lengthen the maturity of Fed’s treasury securities portfolio by buying long-term securities and selling an equal amount of short-term securities (Rosengren, 2015).

To support stronger economic activity, QE3 came into effect in September 2012 when the Fed increased open market operations by a further US \$40 billion, taking the total to US \$85 billion in bond purchasing per month. The end of QE3 was tied to an improvement in labour markets and achieving an inflation rate that was consistent with the Federal Open Market Committee’s (FOMC) dual mandate (Labonte, 2014). Figure 1 shows the growth of the Fed’s balance sheet by key dates while Table 1 presents the date and nature of the policy announcements.

Figure 1: Federal Reserve Assets by key dates



Source: Board of Governors of the Federal Reserve System, “Credit and liquidity programs and balance sheet: total assets of the Federal Reserve” (http://www.federalreserve.gov/mpntarypolicy/bst_recentrends.htm).

Table 1: Dates and nature of the policy announcements

Date	Announcement
December 2007 to November 2008	The Fed created emergency liquid facilities to deal with the financial crisis
November 25, 2008	Fed begins buying agency debt and MBS
December 16, 2008	Reduced Federal funds rate to a range of 0% to 0.25%
March 18, 2009	Large-scale asset purchases
August 10, 2010	Maturing assets from the asset purchases are replaced with treasury securities
August 27, 2010	Ben Bernanke's speech hints that there will be more purchases by the Fed
November 3, 2010	QE2 begins- the Fed begins to buy treasury securities worth \$600 billion for a period of eight months
August 9, 2011	Target date to keep federal funds rate exceptionally low set to mid-2-13. It was later moved to mid-2015
September 21, 2011	Operation Twist
January 25, 2012	Inflation goal is set at 2%
June 20, 2012	Extended Operation Twist
August 22, 2012	Minutes from FOMC suggested a likelihood for another round of monetary stimulus
September 13, 2012	QE3 begins
December 12, 2013	Fed announces it will continue to purchase \$45 billion of treasury securities per month
December 18, 2013	Fed announces they will begin to 'taper off'

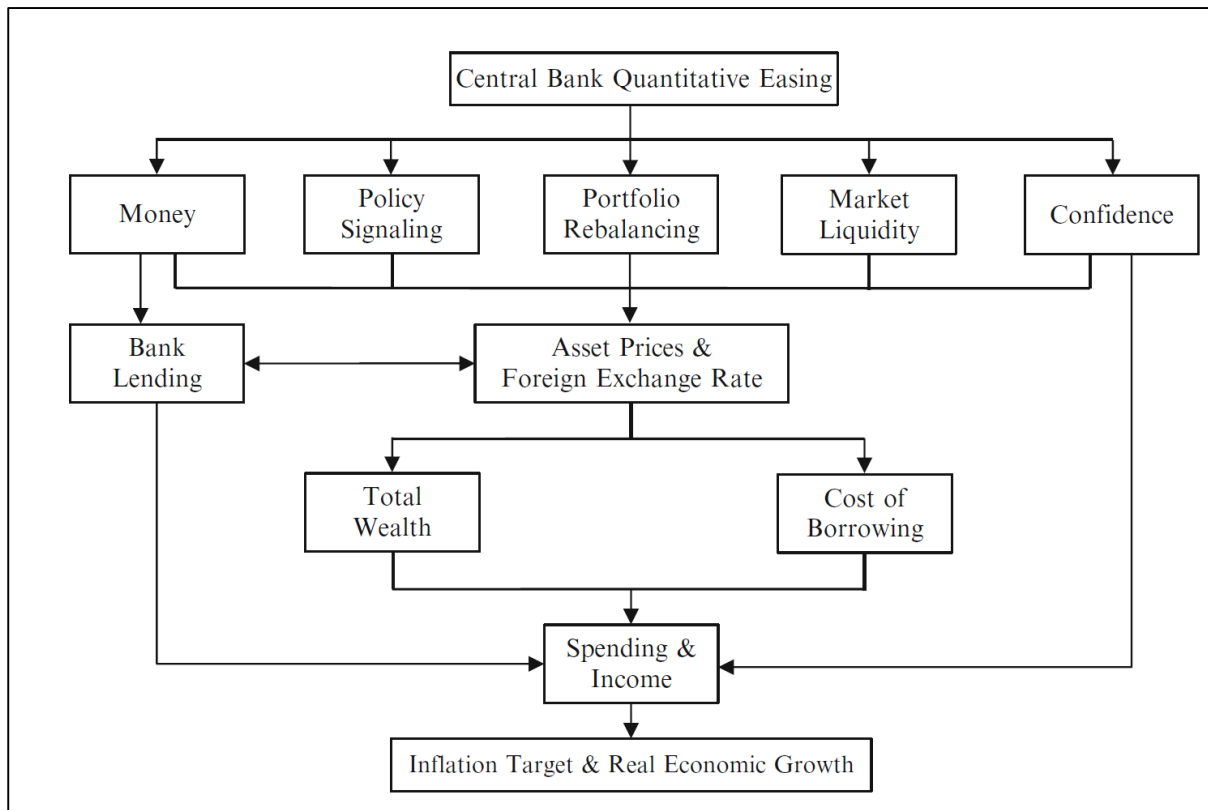
Source: Labonte, 2014:2

In a hypothetical world of perfect financial markets, the purchases done by the Fed would have had no effect on asset prices. This is because the price of an asset depends on expected future returns adjusted for risk. When inflation is very low and the Fed cannot reduce the funds rate anymore, unconventional monetary policies are used. For QE to affect long-term interest rates, forward guidance should be in place. This way, expectations for the future path for monetary policy are created.

QE affects the economy through various transmission channels. Figure 2 shows the transmission channels of QE. The most direct channel is the changes in long-term interest rates. Purchasing treasury securities in large scale by the Fed resulted in high demand for these assets, which in turn raised their prices. As the prices increased, interest rates fell and the cost of financing new capital investments to businesses decreased. For example, to boost the economy, the Fed will lower the FFR and this causes other interest rates to decline. This will boost the

value of the stock market and allow businesses and households to spend more creating more demand for goods and services.

Figure 2: Hypothetical transmission channels of QE



Source: Ncube & Hausken (2013:6)

Below is a brief discussion of the various channels:

a. Money

In the long-run, this channel is expected to affect the economy through inflation and spending. Purchasing of assets by the central bank is expected to increase broad money holdings. This should raise asset prices and lower borrowing costs, thus stimulating expenditure and increasing wealth.

Central bank asset purchases cause the banking sector to gain new reserves at the central bank. This level of new liquid assets should encourage banks to lend more to customers.

b. Policy signalling

The information that accompanied announcements of the asset purchases provided market participants with the likely path of future monetary policies.

c. Portfolio rebalancing

The portfolio-rebalancing channel implies a change in investor's portfolio composition. QE involved buying long-term securities from investors like pension funds and insurance companies. To an investor, different classes of financial assets are not perfect substitutes. This was the key premise to the portfolio-rebalancing channel and is based on ideas from monetary economists such as James Tobin, Milton Friedman, Franco Modigliani, Karl Brunner and Allan Meltzer (Bernanke, 2012). Therefore, it is expected that investors would go for other, riskier assets such as corporate bonds or shares and this would push their prices up.

This happens in three additional ways

- (i) Liquidity premium – this is the compensation investors should get for assuming the risk of potentially having to liquidate their long positions at disadvantageous prices.
- (ii) Risk premium – this is the difference between the risk-free rate and the return expected return on risky assets
- (iii) Flight to safety – in periods of market stress, investors risk aversion increases. This causes them to change their portfolio composition in search of higher risk premiums. This in turn drives down the prices of risky assets.

The above additional ways change the affect an investors choice of assets in portfolio composition.

d. Market liquidity

By purchasing long-term securities, liquidity available to investors is increased. This increased liquidity lowers the premium for illiquidity which means the function of the markets will improve and this will lead to an increase in asset prices.

e. Confidence

If the monetary policy leads to a positive economic outlook, this can boost consumer confidence and thus, the willingness of consumers to spend. This is expected to be reflected in higher asset prices.

1.4 Limitations of the study

Since we are using an event study for our empirical analysis, this means we are not able to capture any persistent effects. Testing for these effects would require a more specified econometric analysis depending on the data being used. Financial variables usually have a low

fit when it comes to fully specified econometric analysis. This would be outside the scope of our analysis.

1.5 Thesis organisation

The rest of this paper is organized as follows: Chapter two presents the theory that relates monetary policy to stock prices.

Chapter three reviews the empirical findings of the impact of QE in the US, United Kingdom (UK), Japan, Euro area and the emerging markets. This chapter also presents empirical evidence on how monetary policy affects the stock market.

Chapter four presents the data, data sources and descriptive statistics.

Chapter five discusses the methodology used.

Chapter six presents the results while chapter seven concludes.

2. Theoretical Overview of Monetary Policy

This chapter discusses the relationship between monetary policy and stock markets when conventional monetary policy is used.

Monetary policy is mostly expressed in terms of macro-economic variables such as inflation, employment and output. Interestingly, the impact of these variables is indirect. However, direct impact of monetary policy actions will be on the financial markets. There are two channels in which stock prices will be affected by monetary policy. Firstly, the interest rates channel. Interest rates influence economic activity through consumption and investment by directly affecting the demand for loans. Higher interest rates mean the cost of borrowing is high and therefore companies invest less and therefore lower economic activity. In addition, high cost of borrowing implies higher cost of capital for firms and therefore the present value of the company's future cash flows will decline, causing a negative impact on the stock price.

One of the methods of valuing a company is by calculating the present value of its discounted cash flows. Using this method, one can deduce important information on stock market effects on monetary policy changes. This method, as explained by Kontonikas and Ioannidis (2008), shows that the intrinsic stock price P_t is valued as the expected value of future expected dividends D_{t+j} of the company and terminal stock price at the last period. Assuming a constant discounting rate, the discounted cash flow method can be shown as follows:

Equation 1: Discounted Cash Flow – constant discount rate

$$P_t = E_t \left[\sum_{j=1}^N \left(\frac{1}{1+R_t} \right)^j D_{t+j} \right] + E_t \left[\left(\frac{1}{1+R_t} \right)^N P_{t+N} \right] \quad (1)$$

where: E_t is the conditional expectation operator, based on the information available up to time t , N is the number of investor's holding period, R_t is the rate of return to discount the future values.

As the stock holding periods N increases to infinity, the second term on the right-hand decreases to zero.

Equation 2: Holding a stock for long periods

$$\lim_{N \rightarrow \infty} E_t \left[\left(\frac{1}{1+R_t} \right)^N P_{t+N} \right] = 0 \quad (2)$$

The discount cash flow method can therefore be defined as follows:

Equation 3: Discounted cashflow

$$P_t = E_t \left[\sum_{j=1}^N \left(\frac{1}{1+R_t} \right)^j D_{t+j} \right] \quad (3)$$

The theory shows that the intrinsic price of a stock is determined by future cash flows and the discounting rate. Smirlock and Yawitz (1985) point out that a reduction in the company's stock price can be caused by an increase in the FFR because: (i) the discount rate R_t will rise and (ii) the expectations of future net cash flows will decrease to the degree that a decrease in monetary policy associated with a rise in the FFR will hamper real economic activity. Monetary policy can therefore affect stock price through the discounting rate that is linked to the interest rate and the future cash flows. An expansionary monetary policy will cause an increase in stock returns and this can be seen through increasing future cash flows or decreasing discount factors (Smirlock & Yawitz, 1985).

The second way monetary policy affects the stock market is through the availability of credit. This can be divided into the bank loan channel and the balance sheet channel. These channels affect the external finance premium. The bank loan channel focuses on the availability of loans. If there is a tightening of the monetary policy, then there is less credit available and economic activity slows down. The balance sheet channel focuses on the changes in the credit worthiness of firms' due to the quality of their balance sheets. A monetary tightening as measured by the balance sheet channel will cause a reduction in the revenues of firm and increase the floating rate interest payments. This will cause the net cashflows to reduce. (Kontonikas & Kostakis 2013). Higher stock prices will improve the financial position of firms and this will allow them to borrow more cheaply and easily.

The relationship between the stock market and monetary policy can either be reactive or proactive. The reactive view argues that monetary authorities should not alter interest rates in a manner to influence stock markets and avoid bubbles but they should wait and see if there are stock price reversals. A reactive approach implies that stock price change can only be inferred from actual results and not forecasts (Bernanke & Gertler, 2001). On the other hand, the proactive view proposes that to reduce macroeconomic volatility, policymakers should change interest rates in response to developing market bubbles (Kontonikas & Ionnidis, 2005).

The actions of the central bank on interest rates will affect company performance in three ways:

(1) Higher interest rates could make it difficult to expand;

(2) Cost of capital can go higher due to fluctuations in the exchange rate which makes the central bank to intervene in the currency market. This intervention can cause volatility in the stock markets;

(3) Unstable inflation will affect consumers' and suppliers' purchasing power (Rizky, 2015).

It is important for central banks and investors to be aware and understand the relationship between monetary policy and the stock market to understand the implications of policy shifts.

3. Literature Review

In this section, we look at the impact of QE in select advanced economies and emerging markets. The aim of this section is to review and critique the work that has been done on the impact of QE following several strands of literature. This is necessary to be able to establish the context of our study and the contribution to this growing literature.

3.1 Review of Impact of QE in the US

QE was aimed at improving economic activity by reducing long-term interest rates. There is empirical evidence to show that QE did in fact lower long-term interest rates (see e.g. Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen 2011; D'Amico et al., 2012). Long-term interest rates can be decomposed into two components. The first component is the expectations component that is equal to the term premium component and the second component is the average of expected future short-term interest rates. There are studies that concentrate on the impact of QE1 on long term interest rates. The first of these studies was by Gagnon et al., (2010) where they combined both time series and event study methodologies to gauge the impact of the LSAPs program. The financial variables used included 2-year and 10-year treasury bond yields, 10-year agency debt yield, the current coupon 30-year agency MBS yield, the 10-year treasury term premium, the ten-year swap rate and the BAA grade corporate bond index yield (Gagnon et al., 2011). The event study had eight episodes where the Federal Reserve made announcements for purchasing of MBS, agency debt or treasury securities.

Their study considered how interest rates responded to QE announcements using a one-day window. Their findings show that all interest rates declined. The 10-year treasury yield declined by 91 basis points, the 10-year agency debt yield declined by 156 basis points and the current coupon agency MBS yield declined by 113 basis points (Gagnon et al., 2011). In addition, they went a step further to change the parameters of the event study. Firstly, they include all the FOMC statements and minutes between November 2008 and January 2010 to allow for market expectations from the communications of the LSAPs programs. Secondly, using the same event dates, they use an expanded event window of two days to allow for lagged reactions to the news by market participants. Their results show that, using the expanded event set, the cumulative declines were between 10 basis points larger and 30 basis points smaller than with the baseline set. Using the two-day response window, the cumulative declines were between 0 to 40 basis points larger than with the one-day window (Gagnon et al., 2010).

Just like Gagnon et al., (2010), Krishnamurthy and Vissing-Jorgensen (2011) did an event study but focused on the first five event dates that Gagnon et al. used. These dates are November 25, December 1, December 16, 2008 and January 28 and March 18, 2009. They did not include the other days because the changes in yields were small. The data they used include federal funds futures contracts, the Credit Default Swaps (CDS) swap rates, inflation swap rates and the implied volatility on interest rate options (Krishnamurthy & Vissing-Jorgensen, 2011). A two-day window was used to present changes for all assets.

In general, long-term bond yields reduced during all the event dates. As discussed earlier, QE affects the economy through various channels. Krishnamurthy and Vissing-Jorgensen (2011) present their results by assessing the following channels: signalling channel, duration risk channel, inflation channel, prepayment risk channel, safety channel and liquidity channel. They argue that the duration risk premium only predicts effects that depend on bond maturity and therefore not substantial. Using QE1 dates, the signalling channel accounts for declines equivalent to almost 40 basis points. The largest effect is a fall in the 10-year agency yields by 200 basis points. Gagnon et al., (2010) also found the largest effect to be on the 10-year agency yields.

The safety channel effects are mostly accounted for using the agency and treasury yields. The prepayment risk channel accounts for a decline in agency MBS yields by 107 basis points for 30-year bonds and 88 basis points for 15-year bonds (Krishnamurthy & Vissing-Jorgensen, 2011). Lower grade corporate bonds are affected by the default risk premium. From their results, CDS rates on triple A (AAA) rated firms did not change appreciably with QE. However, largest falls in CDS rates were recorded in firms with higher credit risk. The inflation channel shows that the impact on expected inflation of the asset purchases by the Fed was large and positive. In addition, by evaluating the inflation uncertainty channel, they find that QE1 reduced inflation uncertainty.

To supplement studies done on QE1, Krishnamurthy and Vissing-Jorgensen (2011) add evidence from QE2 also by doing an event study. The event dates used here were August 10 and September 21, 2010. The data used include treasury yields, corporate bond yields, CDS rates, CDS –adjusted corporate yields, agency and agency MBS yields over the event dates. QE2 had a small effect on yields compared to the effects on QE1. This makes it difficult to determine which channels QE2 worked through. Through the signalling channel, 5-year bonds were lowered by 11 basis points while 10-year bonds were lowered by seven basis points. Using

the safety channel, yields on low-default-risk 10-year bonds were lowered by six basis points. They also found evidence of an increase in inflation expectations. However, no evidence is found on the prepayment risk channel and this is because QE2 did not involve MBS purchases. There is also no evidence on the liquidity channel and credit risk channel.

Adding to the literature on which transmission channels QE affects long term-interest rates, D'Amico et al., (2012) identified three channels, namely, scarcity channel, duration channel and signalling channel. Their paper also seeks to clarify the role of LSAPs on monetary policy strategy. The scarcity channel is associated with the preferred habitat theory and is defined as “a mechanism under which the purchase by the Federal Reserve of assets with specific maturity leads to higher prices (and lower yields) of securities with similar maturities” (D'Amico et al., 2012:2). This channel is identified through looking at the maturity of different treasury securities relative to total treasury debt. The duration channel is defined as “a mechanism under which the removal, by means of the Federal Reserve purchases, of aggregate duration from outstanding stock of treasury debt reduces term premiums on securities across maturities” (D'Amico et al., 2012:2). This channel is closely associated to the portfolio rebalance channel. The signalling channel was felt through the expectations of the market on the short-term policy rate.

The data used in their study is security-specific in that they use the identification number on the issued treasury security. They also use the amount held in the Federal Reserve's System Open Market Account portfolio and the cumulative amount of any treasury buyback. Both results from the scarcity and duration channels are statistically significant. Taking scarcity and duration channels together, QE1 reduced longer-term yields by around 35 basis points. The second LSAP program however, had a smaller impact on duration despite being larger in dollar amount. The long-term treasury yields were reduced by 45 basis points. However, there was no evidence to ascertain the signalling channel (D'Amico et al., 2012).

Some of the studies have focused on the impact of QE on the macro economy. However, there have been criticisms as to whether the LSAPs program would have any effect on the real economy. This is based on New Keynesian model. Eggertsson and Woodford (2003) argue that if arbitrage opportunities were available to market participants, the asset purchases would have no effect on real economic outcomes. To extend this criticism, Curdia and Woodford (2011) argue that if households perceive that assets purchased are equivalent to reserves, then the

LSAPs program would have no effect on the macro economy. Such criticisms have extended to difficulty in empirically evaluating the impact of QE on the macro economy.

The data required to do such an evaluation would include real GDP per capita, hours worked, real wages, core personal consumption expenditures deflator, nominal effective Federal funds rate and the 10-year treasury constant maturity yield (Chen et al.,2012). Using the data mentioned above, Chen et al. (2012) concentrate on QE2 to assess the effects of asset purchase programs on variables such as GDP growth and inflation. They estimate a dynamic stochastic general equilibrium (DSGE) model with segmented markets. This model allows them to evaluate the extent of criticisms mentioned above.

Their results indicate that the effects of GDP growth and inflation are almost negligible but the impact on GDP level is long-run. Their results are consistent with other work from Chung et al., (2011) who find that QE2 caused a reduction in the risk premium of only 20 basis points but increased the level of GDP by around 0.6% and the inflation rate by 0.1%. Different to using the DSGE model, Baumeister and Benati (2011) use a Vector Auto Regression model (VAR) with time-varying coefficients and their results indicate a change in the term premium of 60 basis points, increase in GDP growth of 3% and inflation by 1%. Chen et al., (2012) conclude that the quantitative relevance of the asset programs appears to be limited. Weale and Wieladek (2014) also use structural VAR and include asset purchases announcement. They find that QE1 increased GDP by 0.7% in the USA and 2.5% in the UK; inflation increased by 0.8% in the USA and 4.2% in the UK.

Wu and Xia (2016) use statistical model to compute a shadow rate from forward rates and treasuries that applies when the rates are reserved at the zero-lower bound. They also find that the macroeconomic effects of QE using this shadow rate are small. The unconventional monetary policy during 2009 – 2013 only reduced employment by 1% by December 2013.

Yu (2016) finds that the maturity extension programme carried out on QE had some effect on firm behaviour. His findings indicate that firms that were more dependent on long-term debt issued more long-term debt following operation twist to fund more capital investment.

The last strand of literature has focused on the portfolio balance channel. For this channel to work, long-term debt in the financial market should clearly be identified. Most of the funds the central bank borrowed were from either insurance companies or pension funds. So, if the portfolio channel was to work, the greatest effect would have been seen from investors in these companies. However, most work done on the portfolio rebalance channel has been on how it

affected the behaviour of government bond prices and other asset prices but not on how investors behaved.

Not much has been done empirically to examine the validity of the portfolio balancing channel away from the zero-lower bound. Therefore, from this literature, it would be hard to analyse whether any imperfections in balance sheet dynamics and financial channels are mirrored. Igan, Simone and Tamirisa (2016) evaluate how the balance sheet channel works as a mechanism to transmit monetary policy in the US. They use data from financial intermediaries, households and non-financial firms. These data helped them to evaluate how balance sheets are affected by interest rate changes and if there is a role played by financial frictions channels in transmitting monetary policy to the broader economy. Using a Factor-Augmented Vector Regression to look at the effects of 100 basis points increase in federal funds rate, their results show that house prices, residential investment and the balance sheets of mortgage lenders are affected minimally.

Monetary policy shocks will have an impact on how the portfolio balance sheet channel works. In evaluating how the portfolio balance sheet channel affects the balance sheet of households, Beckworth and Hendrickson (2014) find that monetary policy shocks cause a rebalancing of portfolios which is consistent with the transmission mechanism outlined by the channel. A monetary policy shock due to monetary easing will cause a shift in portfolio composition out of equities and into bonds and this represents a negative conditional correlation between flows in equities and bonds and the benefits of diversification.

Carpenter et al., (2015) assess how portfolios belonging to investors that sold securities to the Fed changed after the sales. They use these investors and divide them into eight different categories. These categories include rest of the world, depository institutions, insurance companies, investment funds, pension and retirement funds, state and local governments, broker-dealers and households (Carpenter et al., 2015). The data they used begin from 1991: Q1 and ends in 2012: Q3.

Their results suggest that sales to the Fed by the investors was not uniform. The largest seller of treasury securities to the Fed were hedge funds, broker-dealers and insurance companies. Households, investment companies, and to a lesser extent, pension funds are the largest seller of MBS when the Fed buys (Carpenter et al., 2015). Selling to the Fed prompted households to shift their portfolios toward corporate bonds, commercial paper and municipal loans and debt. Additionally, sales of MBS to the Federal Reserve by pension funds caused households

to shift their portfolios towards short-term assets (Carpenter et al., 2015). They also find evidence to support purchase of other assets by investors putting downward pressure on market rates.

Montecino and Eipsten (2015) use household data from the Federal Reserve's Survey of Consumer Finances to identify the key channels of the impact of QE on income distribution. They find that due to the large impact on equity prices increase, inequality also increased. However, QE had small impact on reducing inequality through employment generation and mortgage refinancing.

Montecino and Eipsten (2015) go a step further to investigate how the financial market reacts to QE announcements. They perform event-style regressions using daily stock return data obtained from Centre for Research in Security Prices (CRSP) in which they are able to assess whether a portfolio attained abnormal returns following a market event. They assess which business sectors lost or gained due to QE announcements. Their findings indicate that for QE1, investors' expectations were widely distributed; large financial firms benefited as did other key business sectors like autos, energy and construction. For QE2 most firms were expected to benefit while in QE3, only a few firms were expected to benefit.

3.2 Review of impact of QE in UK

QE in the UK was also expected to work through the portfolio-rebalancing channel. Not much work has been done to find the impact of QE in the UK compared to the USA. Studies done on the impact of QE on financial markets are in consensus that QE reduced bond yields. The impact on the real economy however, is not clear.

One of the earliest studies on the impact of QE in the UK was by Joyce et al., (2011). They investigate the impact of QE on financial markets. They find that the asset purchases of £200 billion in QE1 may have depressed medium to long-term yields by 100 basis points and the largest impact came through the portfolio balance approach. However, they find that the impact on other assets is affected by other influences.

Breedon, Chadha and Waters (2012) measure the impact of the initial QE programme (2009-2010) on bonds and other assets. They construct a counterfactual yield curve that is able to represent the QE period using actual estimates from the government liability curve. They find that the portfolio-rebalancing channel worked to lower bond yields by around 50 basis points. They use an event study to assess how market liquidity was impacted. They find that there is a significant price difference in bond prices on the day of the QE operation. However, on the

equity market, results suggest that there was little QE effect. This could be ascribed to the fact that since equities have long duration the reduction in duration risk from QE did not flow through to equities. They conclude that QEs impact on market liquidity was mostly in the bond market.

Bridges and Thomas (2012) believe that if QE had not been undertaken between March 2009 and January 2010, the level of inflation would have fallen to negative and real GDP would have fallen to levels lower than those reached in 2009. They use a monetarist framework to find the impact of QE in the UK. This kind of approach focuses on the macroeconomic effects of the supply of money from the central bank. To estimate the impact of QE, they create a framework that considers the supply and demand for money. This approach shows how the portfolio rebalancing channel induced QE and the subsequent impact on the broader economy. In other studies, the role of asset quantities and the money supply in QE transmission is in the background. Bridges and Thomas (2012) also consider how the sectoral pattern of money holdings and spending evolves as QE unfolds.

These researchers find that QE boosted broad money supply by £122 billion (8%). This estimate is then applied to the models and shows that such an increase could have pushed down yields by around 150 basis points in 2012 and increased asset values by 20% (Bridges & Thomas, 2012). This then stimulated demand and there was a positive effect on the level of GDP of around 1.5% and on inflation of 1.25 percentage points. They do however, caution that their results are subject to uncertainty.

Most studies done on the portfolio-rebalancing channel have inferred its importance from the behaviour of government bond yields but not from direct evidence on the investors behaviour. Joyce, Liu and Tonks (2014) try to fill this gap by evaluating how QE affected the investment behaviour of insurance companies and pension funds. This is the group of investors that the BoE purchased government bonds from. They ask the question, would the investment behaviour of these investors change if QE policy was not in place? If QE worked through this channel, did these investors reduce the holdings of UK government bonds and increase their holdings to riskier assets like equities? To answer this question, it is important to consider other factors that could have been present in driving portfolio allocation. Joyce, Liu and Tonks (2014) consider factors that cannot be affected by bank's purchases but influence portfolio allocation. These factors are gilt issuance by the Debt Management Office and foreign financial variables (Joyce, Liu and Tonks, 2014).

Their results indicate that QE led institutional investors to reinvest their proceeds from gilt holdings into corporate bonds. In addition, during the period of QE purchases the investors sold equities limiting portfolio reallocation to corporate bonds.

3.3 Review of Impact of QE in Japan

Despite evidence of the success of QE in UK and US, the story in Japan has been different. There has been consensus by analysts that QE failed in stimulating aggregate demand sufficiently to overcome deflation. It is possible that QE provided little stimulus but these positive effects could have been outweighed by contractionary forces in Japan's post-bubble economy (Bowman, Londono & Sapriza, 2015).

Studies on the impact of QE in Japan have attempted to assess the channels through which QE has worked. These channels include the impact on the current account balance, expectations of market participants and increased central bank purchases of long-term Japanese government bonds (JGB) that would reduce long-term interest rates. To extract the effects of QE, most of the studies done have used JGB yields or yen-swap interest rates to decompose the yield curve.

The BOJ made a commitment to keep the policy rate at zero if the economy was experiencing deflation. Oda and Ueda (2005) use a macro-finance, no arbitrage model of the term structure to model a counter-factual to estimate the effects of this commitment. The use of the macro-finance approach enabled them to use financial and macroeconomic data to be able to effectively analyse how long-term interest rates are affected by monetary policy and the economic structure.

To find the impact of QE through the current account balance channel, Oda and Ueda (2005) find the increase in the current account to be small but statistically significant. By keeping the interest rates at zero percent, the short and medium-term maturities were lowered. This shows the expectations component of the yield curve was achieved. However, the commitment did not lower the risk premium component. Their finding indicates that purchasing long-term government bonds did not lead to a portfolio rebalancing. Their results also suggest that by raising the reserve target the market interpreted this as a positive signal on the willingness of BOJ to continue with QE.

Market perceptions on the stance the central bank takes on monetary policy are very important. This is another channel where the real effects of QE could have been felt. Kobayashi, Spiegel and Yamoshi (2006) examine the insights of the market regarding the BOJ supporting the banking sector. The period under study is March 2001 to end of 2004 where they identify 10

dates related to announcements regarding changes in the QE policy (Kobayashi, Spiegel & Yamoshi, 2006).

It is assumed that Japanese industries and firms dependent on troubled banks were expected to benefit from QE. Kobayashi, Spiegel and Yamoshi (2006) find evidence to support this notion. They also find that when QE policies were aimed at flattening the yield curve, statistically significant positive returns were reported in the banking system. Policies aimed at flattening the yield curve include the increases in purchases of JGBs (Kobayashi, Spiegel & Yamoshi, 2006). However, there were no abnormal returns on Japanese stock equities since increases in the current account were not because of increases in the bond purchases.

QE could have lowered expected future interest rates and nominal longer-term rates while increasing expected inflation. Findings from Baba et al., (2005) suggest that the introduction of the QE policy caused a reduction in the variance of deposit rates across banks, more than the decline expected in the variance of bank credit ratings.

QE could have operated through the credit channel which means increasing the liquidity of banks so that they are able to provide more loans to borrowers. Ugai (2007) finds mixed results on the impact of QE in Japan. He finds evidence that suggests that through the signalling channel of QE interest rates were expected to remain but finds that bond yields were not directly impacted by QE. However, Bernanke, Reinhart & Sack (2004) find that Japanese yields were roughly 50 basis points lower than expected during the QE period.

3.4 Review of Impact of QE on the Euro area

The impact of QE in Europe has also been quite different mostly due to the difference in the structure of its financial system. Researchers have argued that QE is expected to have little direct effect on the economy. This is because at the announcement of QE, January 2015, the financial conditions in Europe were stable and yields and spreads were already compressed. These factors limit the effectiveness of QE. There have also been concerns regarding how QE will influence the markets. For example, there would be insufficient liquidity in the market for the programme to have any effect. Side effects would increase risk to financial stability or worsen income inequality. Another concern was that the risk sharing arrangements could exert pressures on the euro area solidarity if a member state declared bankruptcy. However, none of these concerns has materialised.

The same channels of transmission are expected to work in the euro area. These are portfolio-rebalancing channel, signalling channel and bank lending channel. Most studies have focused

on the channels where QE is expected to work and what lessons can be learned from the USA and UK. In general, QE in the euro zone has had a much smaller effect on bond yields for the core member states and greater impact on the periphery states.

Altavilla, Carboni & Motto (2015) evaluate the effects on the asset prices of the ECB purchase programme. Even though the programme was announced at a time when financial conditions were stable, the purchases had significant effects on asset prices. Their findings suggest that the ECB programme was able to reduce the 10-year long-term yields by around 30-50 basis points and roughly twice as much for countries such as Italy and Spain. For the 20-year yields, the German yields reduced by 30 basis points while in Spain they reduced by 80 basis points. The authors show that the reason why QE worked, despite stable financial conditions, is that assets which were targeted by the ECB were the ones with long maturity, causing a change in the investment grade space. This supports the duration and credit channels. In addition, there were spill-overs in non-targeted assets. For instance, the authors find that there is a decline by about 20 basis points in the spread between the risk-free rate and the non-targeted bonds for the corporations in the euro area.

3.5 Brief Review of Impact of QE in Emerging markets

The increase in globalisation means that the changes in monetary policy of the developed economies will have an impact globally. In theory, the main source of influence the US monetary policy has on emerging markets is through emerging market debt. An increase in the US federal funds rate will cause an increase in the domestic interest rates of emerging markets and therefore increase debt-service costs. The IMF (2013) suggested that the unconventional monetary policy measures would have financial spill overs when the policies change the monetary framework. The impact to other countries depends on the stability of the country's financial system.

The transmission channels of QE to emerging markets are the portfolio balance channel, signalling channel, exchange rate channel and trade-flow channel. Purchasing the longer duration assets compresses the term premium in these assets leading to an increase in demand for substitute assets. Emerging market assets fall under substitute assets. These substitute assets will have higher risk adjusted returns. As investors move to these riskier assets their risk premiums will be lowered boosting the prices for assets. For emerging markets, an increase in price will cause a decrease in yields leading to an easing in financial conditions in the economy. In addition, if future policy rates were kept lower than previously expected, there would be

larger interest rate differentials with respect to EMEs, which could prompt carry trades and capital flows to EMEs. Portfolio flows could result in a depreciation of the US dollar, which in turn could compress the demand for foreign-produced goods and services, and this would affect emerging market exports negatively (Lavigne, Sarker & Vasistha, 2014).

Most of the literature done on emerging markets has focused on the impact of QE on capital flows, exchange rates, long-term bond yields and the stock market. Hausman and Wongswan (2011) analyse the impact of the US monetary policy announcement surprises on foreign equity indexes, short-and-long-term interest rates and exchange rates in 49 countries (Hausman & Wongswan, 2011). For the monetary policy surprise two proxies are used. These are: a target surprise which is the surprise change to the current target federal funds rate and a path surprise which is the revision to the expected path of future monetary policy (Hausman & Wongswan, 2011).

Hausman and Wongswan (2011) results indicate that asset classes respond differently to monetary policy surprise mechanism. For example, global equity indexes respond mainly to target surprise; exchange rates and long-term interest rates respond to the path surprise while short-term interest rates respond to both surprises. They also find that asset price responses to FOMC announcements are related to a country's exchange rate regime. If a country has a more flexible exchange rate regime, equity indexes and interest rates do not respond significantly to US monetary surprises (Hausman & Wongswan, 2011).

In their paper, on the International Spill overs of US Quantitative Easing, Fratzscher, Lo Duca and Straub (2016) analyse the effects of the Federal Reserve's unconventional policies on the US and several foreign financial markets. They investigated the effects of QE1 and QE2 on global asset prices and capital flows using data from daily portfolio flows into bonds and equity mutual funds taken from the perspective of a US investor.

Their findings indicated that the changes in the US monetary policy led to a portfolio re-allocation and global financial markets experienced a re-pricing. They find that QE1 improved both US equity and bond prices and led to US dollar appreciation. On the contrary, QE2 led to a US dollar depreciation and the improvement in global equity prices. A portfolio rebalancing occurred in QE1 with target being riskier markets in US equity. However, QE2 and QE3 saw inflows into emerging markets (Fratzcher, Lo Duca & Straub, 2016).

In another study, Burns et al., (2014) examine the implication of QE for emerging market capital flows and crisis risks. They point out the effects that the expansionary policy has had

on markets beyond the U.S. These include a slowdown of capital inflows in developing countries; weaker portfolio investments in other markets outside of developing economies; higher risks of abrupt adjustments; abrupt changes in market expectations (increasing global bond yields); substantial expansion of domestic credit balances; deteriorating current balances; higher levels of foreign and short term debt and overvalued exchange rate.

They point out that the effects of monetary retrenchment within the US will have the greatest effect on frontier and emerging markets. This is because these countries may be forced to raise interest rates to curb rising inflation, currency depreciation and weak economic growth as capital flows take flight. The negative effects of rising international interest rates should be countered by a tighter fiscal and monetary policy (Burns et al.,2014).

Similar to the literature done on advanced economies on the impact of QE on financial markets, Bowman, Londono and Sapriza (2014) analyse the effects of QE on emerging market economies sovereign yields, foreign exchange rates and stock prices. They also analyse how these effects depend on country-specific characteristics. The data they used includes sovereign bond yields, exchange rates and headline stock indexes (Bowman, Londono & Sapriza, 2014). The country-specific variables assessed are interest rates, CDS spreads, inflation rates, current account deficits and the banking system (Bowman, Londono & Sapriza, 2014).

They find that prices of sovereign bonds respond strongly to unconventional monetary policy announcements by the Fed. They find that the shock that lower US sovereign yields also lowers yields in EMEs. In their country-specific analysis, they find that those countries with high interest rates, inflation rates, CDS spreads, current account deficits and a vulnerable banking system are more prone to changes in the US financial variables. Finally, they conclude that deteriorating financial or macroeconomic conditions in an EME could cause unexpected and unwelcome effects on asset prices due to unconventional monetary policies (Bowman, Londono & Sapriza, 2014).

Aizenman, Binici and Hutchinson (2014) analyse the impact of tapering news announcements by the Fed on emerging markets. They apply a panel framework on daily data to assess how emerging market asset prices respond to statements by the Fed. They also group the markets into those with “robust” fundamentals and those with “fragile” fundamentals. The fundamentals analysed are current account, international reserves and external debt. A country with “robust” fundamentals will have current account surpluses, high international reserves and low external debt (Aizenman, Binici & Hutchinson, 2014).

They find that emerging market stock prices and currency exchange rates decline considerably in response to the tapering news announcements. Interestingly, the currency exchange rates of the robust group were more adversely affected by the tapering news than the fragile group. However, cumulative effects of tapering news after a month appear to be similar for both groups. The fact that more financially developed economies are more impacted by tapering news, at least in the short term, shows that they are more exposed to external news announcements.

Chen, Griffoi and Sahay (2014) add to the literature on spill overs of unconventional monetary policy to emerging markets by asking three questions. Firstly, do US monetary policy shocks have significant effects on capital flows and asset price movements of emerging market economies? Secondly, do these effects differ across different phases of US monetary policy from conventional to unconventional? Finally, do the effects of US monetary shocks depend on the domestic economic conditions of EMEs?

Their results indicate that US monetary shocks do affect capital inflows and asset price movements in emerging market economies. They find that effects are stronger during the unconventional monetary policy relative to conventional monetary phase. They also find that countries with stronger fundamentals are subject to smaller spill overs. They find that the signalling channel played the leading role in transmitting monetary policy shocks.

Bhattarai, Chatterjee and Park (2015) use a Bayesian VAR model on monthly US macroeconomic and financial data to first identify the US QE shock on US output, consumer prices, long-term yields and asset prices. The data they use for this includes US treasury securities, Federal agency debt securities, real GDP, private consumption expenditure deflator, 10-year treasury yields, the S& P 500 index and nominal effective exchange rates (Bhattarai, Chatterjee & Park, 2015).

They then use this US QE shock in a monthly Bayesian panel VAR model to deduce the spill over effects on emerging markets. The data used for this includes output, prices, US dollar exchange rates, the stock market index, bond index, long-term and short-term interest rates, monetary aggregate data and trade flows data. They find that an expansionary US QE shock leads to an exchange rate appreciation, a stock market boom, an increase in capital inflows and a reduction in long-term bond yields. The impact of the nominal exchange is around 25 basis points, on stock prices around 100 basis points and on long-term yields around three basis points (Bhattarai, Chatterjee & Park, 2015). They also find that financial markets receive more

capital flows following an expansionary QE shock. However, in emerging markets, they find no significant effect on output and consumer prices.

3.6 Review of how Monetary Policy affects the Stock Market

There has been a considerable amount of research done on the impact of stock market reactions to monetary policy surprises. The studies done on the relationship between monetary policy and the stock market have used a range of empirical approaches ranging from empirical studies to vector autoregressive models. Most literature documented agrees that there is a positive reaction to expansionary monetary policy surprises. However, most of this literature is before the crisis.

Bernanke and Kuttner (2004) analyse the impact of changes in monetary policy on equity prices. The objective of their study is to measure the average reaction of the stock market to a policy change and to understand the economic sources of that reaction. They use the federal funds futures data to construct a measure of surprise rate changes (Bernanke & Kuttner, 2004).

The main finding on their paper is that policy impact on equity prices is felt through expected future excess returns or on expected future dividends. In particular, they find that while an unanticipated rate cut causes equity prices to rise immediately, this tends to be associated with long periods of lower-than-normal excess returns. Very little effect on policy can be attributed to changes in expected real interest rates. In terms of how different sectors are affected by monetary policy, they find that sectors such as energy and utilities are not significantly affected by monetary policy while telecommunications and high-tech sectors are affected as much as the broad market indices (Bernanke & Kuttner, 2005).

Kontonikas and Kostakis (2013) use a macro-based VAR approach to examine whether performance of stock portfolios during the period 1967-2007 was affected by unexpected US monetary policy actions based on their value, size and past performance. Their results show that value, small capitalization and past loser stocks are more affected by monetary policy shocks in comparison to growth, big capitalization and past winner stocks. This shows that when it comes to monetary policy transmission, the balance sheet transmission channel is important. The data they use includes FFR, inflation rate, industrial production, commodity price index and stock returns (Kontonikas & Kostakis, 2013).

Kontonikas, MacDonald and Saggi (2013) examine the impact of 189 FOMC decisions on the FFR surprises on stock returns for the period of 1989-2009 with a focus on the impact of the financial crisis. Their data thus consists of federal funds rate futures contracts. Using an event

study, their results indicate that prior to the crisis, stock prices increased because of an unexpected federal rate cut. An unexpected 1% cut in the FFR is associated with almost a 4% increase in the S&P 500 index. They further assert that in times of recession, stock market prices have larger increases when interest rate is cut. This indicates that the response of the stock market to monetary policy is asymmetrical. During the period of 2007-2009, their estimates indicate that expansionary surprises in the interest rate affected the stock market negatively. This period was characterized by a weakening financial system and monetary policy was operating at the zero-lower bound.

Unalmis and Unalmis (2015) estimate the impact of conventional and unconventional monetary policy surprises on asset markets in the US. The asset markets they assess are stock, treasury bond, corporate bond and currency markets. They use a heteroscedasticity-based General Method of Moments (GMM) technique on the following data stock market indices (Dow Jones Industrial Average, S&P 5600, NASDAQ and Wilshire 5000), treasury bond market (constant maturity rates on one, five, ten and thirty –year maturity bonds), corporate bond markets (Moody's triple A and BAA), and exchange rate market (value of dollar versus Swiss franc, Japanese yen, British pound and the Euro). They also include implied volatilities in the stock and bond markets (VIX and MOVE).

They find that monetary policy surprises have statistically significant effects on the asset markets in both periods but the magnitude of responses differs remarkably in the unconventional period. The impact of monetary policy surprises on stock returns and implied volatilities in both stock and bond markets are found to be lower in the unconventional period. For other assets, responses are found to be either similar or higher in the unconventional period.

In the Euro area, Haitsma, Unalmis and de Haan (2016) examine how stock markets respond to the policies of the ECB during the period 1999-2015. This enables them to incorporate both periods of conventional and unconventional monetary policy and crisis and non-crisis years. They examine the reaction of the Euro stoxx 50 index to monetary policy surprises and analyse the reaction of several portfolios of stocks. These portfolios are created based on firm's characteristics such as size, the free cash flow to income ratio, financial leverage ratio and the debt-to-equity ratio. They also add two stock characteristics, namely value versus growth stocks and momentum. They use market prices of futures to identify surprises in unconventional monetary policy.

They find strong effects for the unconventional monetary policy surprises. Using an event study on daily data, their results provide weak evidence for a credit channel before the financial crisis and strong evidence for the credit channel for unconventional monetary policy surprises. In addition, their results suggest that highly leveraged firms respond strongly to policy surprises and value and past loser stocks show a larger reaction to policy surprises (Haitsma, Unalmis & de Haan, 2016).

3.7 Conclusion

In the US, the estimated magnitude of how QE has affected either mortgage rates or interest rates differed greatly. It is also not clear through which channel the asset purchases have affected the long-term interest rates especially in QE2 and QE3 and therefore most literature has concentrated on the signalling channel and the portfolio rebalancing channel. However, the effectiveness of these channels is still subject to debate.

There has been little done quantitatively to analyse the interaction between forward guidance and Fed's asset purchases. Unfortunately, our work also does not include it. For the reduction of interest rates to be able to spur economic activity, this would have meant that QE policies were able to lower private borrowing costs. Most literature done on QE focuses on whether the long-term interest rates were lowered.

A challenge in comparing the results directly across the studies is prevalent since different researchers used different methodologies, data and sample periods. Other researchers have been careful to point out that their results should be taken with a grain of salt due to uncertainties in modelling.

An important theme present in most papers was analysing whether the use of unconventional monetary policies can be used in future as a tool for monetary policy. Based on the impact of portfolio rebalancing channel, most studies agree that the UMPs were effective.

Most of the literature reviewed agreed that QE led to a decrease in long term interest rates especially in developed economies. In addition, QE did not lead to currency depreciation of the developed countries. In fact, the US dollar, the British pound and the Japanese yen strengthened following major QE policy announcements.

Most of the literature reviewed for emerging markets focused on capital flows, exchange rates, long term bond yields and stock market. None of the literature focused on how QE announcements affected the different listed stocks in a particular country but mostly focused

on the stock exchange index. We choose to look at how stocks were affected by these announcements because as mentioned earlier monetary policy will affect different industries differently. From the literature reviewed, we expect to find that stocks that mostly make up the index were greatly impacted by QE.

4. Data and Descriptive Statistics

This chapter introduces the data, data sources and descriptive statistics for our study. We explain the methods used to correct and make any adjustments to the data to remove any irregularities. Using descriptive statistics, we will discuss any biases present in the financial data and what can be done to reduce the impact of the bias in line with prior literature.

Initial data capturing and handling was done in Microsoft Excel.

4.1 Data

The economic and financial indicators dataset consists of the 10-year bond for the US and SA, the stock market index, the nominal exchange rate of Rand to US\$, the quarterly GDP, portfolio investments and the monthly inflation rate. This dataset is used to assess the correlation between QE policy and movements in key macroeconomic and financial indicators in SA. Descriptive graphs and correlation matrix will be used to assess whether there is any movement on the macroeconomic indicators prompted by QE.

To examine the effect of QE policy on the JSE stock market, we use share prices and the price for the All Share Index (ALSI). The ALSI is used to capture the market return which represents 99% of the full market capitalisation value of all ordinary securities listed on the main board. For the portfolio analysis, we use the following indices: Financial and Industrial 30 (FINDI30), Resource 20 (RESI20), Financial 15 (FINI15), Industrial 25 (INDI25), Industrials (JASIN), All Share Ex Resources (JALEX), Small Caps(JSMLC), Banks (JBNKS), Mid-Caps (MIDCAP), Mining (JMNG), Gold (JGOLD) and Platinum (JPLAT). A list of the companies and the indices used can be found in Appendix A.

The JSE data was obtained from Bloomberg which is accessed from the Business Corner in The Research Wing at The Chancellor Oppenheimer Library, University of Cape Town. The frequency of the data on the share price and the index was taken daily from January 2008 to December 2014. This time horizon captures the important event dates on QE announcements. The data used for the economic and financial indicators was obtained from the IMF databank.

The JSE has over 400 listed companies. With preference to work with a balanced panel, all the companies that did not have full data for the entire period were removed. This left us with 232 listed companies. The companies are then sorted into their respective sectors. Our definition of sectors is borrowed from the Industry Classification Benchmark (ICB). The ICB provides a service to investors in quoted equity securities by grouping within homogenous subsectors. The subsectors are grouped into sectors, the sectors are grouped into super sectors which are further

aggregated into industries (FTSE, 2013). The JSE has 10 industries which are further disaggregated into 41 sectors. Since some of the sectors did not have any companies from the sample of 232 companies, the sectors used in our analysis are 34 in total.

Complete data is very important for an empirical research as it enables the researcher to get robust results. Our data is subject to the level of completeness from our data source, which is Bloomberg. We do however, have an issue with missing data points for some of the companies. Haugen and Baker (1996) propose that to deal with incomplete stock returns data, one can assign the population mean for each of the missing data points. Doing this leaves the sample open to bias because these figures could have been available during the period of the analysis and this could impact our estimates. Haugen and Baker (1996) believe that it is more appropriate to assign population means than removing the incomplete stock from the population. Each stock in our data had 1,749 observations. This gives a total of 405,768 observations for our analysis. We only had six missing data points in our data and these were therefore assigned the population mean.

4.2 Returns, Adjustments and Biases

Returns of the shares were calculated in Excel using the formula:

Equation 4: Calculation of returns

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (4)$$

where: $R_{i,t}$ is the return on the stock, $P_{i,t}$ is the current day share price, $P_{i,t-1}$ is the previous day share price.

In calculation of the returns, dividends were ignored.

4.2.1. Event Window Dummy

An event window dummy variable is an independent variable that takes on the value of 0 or 1. In our analysis we include an event dummy which distinguishes between when the QE announcement was done, by assigning it a value of one and when there was no announcement, a value of 0 is assigned. We created three dummy variables for each of the QE announcement as follows: QE1 announcement was on 25th November 2008 – qe1dum; QE2 announcement was on 27th August 2010 – qe2dum and qe3 announcement was on 22 August 2012 – qe3dum.

4.2.2. Possible Bias and Solutions

Empirical analysis that uses long periods of data are subject to various biases that can render the analysis meaningless or can lead to misleading results. Below we identify the potential biases in our analysis and what was done to minimize them.

4.2.2.1. Survivorship bias

When a database excludes several firms that have become individually inactive, Haugen and Baker (1996) suggest that this data is prone to survival bias. When an analysis is done on only firms that have survived, the results could be upwardly biased since surviving companies will look better than those that no longer exist. This will mean that parameter estimates in the database will be misleading.

To avoid this bias, we used the actual membership of the companies listed on the JSE. This includes all companies that were suspended.

4.2.2.2. Data snooping

According to Haugen and Baker (1996), data snooping occurs when researchers “(a) examine the properties of the database or the result of other studies of a database, (b) build predictive models using promising factors based in the previous results and then (c) test the power of their models on the same database” (Haugen & Baker, 1996:5). They advise that employing data from markets that have not been studied extensively or predicting by using new time periods can address this problem.

Many studies have been done using share returns on the JSE. However, this study uses an event study analysis to test for the impact of QE and this has not been done before.

4.3 Descriptive Statistics

Here we describe the basic features of our data. This helps us to gain an initial understanding of our data. Table 2 below presents the summary statistics of the variables.

Table 2: Summary statistics of the variables

Variable	Mean	Median	Std. Dev.	Min	Max	Skewness	Kurtosis	Observations
return	0,0007	0,0000	0,0395	-0,8909	6,0833	19,4045	1982,0570	N = 405768 n = 232 T = 1749
ALSI return	0,0004	0,0005	0,0132	-0,0730	0,0707	0,4203	6,9185	N = 405768 n = 232 T = 1749
S&P 500	93,7132	91,2124	22,0094	46,7488	143,4099	0,4150	2,4980	N = 405768 n = 232 T = 1749
US 10-yr bond	2,8034	2,7500	0,7183	1,4300	4,2700	0,0036	1,8448	N = 405768 n = 232 T = 1749
SA 10-yr bond	8,3855	8,4070	0,6230	6,5780	10,6450	-0,0437	3,7570	N = 405768 n = 232 T = 1749
Nominal Exch. Rate	8,4518	8,0650	1,2679	6,5686	11,5650	0,5604	2,0270	N = 405768 n = 232 T = 1749
Emerging market volatility index	11,4488	10,2200	4,3906	5,8000	32,9600	1,9721	7,6453	N = 405768 n = 232 T = 1749

Notes: Standard deviations captures the overall variation from the mean, between and within variation. Total number of companies is 232. N represents the total number of observations; n represents the number of firms while T represents the number of daily observations per firm.

The table above shows the mean, median, standard deviation, minimum, maximum, skewness and kurtosis of our variables. Our data constitute a panel of 232 companies observed for 1,749 days. The total number of observations is equal to 405,768. The standard deviation captures the variation of variables from their mean value (overall, between and within). Variation over time for a given variable is known as “within variation” and variation across firms is called the “between variation”. Individual-invariant regressors have zero between variation (Cameron & Trivedi, 2009).

The overall mean for the returns was 0.0006979 while the mean for the returns for the all share index was 0.0003902. In addition, it is possible to observe if we have any outliers in the mean returns. A general rule of thumb is that a series contains outliers if it is greater or less than the sample mean plus or minus three times the standard deviation. For example, the maximum

return in our sample is equal to 6.08, which is an outlier using this criterion. However, since our interest is to identify abnormal returns because of QE, we chose not to drop these extreme values as they may be reflecting critical information that is the focus of this study.

Table 3 below lists the summary statistics for the different sectors used in our analysis. The summary statistics were calculated using the returns for all the companies in our dataset. The mean, median, standard deviation, minimum, maximum and the number of firms are presented for each sector. Sectors like Automobiles & Parts, Leisure Goods, Personal Goods and Fixed Line Telecommunications have only one company. Companies in the mining sector have the highest mean of 0.0148435 while the company in Personal Goods has a mean of 0.

Table 3: Sector summary statistics

Sector Code	Sector name	Mean	Std. Dev	Min	Median	Max	No.Firms
570	Oil Equipment & Services	0,0017	0,0144	-0,0085	0,0017	0,0119	2
1350	Chemicals	0,0062	0,0237	-0,0321	0,0000	0,0412	7
1730	Forestry & Paper	-0,0233	0,0180	-0,0381	-0,0276	0,0000	4
1750	Industrial Metals & Mining	-0,0046	0,0125	-0,0283	-0,0048	0,0270	13
1770	Mining	0,0148	0,0459	-0,1033	0,0000	0,1429	23
2350	Construction & Materials	-0,0036	0,0107	-0,0352	0,0000	0,0101	16
2720	General Industries	-0,0242	0,0280	-0,0604	-0,0283	0,0350	9
2730	Electronic & Electrical Equipment	-0,0075	0,0191	-0,0439	-0,0027	0,0251	10
2750	Industrial Engineering	-0,0107	0,0309	-0,0419	-0,0142	0,0276	4
2770	Industrial Transportation	0,0013	0,0341	-0,0310	-0,0018	0,0656	6
2790	Support Services	-0,0009	0,0113	-0,0196	0,0000	0,0256	11
3350	Automobiles & Parts	-0,0271		-0,0271	-0,0271	-0,0271	1
3530	Beverages	-0,0017	0,0029	-0,0050	0,0000	0,0000	3
3570	Food Producers	-0,0088	0,0121	-0,0383	-0,0045	0,0000	10
3720	Construction	-0,0102	0,0144	-0,0204	-0,0102	0,0000	2
3740	Leisure Goods	-0,0185		-0,0185	-0,0185	-0,0185	1
3760	Personal Goods	0,0000		0,0000	0,0000	0,0000	1
4530	Health care Equipment & Services	-0,0284	0,0200	-0,0476	-0,0299	-0,0078	3
4570	Pharmaceuticals & Biotechnology	-0,0064	0,0499	-0,0417	-0,0064	0,0289	2
5330	Food & Drug Retailers	-0,0153	0,0094	-0,0290	-0,0114	-0,0091	4
5370	General Retailers	-0,0077	0,0200	-0,0429	0,0000	0,0465	18
5550	Media	-0,0098	0,0162	-0,0337	-0,0028	0,0000	4
5750	Travel & Leisure	-0,0011	0,0077	-0,0106	0,0000	0,0137	8
6530	Fixed-line Telecomm.	-0,0179		-0,0179	-0,0179	-0,0179	1
6570	Mobile Communications	-0,0161	0,0148	-0,0266	-0,0161	-0,0057	2
8350	Banks	-0,0149	0,0127	-0,0323	-0,0180	0,0000	7
8530	Nonlife Insurance	0,0025	0,0035	0,0000	0,0025	0,0049	2
8570	Life Insurance	-0,0127	0,0023	-0,0162	-0,0125	-0,0102	5
8630	Real Estate Investment & Services	-0,0065	0,0150	-0,0500	0,0000	0,0000	12
8670	Real Estate Investment Trusts	0,0017	0,0132	-0,0253	0,0000	0,0230	9
8770	General Financial	-0,0078	0,0117	-0,0388	-0,0020	0,0000	12
8980	Equity Investment Instruments	0,0036	0,0109	0,0000	0,0000	0,0326	9
9530	Software & Computer Services	0,0008	0,0176	-0,0237	0,0000	0,0429	9
9570	Technology Hardware & Equipment	-0,0052	0,0073	-0,0103	-0,0052	0,0000	2

5. Methodology

The semi strong form of efficient market hypothesis suggests that a company's share price reflects all the available information about the prospects of the company. This implies that the speed and the accuracy of how the information flows to market participants is important. Empirical evidence regarding the efficiency of the JSE has not been conclusive (Bonga-Bonga & Makakabule, 2010). Van Heerden et al., (2013) notes that the variation in the findings could be because the studies do not take into consideration possible nonlinear behaviour in the JSE stock indices. Using the runs tests and random walks test, Smith, Jefferis and Ryoo (2002), Magnusson and Wydick (2002) and Jefferis and Smith (2005) find the JSE to be weak-form efficient. On the contrary, Appiah-Kusi and Menyah (2003) conclude that the JSE is not weak-form efficient for the period between 1990 to 1995 but reverts to weak-form efficient from 2000 onwards. Grater and Struweg (2014) using both the Augmented Dickey-Fuller and Phillip-Perron tests find the JSE was not weak form efficient for the period between 1999 and 2014.

Using Grater and Struweg's (2014) findings, we assume that the JSE was semi strong efficient during the period 2008 -2014. To make an analysis on how an event affects stock prices, an event study analysis would be appropriate. In the section that follows we outline the procedure for an event study.

5.1 Event study methodology

The first step in an event study is to identify the event dates. The event dates we use are as defined by Montecino and Eipsten (2015). Their focus is on the initial announcement of QE which they identify as any hint that provides information on a new QE program. The reason we also focus on each QE program is because we are interested in finding out whether different QE programs had different impacts on listed companies and sectors on the JSE.

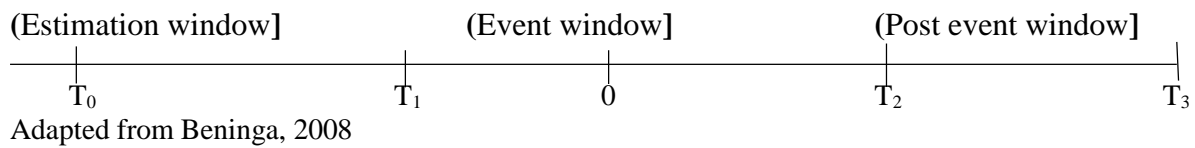
Three dates are identified. On 25 November 2008, the Federal Open Market Committee made a statement and this was identified as the first hint of QE. For QE2, Ben Bernanke's speech on August 27, 2010 is identified. Finally, the minutes released by the FOMC on August 22,2012 reflect the announcement of QE3.

The second step is to identify estimation, and event windows. The estimation window is the period before the event date over which parameters are estimated. The estimation window is used to determine the normal behaviour of stock with respect to market factors. A research meta reviewing over 400 event studies found that estimation window lengths vary from 30 to

750 days. Studies investigating the sensitivity of results suggest that results are not sensitive to varying estimation window lengths.

The event window is the period of trading days over which we calculate abnormal returns. We use data from this window in conjunction with α and β of the stock estimated over the estimation window to calculate abnormal and cumulative abnormal returns. Event windows range between 1 and 11 days and they centre around the event day (Holler, 2014). The figure below provides a summary of the event study timeline.

Figure 3: Event study timeline



We focus on the reaction of the stock prices over a narrow interval after the QE-related news (event window) is released. How large to make the event window is determined by our own judgement. If we make it too long, then there is the risk that the news could be contaminated by other news events; if we make it too short we could miss the full market reaction as it may take time for the market to evaluate the news and reflect it on the stock prices. Therefore, in our analysis we use a two-day window, but for robustness we also examine the impact using a three-day window.

The third step is to estimate the alpha(α) and betas(β) of the stocks over the estimation window. In this paper, we make use of the market model to find the expected returns. This model assumes a linear and constant relation between the individual asset returns and the returns of the market index. It theorizes that the only factor determining the return of stock i in time t , is the return of the market at time t .

Equation 5: Obtaining α and β

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + \epsilon_{i,t} \quad (10)$$

with $E[\epsilon_{i,t}] = 0$ and $VAR[\epsilon_{i,t}] = \sigma_{\epsilon_i}^2$

where t is the time index; $i=1, 2,..,N$; $R_{i,t}$ and $R_{M,t}$ are the returns on security i and the market index respectively during period t and $\epsilon_{i,t}$ is the error term for security i . This regression helps us to estimate normal performance for each company within the estimation window. The alphas

and betas obtained will be used to predict normal performance during the event window (Princeton University, 2008).

The fourth step is to measure the abnormal returns (AR) and the cumulative abnormal returns (CARs) in the event window. The abnormal return is the difference between the actual return and the predicted normal return. The predicted normal return is obtained with the estimates α_i and β_i obtained from equation (10). The cumulative abnormal return is the sum of the abnormal return over the event window. We calculate the AR for each observation in the event window. We then set the CARs to be equal to the sum of the AR for each company (Princeton University, 2008).

Equation 6: Abnormal Returns

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{M,t} \quad (11)$$

Equation 7: Cumulative Abnormal Returns - Companies

$$CAR_{i(T_1,T_2)} = \sum_{t=T_1}^{T_2} AR_{i,t} \quad (12)$$

To assess the impact of QE on the different sectors, we calculate the average of the cumulative abnormal returns in each sector.

Equation 8: Cumulative Abnormal Returns - Sectors

$$CAR_{j(T_1,T_2)} = \frac{1}{N} \sum_{i=1}^N CAR_{ij(T_1,T_2)} \quad (13)$$

where $i=1, 2, \dots, N$ are companies in sector j .

5.2 Portfolio Methodology

To create our hypothetical portfolio, we use the Solver add-in in excel. Our input in Solver is a minimization objective function subject to one constraint. The objective function is to minimize the coefficient of variation of the portfolio. The coefficient of variation (CV) measures the volatility of an investment in comparison to the expected return. The CV is calculated as follows:

Equation 9: Coefficient of variation

$$CV_p = \frac{\sigma_p}{E(R_p)} \quad (14)$$

where CV_p is the Coefficient of variation, $E(R_p)$ is the expected return of the portfolio and σ_p is the standard deviation of the portfolio.

The model used is to minimize CV subject to the portfolio weight.

Equation 10: Portfolio weight

$$\sum_1^n X_i = 1 \quad (15)$$

where X is the weight of the portfolio. This means the portfolio weights must be equal to one; n is the number of indices. The following assumptions were used:

- All optimal weightings are based on historical returns and the variation within those returns. We therefore note that past performance cannot be used as a basis for future performance.
- The average returns of each index were altered according to the abnormal returns for each QE.
- The covariance matrix was left unchanged. This is because it represents the relationship between the indices and the market for the period used in the analysis. Changing the covariance matrix means altering the details of how the indices change together and how this would relate to the market. This would have an impact on the diversification benefits of each index.

6. Results and Discussion

In this section, we present the exploratory analysis of the impact of QE on the macroeconomy and the empirical results of how QE affected different sectors. Finally, we present an investment strategy for the JSE sectors following the results of QE impact on sectors.

6.1 QE and the Macroeconomy in South Africa

The exploratory analysis on the macroeconomy shows that the slowdown in economic activity after the financial crisis caused a contraction in GDP during the quarter when QE1 was announced. For the quarters when QE2 and QE3 were announced, GDP growth rate was increasing, although at a lower rate in 2012. Global economic activity did not have much impact on inflation.

The rand is a very volatile currency so its performance can be at the mercy of global events. On average, the rand has been weakening since the financial crisis began. However, during the QE phase, there are other factors that contributed to its weakening. This included large current account deficit, weak GDP and labour unrest. The last quarter of 2008 saw a decline in portfolio investments as investors preferred to invest in safe markets due to uncertainty in global markets. This was, however, followed by inflows as they sought to benefit from higher yield in emerging markets. Most of the inflows were in the bond market. Despite capital raised in equity markets being lower than the periods before the crisis, there is still evidence to show that some of the capital inflow was in the stock markets. Detailed analysis on the macroeconomic indicators can be found in Appendix B.

6.2 QE and Listed Companies in South Africa

We will first present the broad trends in distribution of CARs across individual firms in each of the QE phase. Next, we will discuss the distribution of CARs across the sectors.

6.2.1. Stock-Level Analysis

In this section, we consider the impact of quantitative easing on individual firm stock returns. The tables with results on the stock-level analysis are in Appendix C.

On the day of QE1 announcement, 54.4 % of the companies had positive returns, 29.1% of the companies had zero returns while 16.5% had negative returns. The highest returns were recorded by SNV (Santova Ltd) with 0.4 which is in the Support Services sector. SNV is referred to as a penny stock. A penny stock is a stock which is cheap and has low market cap. Penny stocks are however very volatile.

We calculate the cumulative abnormal returns for each of the 232 companies in our dataset. We compute a test statistic to check whether the average abnormal return for each stock is statistically different from zero. We used a t-test to decide if the cumulative abnormal returns are statistically significant or not. If the calculated t-statistic is greater than 1.96 then the abnormal return for that stock is statistically significant at the 5% level.

In QE1, 29.3% (68 companies) of the companies had abnormal returns which were statistically significant with 13 companies having positive significant CARs. These companies represent 27 sectors out of the 34 sectors. Most of the companies that had significant abnormal returns were from the general retailers' sector (5370) with ten companies followed by the Support services sector (2790) with five companies.

The large number of companies with significant negative abnormal returns is consistent with what was happening in the economy since the markets were under pressure. Mining companies like Assore Ltd (ASR) and Impala Platinum Holdings benefited from the boom the resource shares had enjoyed before the financial crisis. Interest-sensitive shares like FirstRand (FSR), Putprop (PPR) and Zurich Insurance (ZSA) seem to have benefited from the low interest rate environment. Awethu Beverages (AWT) and Crookes Brother Limited (CKS) are part of consumer goods and can fall under defensive stocks which are not affected by the economic cycle. Other industrial stocks which had significant positive CARs are Cargo Carriers Ltd. (CRG), Micromega (MMG) and Reunert (RLO).

Some of the companies that had significant negative returns are large companies that are largely affected by interest rates specific to SA. These include Bidvest Group (BVT), Massmart Holdings (MSM), Shoprite Holdings (SHP), and Truworths (TRU). Old Mutual (OML) was impacted by the global financial markets due to its US Life Business. Included in the negative CARs is Steinhoff Holdings (SNH) which acts as an industrial hedge on the JSE because of its distinct global reach and its earnings and market value are not measured in rand value.

Performance of companies on the day QE2 was announced seemed to be equally distributed between zero, positive and negative returns. 36.6% of the companies had zero returns, 32.8% had negative returns while 30.6% had positive returns. The highest returns recorded on that day were from PAN (PAN African Resource) with 0.0526. PAN had recorded -0.08 on the day of QE1 announcement. SNV which had the highest returns for QE1 had -0.14286 returns on 27th August 2010.

There was a reduction in the number of companies that had significant CARs the day of QE2 announcement. Only 12.1% (28 companies) of the companies had cumulative abnormal returns that were statistically significant with 12 companies having CARs that were positive. Most of the companies were from the General Retailers sector (5370) with five companies. Consumer services and consumer goods stocks are defensive shares. Several of these had positive significant CARs. These are Tiger Brands (TBS), Clicks Food & Drug (CLS), Cullinan Holdings (CUL), Mr. Price (MRP), The Foschini Group (TFG) and Woolworths (WHL). Healthcare stocks are also categorised as defensive stocks but we find Mediclinic (MDC) with negative significant CARs. According to Advantage Asset Managers, the MDC share had lost 1.6% for a three-month period ending August 2010 (Advantage Asset Managers, 2010). Another share which is not expected to be affected by the economy is Distell (DST). This is because it is a 'sin stock' and therefore its demand, even in times of economic downturn, should be stable (Salaber, 2009).

A recovery in commodity prices between the period of 2009-2011 boosted the resources stock. Aquarius Platinum(AQP) and DRD gold (DRD) reported significant CARs. However, Village Main Reef (VIL) and ArcelorMittal SA Ltd (ACL) had significant negative CARs.

On the day of QE3 announcement, 34.1% of the companies had zero returns, 39% had negative returns while 29.9% had positive returns. The highest returns on that day were recorded by MED (Middle East Diamond Res Ltd) with 0.156. During QE1 and QE2 announcements, MED had recorded zero returns. In addition, our analysis shows that 21.6% (50 companies) of the companies had cumulative abnormal returns that were statistically significant on the day of QE3 announcement. 26% of the companies had positive significant CARs. This is an indication that by the time QE3 was being announced investors had increased their interest in the SA financial market. These companies belonged to 23 sectors of the 34 sectors in our analysis.

In 2012, commodity prices started experiencing a slowdown. This affected the resource companies on the JSE. However, companies such as Atlatsa resource group (ATL), Hwange Colliery Company (HWA), Northum Platinum Ltd (NHM), Pan African resource PLC (PAN) and Rockwell Diamonds Incor (RDI) had significant positive CARs. Despite demand for coal increasing both locally and internationally (PWC, 2012), Coal of Africa (CZA) and Wescoal Holdings Ltd. (WSL) had significant negative CARs. Other resource companies that had negative CARs are African Rainbow Metals (ARI) and Mondi (MND). As a rand-hedge stock Steinhoff (SNH) reported a positive CAR.

An analysis of the means of the CARs suggests that the greatest impacted of QE was felt in phase one. The CARs in QE1 had a mean of – 0.229159. QE2 had a positive mean of 0.0018942 while QE3 saw a slight reduction in the means to -0.0004868.

Finally, three companies seemed to experience significant CARs throughout the three phases of QE. These are Culliana Holdings Ltd (CUL), Zurich Insurance Co. (ZSA) and Nu-World Holdings (NWL). However, CUL and ZSA which had positive CARs in QE1 and QE2 had negative in QE3 while NWL which had negative CAR in QE1 and QE2 received positive CAR in QE3. Table 4, 5 and 6 shows the common companies that had significant CARs in QE1 and QE2; QE1, QE2 and QE3 and QE1 and QE3.

Table 4: Companies with significant CARs in QE1 and QE2

QE1& QE2	
Positive CARs	
Culliana Holdings Ltd	
Zurich Insurance Co SA	
Negative CARs	
African Oxygen Ltd	Rex Trueform Clothing Company
African and Overseas Enterprises Ltd	Tradehold Ltd
Nu-World Holdings Limited	Village Main Reef Ltd
Negative to Positive CAR	
Mr Price Group Limited	

Table 5 : Companies with significant CARs in QE1, QE2 and QE3

QE1& QE2 & QE3	
Positive to Negative CARs	
Culliana Holdings Ltd	
Zurich Insurance Co SA	
Negative to Positive CAR	
Nu-World Holdings Limited	

Table 6: Companies with significant CARs in QE1 and QE3

QE1& QE3
<p>Negative to Positive CAR Adrenna Prop Group Ltd Cashbuild Ltd Grindrod Ltd Iliad Africa Ltd Masonite (Africa) Limited Northam Platinum Ltd Npl Shoprite Holdings Ltd Steinhoff Int Hldgs N.V</p> <p>Negative CARs JD Group Ltd JSE Ltd Remgro Limited</p>

Table 6 above shows that most of the companies that had negative CARs in QE1 turned to have positive CARs by QE3.

6.2.2. Sector-Level Analysis

Table 7 below shows the cumulative abnormal returns for the sectors in QE1.

Table 7: Cumulative abnormal returns across sectors in QE1

Sector code	Sector name	Sector returns	CAR	t-stat
1	570 Oil Equipment & Services	0,0000	-0,2302	-2,5328**
2	1350 Chemicals	0,0026	-0,3471	-14,857***
3	1730 Forestry&Paper	0,0191	-0,3369	-4,9428***
4	1750 Industrial Metals&Mining	0,0608	0,0297	0,8078
5	1770 Mining	0,0126	1,0603	22,39***
6	2350 Construction & Materials	0,0229	-0,5720	-40,455***
7	2720 General Industries	-0,0044	-0,5245	-26,221***
8	2730 Electronic & Electrical Equipment	0,0383	-0,2683	-12,193***
9	2750 Industrial Engineering	-0,0056	-0,4828	-12,197***
10	2770 Industrial Transportation	-0,0016	-0,2747	-10,25***
11	2790 Support Services	0,0448	-0,0481	-1,0840
12	3350 Automobiles & Parts	0,0000	-0,0209	-0,6193
13	3530 Beverages	0,0172	0,1491	3,50497***
14	3570 Food Producers	0,0134	0,0935	17,3877***
15	3720 Household Goods and Home Construction	0,0093	-0,2597	-13,183***
16	3740 Leisure Goods	0,0599	-0,0713	-1,4091
17	3760 Personal Goods	-0,0204	0,0448	1,3520
18	4530 Health care Equipment & Services	0,0000	-0,2033	-6,3903***
19	4570 Pharmaceuticals & Biotechnology	0,0000	-0,1132	-6,0317***
20	5330 Food & Drug Retailers	0,0371	-0,3617	-10,523***
21	5370 General Retailers	0,0032	-0,5845	-26,006***
22	5550 Media	-0,0104	-0,1152	-2,9721***
23	5750 Travel & Leisure	0,0236	-0,1513	-7,2336***
24	6530 Fixed Line Telecommunications	0,0224	0,0066	0,5296
25	6570 Mobile Communications	0,0193	-0,1216	-2,2757**
26	8350 Banks	0,0410	-0,1868	-5,0081***
27	8530 Nonlife Insurance	0,0078	-0,0434	-5,9317***
28	8570 Life Insurance	0,0260	-0,4486	-12,509***
29	8630 Real Estate Investment & Services	0,0080	0,0628	3,36374***
30	8670 Real Estate Investment Trusts	0,0238	0,2242	12,4403***
31	8770 General Financial	0,0042	-0,2933	-7,8933***
32	8980 Equity Investment Instruments	-0,0159	-0,0305	-1,0736
33	9530 Software & Computer Services	0,0097	-0,7698	-31,862***
34	9570 Technology Hardware & Equipment	0,0527	-0,1279	-1,5006

*** p<0.01, ** p<0.05, * p<0.1

Notes: QE1 date is 25th November 2008

The t-statistics indicate that 26 out of the 34 sectors had significant abnormal returns at the 5% level. Five of these were positive while 21 were negative. In the US, the sectors that benefited from QE1 were energy, construction, auto and large financial firms. In SA, these sectors lost as reflected by the negative cumulative abnormal returns.

The JSE SA Sector categorizes listed shares into three broad categories, namely SA Resources which comprises of companies in the Oil & Gas and Basic materials sector; SA Financial which comprises of companies in the financial sector and finally SA industrial which has all the other companies that are not listed as resources or financial. Our empirical analysis suggests that most of the sectors that had significant cumulative abnormal returns are in the industrial sector.

Prior to the 2008/2009 market crash, the indices that track these sectors moved closely together. In 2008, most of the resource stocks were believed to be attractively valued compared to the industrials and financial stocks. The resources sector was benefitting from higher commodity prices and a weaker rand. The global commodities market had been experiencing a boom from the period between 2000 to around 2008 (Gruss, 2014). This was attributed to an increasing demand for commodities in the emerging markets; the role of biofuels in fuelling demand for specific food crops; slow supply responses that amplified price pressures; linkages between commodities that could have transmitted higher prices and finally low interest rates and effective dollar depreciation (Helbing, Blackman & Cheng, 2008). The banking and insurance sector in SA was not exposed to the sub-prime crisis. However, the four major banks had a rocky start as the financial crisis began. The global deleveraging process and lower financial markets caused a period of low profit growth in financial markets.

World financial markets started to recover in the first quarter of 2009 and the South African market was not left behind. The demand for commodities started plunging in 2009, weakening commodity prices and in turn affecting the resources sector. Following the decline in commodity prices, the resource shares started experiencing poor returns. On average, in August 2010, the financial sector delivered better results than industrials and the resource sector. Table 8 below shows the cumulative abnormal returns for the sectors in QE2.

Table 8: Cumulative abnormal returns across sectors in QE2

Sector Code	Sector name	Sector Returns	CARs	t-stat
1	570 Oil Equipment & Services	0,0063	-0,012	-0,0949
2	1350 Chemicals	0	-0,1292	-4,8629***
3	1730 Forestry&Paper	0,0086	0,0085	0,2645
4	1750 Industrial Metals&Mining	-0,0097	-0,0002	-0,0051
5	1770 Mining	0,0003	0,0987	0,9823
6	2350 Construction & Materials	-0,0026	0,1516	2,8962***
7	2720 General Industries	-0,0031	-0,1344	-5,0220***
8	2730 Electronic & Electrical Equipment	0,0026	-0,0164	-0,4846
9	2750 Industrial Engineering	0,0051	-0,0522	-1,124
10	2770 Industrial Transportation	0,0023	0,2155	3,1581***
11	2790 Support Services	-0,0119	-0,0359	-0,4918
12	3350 Automobiles & Parts	-0,005	-0,0347	-1,3236
13	3530 Beverages	-0,0086	-0,0564	-3,2509***
14	3570 Food Producers	0,0101	0,1061	3,7829***
15	3720 Household Goods and Home Construction	-0,0005	-0,0141	-1,1539
16	3740 Leisure Goods	-0,0018	-0,0196	-1,1121
17	3760 Personal Goods	-0,0182	-0,0166	-0,7933
18	4530 Health care Equipment & Services	-0,004	-0,0535	-0,9063
19	4570 Pharmaceuticals & Biotechnology	-0,0001	0,0137	0,6555
20	5330 Food & Drug Retailers	0,0124	0,0699	4,2202***
21	5370 General Retailers	0,007	0,1238	3,6766***
22	5550 Media	-0,0056	-0,0082	-0,3075
23	5750 Travel & Leisure	0,0012	-0,0026	-0,1681
24	6530 Fixed Line Telecommunications	0,0074	0,0296	3,0482***
25	6570 Mobile Communications	-0,0099	0,0486	0,972
26	8350 Banks	-0,0027	-0,0252	-1,2808
27	8530 Nonlife Insurance	0	-0,0053	-1,015
28	8570 Life Insurance	-0,0027	-0,0666	-2,0731**
29	8630 Real Estate Investment & Services	0,0011	-0,0822	-3,2791***
30	8670 Real Estate Investment Trusts	0,006	0,0673	4,3010***
31	8770 General Financial	0,0056	0,2924	4,6665***
32	8980 Equity Investment Instruments	-0,0206	-0,1291	-1,6346
33	9530 Software & Computer Services	-0,0039	0,0552	1,3789
34	9570 Technology Hardware & Equipment	0,0054	0,0529	1,3661

*** p<0.01, ** p<0.05, * p<0.1

Notes: QE2 was announced on 27th August 2010

On the day of QE2 announcement, only 13 sectors had significant cumulative abnormal returns, eight of these were positive while five were negative.

In 2010, South Africa hosted the FIFA World Cup. This was expected to mitigate the effects of the financial crisis. Sectors that were boosted by the World Cup included Construction & Materials, Tourism, Transport and other industries. An increase in acquisition in the mining, property and health sectors did not boost the returns in these sectors.

QE2 shows a slight increase in the number of sectors that had positive cumulative abnormal returns. This is also the case for firms and sectors in the US. This is reflecting that by the time QE2 was being announced, investors' expectations were less dispersed as to which sectors would gain or lose from QE.

Table 9 below shows the cumulative abnormal returns for the sectors in QE3.

Table 9: Cumulative abnormal returns across sectors in QE3

Sector Code	Sector name	Sector Returns	CARs	t-stat
1	570 Oil Equipment & Services	0	-0,0877	-1,4235
2	1350 Chemicals	-0,0106	-0,0859	-1,9236*
3	1730 Forestry&Paper	-0,0108	-0,1368	-6,7950***
4	1750 Industrial Metals&Mining	-0,0109	-0,3099	-9,5008***
5	1770 Mining	-0,0026	0,0374	0,3793
6	2350 Construction & Materials	0,0057	0,2303	3,0667***
7	2720 General Industries	-0,0014	-0,0458	-1,3097
8	2730 Electronic & Electrical Equipment	-0,0039	-0,2964	-5,9874***
9	2750 Industrial Engineering	-0,0055	0,0093	0,4402
10	2770 Industrial Transportation	0,015	0,1828	5,4077***
11	2790 Support Services	-0,0141	-0,0981	-1,6815*
12	3350 Automobiles & Parts	0,0222	0,116	2,7885***
13	3530 Beverages	-0,0014	0,1605	1,2194
14	3570 Food Producers	0,0014	0,0987	3,7065***
15	3720 Household Goods and Home Construction	0,0008	0,0239	4,3922***
16	3740 Leisure Goods	-0,0036	0,0037	0,1952
17	3760 Personal Goods	-0,0143	-0,0379	-2,1614**
18	4530 Health care Equipment & Services	0,0034	-0,0223	-1,141
19	4570 Pharmaceuticals & Biotechnology	0,0023	0,0022	0,0961
20	5330 Food & Drug Retailers	-0,0051	0,0968	3,6189***
21	5370 General Retailers	0,0089	0,3267	7,1969***
22	5550 Media	-0,0031	-0,0138	-0,6308
23	5750 Travel & Leisure	-0,0024	0,0194	0,8566
24	6530 Fixed Line Telecommunications	0,0047	0,0875	1,4492
25	6570 Mobile Communications	0,0049	0,1371	4,4310***
26	8350 Banks	-0,0014	-0,0987	-1,189
27	8530 Nonlife Insurance	0,0039	0,0175	1,2053
28	8570 Life Insurance	-0,004	-0,0502	-2,5958***
29	8630 Real Estate Investment & Services	0,0036	-0,1786	-4,2808***
30	8670 Real Estate Investment Trusts	0,0039	-0,0972	-2,7419***
31	8770 General Financial	-0,0037	-0,1129	-5,0029***
32	8980 Equity Investment Instruments	-0,0046	-0,1009	-4,7360***
33	9530 Software & Computer Services	-0,0071	0,1493	2,1018**
34	9570 Technology Hardware & Equipment	-0,0009	-0,0391	-2,5119**

*** p<0.01, ** p<0.05, * p<0.1

Notes: QE3 was announced on 22nd August 2012

On the day of QE3 announcement, 19 sectors had CARs that were statistically significant. Positive and significant CARs were reported in nine sectors while 10 reported negative significant CARs.

The industrial sector continued to perform well following QE3 announcement. In our analysis, apart from Personal Goods (3760), the rest of the sectors had significant CARs. The share prices of retailers such as Woolworths, Foschini and Mr. Price had risen by almost 40%. The low interest rates environment encouraged domestic spending. This can be seen in the increase in vehicle sales and retail sales (SARB, 2012). As such, retail companies had improved bottom line earnings. Since 2003, the dividend yield of retail companies had grown by about 27.1% (Kantor, 2012). Their dividend yield and growth opportunity makes them appealing in an economy plagued by low interest rates.

The commodity downward cycle continued to weigh down on earnings from resource shares. This can be seen from the negative significant CARs in Forestry & Paper (1730) and Industrial Metals & Mining (1750). The mining sector was also faced with quite a few challenges including the tragic events at Marikana and widespread labour disputes. Due to the interdependencies in the economy, the impact of the platinum strikes went through other all sectors. According to Jordaan (2016), the wholesale and retail sector lost close to R2 billion, the financial services lost almost R1.8 billion, the transport sector lost R1.6 billion, the real-estate sector lost R1.1 billion while other services lost R1.5 billion (Jordaan, 2016).

A look at the summary statistics of the CARs across the three phases of QE suggests that QE1 had the most impact. The mean of the CARs in QE1 was -0.111508, QE2 was 0.0362279 while QE3 had -0.0033881. The summary statistics are presented in Appendix D. In the US, the expected benefits of QE to sectors as measured by CARs experienced a vanishing effect as QE progressed. Monetcino and Eipsten (2015) refer to this as a ‘QE fatigue’ on the US business sectors.

Table 10: Summary of the sector results

Significance	1%	5%	10%
QE1 only	Chemicals Forestry&Paper Mining Construction & Materials General Industries	Oil Equipment & Services Mobile Communications	

Significance	1%	5%	10%
	Electronic & Electrical Equipment Industrial Engineering Industrial Transportation Beverages Food Producers Household Goods and Home Construction Health care Equipment & Services Pharmaceuticals & Biotechnology Food & Drug Retailers General Retailers Media Travel & Leisure Banks Nonlife Insurance Life Insurance Real Estate Investment & Services Real Estate Investment Trusts General Financial Software & Computer Services		
QE2 only	Chemicals Construction & Materials General Industries Industrial Transportation Beverages Food Producers Food & Drug Retailers General Retailers Fixed Line Telecommunications Real Estate Investment & Services Real Estate Investment Trusts General Financial	Life Insurance	
QE3 only	Forestry&Paper Industrial Metals&Mining Construction & Materials Electronic & Electrical Equipment Industrial Transportation Automobiles & Parts	Personal Goods Software & Computer Services Technology Hardware & Equipment	Chemicals Support Services

Significance	1%	5%	10%
QE1 & QE2	Food Producers Household Goods and Home Construction Food & Drug Retailers General Retailers Mobile Communications Life Insurance Real Estate Investment & Services Real Estate Investment Trusts General Financial Equity Investment Instruments		
QE1 & QE3	Chemicals Construction & Materials General Industries Industrial Transportation Beverages Food Producers Food & Drug Retailers General Retailers Real Estate Investment & Services Real Estate Investment Trusts General Financial		
QE2 & QE3	Forestry&Paper Construction & Materials Electronic & Electrical Equipment Industrial Transportation Food Producers Household Goods and Home Construction Food & Drug Retailers General Retailers Life Insurance Real Estate Investment & Services Real Estate Investment Trusts General Financial		
	Construction & Materials Industrial Transportation Food Producers Food & Drug Retailers		

Significance	1%	5%	10%
QE1 & QE2 & QE3	General Retailers Real Estate Investment & Services Real Estate Investment Trusts General Financial Construction & Materials Industrial Transportation Food Producers Food & Drug Retailers General Retailers Real Estate Investment & Services Real Estate Investment Trusts General Financial		

The table above shows that only eight sectors had significant CARs across the three phases of QE. Our results, both at the company and sector level, indicate that QE1 had the greatest impact. Contrary to our results, most studies show that QE1 had a positive impact on emerging market economies.

6.2.3. Robust Analysis

For sensitivity analysis, we increase the event window to three days. In addition, we regress equation (8) on a constant to obtain the average abnormal returns per sector associated with each of the QE announcements. The P-value on the constant will give the significance of the cumulative abnormal returns across all companies in a sector. This test is better than the t-test as it allows us to use robust standard errors (Princeton University, 2008), which considers any form of heteroscedasticity in the residuals from Equation (10) above. The tables for the robust analysis are presented in Appendix E.

The results for QE1 show that all the sectors that had significant CARs using two days, also have significant CARs with the expanded event window. Also, the signs did not change. Regressing equation (10) above shows that only 4 sectors had CARs that were significant. These sectors are General Industries, Food & Drug Retailers, Real Estate Investment Trust and Software & Computer Services. These sectors are also significant using equation (13) and have the same signs as results from equation (10).

In QE2, most of the sectors that had statistically significant CARs are the same as the ones with the 2-day event window. Only Construction & Materials had a different sign. Regressions based on equation (10) shows only Food & Drug Retailers had significant and abnormal returns.

The expanded event window yielded the same results in QE3 as with the 2-day event window. However, the regression analysis shows that only Forestry & Paper had significant and abnormal CARs.

In general, using equation (13) shows that our results are robust. There is little support to show robustness using equation (10).

6.3 Investment Strategy for the JSE

Here we discuss an investment for the JSE using the indices. Table 11 below shows the results for the benchmark portfolio.

Table 11: Benchmark portfolio

BENCHMARK PORTFOLIO					
	TICKER	WEIGHT	EXPECTED RETURN	STD. DEV.	BETAS
All Share Index	ALSI	72,82%	-0,10%	2,30%	
Top40	Top40	7,14%	-0,09%	2,29%	0,98
Financial and Industrial 30	FINDI30	0,00%	0,06%	0,87%	0,72
Resource 20	RESI20	1,72%	-0,06%	1,31%	1,46
Financial 15	FINI15	0,00%	0,09%	0,96%	0,68
Industrial 25	INDI25	1,53%	0,04%	0,91%	0,73
Industrials	JASIN	0,94%	0,05%	0,83%	0,67
All Share ex Resources	JALEX	0,00%	0,06%	0,79%	0,66
Small Caps	JSMLC	0,00%	0,06%	0,44%	0,25
Banks	JBNKS	3,74%	0,08%	1,25%	0,71
Mid Caps	MIDCAP	0,00%	0,06%	0,60%	0,48
Mining	JMNNG	1,32%	-0,06%	1,36%	1,49
Gold	JGOLD	10,79%	0,06%	2,25%	0,78
Platinum	JPLAT	0,00%	-0,16%	1,68%	1,34
Portfolio Return			0,00%		
Portfolio Risk			2,26%		
Coefficient of variation			-7365942204%		

Our benchmark portfolio indicates that out of the 12 indices, only eight would have weight in our portfolio. The highest percentage would be in the All Share index with 72%. The other indices included are Top40 (7%), RESI20 (1.72%), INDI25 (1.53%), JASIN (0.94%), JBNKS (3.74%), mining index (1.32%) and the gold index (10.79%). Unfortunately, the portfolio would have a zero return with a risk of 3% and a very small coefficient of variation.

Despite having negative returns and a high risk, the ALSI is the favoured index in our benchmark. This can only be attributed to diversification benefits. As noted earlier, prior to the crash, the resources, industrials and the financial indices moved in the same direction. We see this also in the way solver allocates weights in these indices. In times of uncertainty, investing in gold is a good way to diversify risk due to its strength as a traditional store of value and liquidity. Globally, gold prices dropped during the financial crisis but then went steeply higher till September 2011. Mining forms a great part of the economy in SA. As seen from our sector analysis, the mining sector had significant CAR on the day of QE announcement implying the sector was doing well in 2008. To get a better understanding of why the indices were included in the portfolio, we calculate their betas.

The reason why we calculate betas is to show the volatility of the indices in comparison to the market (ALSI). Also, beta is the only driver of returns above the risk-free rate and therefore, high beta stocks tend to be riskier but provide potential for higher returns. According to CAPM, higher expected returns should compensate for high risk. Despite having the highest return and low risk, the FINDI index is not included in the benchmark portfolio. The RESI index which has a negative return and a slightly higher risk is included. This is because of its high beta which shows potential for higher returns. This also applies for the mining index.

Our benchmark represents a hypothetical portfolio that would have been made in 2008 when QE started. Bearing in mind that QE was to continue, we look at portfolios that would have applied during QE2 and QE3. We adjust the arithmetic means based on qualitative and quantitative assumptions identified below. The quantitative assumptions made were motivated by the abnormal returns calculated on the sectors in section 6.2.2.

6.3.1. QE2 Portfolio

Global uncertainty was still present in 2010 but there had been improvements in the financial markets. Our empirical analysis shows the sectors that lost or gained on the day of the announcement. We compound these losses or gains to make the adjustments on our indices. Assumptions made on the ALSI, Small Caps, Mid-Caps and Top40 are qualitative based on financial reviews.

According to the JSE website (JSE, 2010), the ALSI had gained 13.86% during the year 2010, we therefore adjust our index by 5.6% to account for daily increase. We also increase the Top40 by 2.24%. Financial reviews done on the indices show that for the period from June 2002-2010,

the midcaps and small caps index performed better than the Top40. Therefore, we increase these indices by 2.2% and 2.7% respectively.

Table 12 below shows the results after the mean adjustments.

Table 12: QE2 Portfolio

QE2 PORTFOLIO						
		BENCHMARK	BENCHMARK	INCREASE/DEC	%	ADJUSTED
	TICKER	RETURN	WEIGHT	REASE		WEIGHT RETURNS
All Share Index	ALSI	-0,10%	72,82%	5,60%	0,00%	5,50%
Top40	Top40	-0,09%	7,14%	2,24%	0,00%	2,15%
Financial and Industrial 30	FINDI30	0,06%	0,00%	2,87%	0,00%	2,79%
Resource 20	RESI20	-0,06%	1,72%	-0,68%	0,00%	-0,77%
Financial 15	FINI15	0,09%	0,00%	0,73%	0,00%	0,61%
Industrial 25	INDI25	0,04%	1,53%	2,14%	0,00%	2,08%
Industrials	JASIN	0,05%	0,94%	2,14%	0,00%	2,07%
All Share ex Resources	JALEX	0,06%	0,00%	4,90%	20,16%	4,81%
Small Caps	JSMMLC	0,06%	0,00%	2,27%	65,44%	2,54%
Banks	JBNKS	0,08%	3,74%	2,52%	0,00%	-2,56%
Mid Caps	MIDCAP	0,06%	0,00%	2,23%	0,00%	2,11%
Mining	JMNG	-0,06%	1,32%	9,87%	14,40%	9,77%
Gold	JGOLD	0,06%	10,79%	0,02%	0,00%	0,07%
Platinum	JPLAT	-0,16%	0,00%	-0,02%	0,00%	-0,20%
Portfolio Return				4,04%		
Portfolio Risk				1,27%		
Coefficient of variation				31,46%		

After the adjustments, only three indices make it to the portfolio that could weather changes brought about by QE2. These are the All-share ex resources index, small caps index and the mining index. Despite the ALSI index having the second highest returns, it is not included in the portfolio. This is because it has the highest risk on the portfolio. The small caps index has the highest weight and this is because of its high returns and low risk.

6.3.2. QE3 Portfolio

Financial reviews show that in 2012, the mid-cap index performed better than the ALSI, the ALSI had gained around 26% by the end of the year. Platinum index was increased because the rand weakness helped to improve its prices.

Table 13 below shows the results of the adjusted means portfolio:

Table 13: QE3 Portfolio

QE3 PORTFOLIO						
		BENCHMARK	BENCHMARK	INCREASE/DEC	%	ADJUSTED
	TICKER	RETURN	WEIGHT	REASE		WEIGHT RETURNS
All Share Index	ALSI	-0,10%	72,82%	10,40%	0,00%	10,30%
Top40	Top40	-0,09%	7,14%	4,20%	0,00%	4,11%
Financial and Industrial 30	FINDI30	0,06%	0,00%	-9,17%	0,00%	-9,25%
Resource 20	RESI20	-0,06%	1,72%	-11,60%	0,00%	-11,75%
Financial 15	FINI15	0,09%	0,00%	-8,87%	0,00%	-8,99%
Industrial 25	INDI25	0,04%	1,53%	-0,30%	0,00%	-0,36%
Industrials	JASIN	0,05%	0,94%	-0,30%	0,00%	-0,37%
All Share ex Resources	JALEX	0,06%	0,00%	1,20%	0,00%	-1,29%
Small Caps	JSMLC	0,06%	0,00%	10,50%	100,00%	10,24%
Banks	JBNKS	0,08%	3,74%	-9,87%	0,00%	-9,90%
Mid Caps	MIDCAP	0,06%	0,00%	11,00%	0,00%	10,91%
Mining	JMNG	-0,06%	1,32%	3,74%	0,00%	3,64%
Gold	JGOLD	0,06%	10,79%	2,17%	0,00%	2,22%
Platinum	JPLAT	-0,16%	0,00%	1,80%	0,00%	1,62%
Portfolio Return				10,24%		
Portfolio Risk				0,91%		
Coefficient of variation				8,89%		

Our results show that solver allocates all the weight to the small caps index. The returns of this index are less than those of the ALSI and the mid-caps index but upon further investigation, we find that it has the lowest risk in all the indices.

In conclusion, we find that the small caps index is the favoured index in both QE2 and QE3. This is because of its low risk and also it has a very low correlation with the market.

7. Conclusion

The aim of the study is to examine whether the announcements of QE resulted in listed companies in South Africa recording abnormal returns. To justify this study, we first explored what happened to the macroeconomy during the QE phase. Our exploratory analysis establishes that the major impact of QE to SA was the inflows to the bond market. We also note that some of the inflows were in the equity markets and therefore we proceed to check whether they resulted in abnormal returns for companies and sectors.

Our empirical analysis shows that three companies had significant CARs in the three phases of QE. On the sector front, nine out of the 34 sectors had significant CARs every time QE was announced. A broader classification of these sectors into industries shows that the industries represented are industrials, consumer goods, consumer services and financials. In QE1, the industrials industry and the consumer services industry had negative CARs but in QE2 and QE3, they had positive CARs. The consumer goods industry had positive CARs during the three phases of QE.

Despite the construction industry undergoing a decline after the 2010 World Cup, the sector still managed to scoop abnormal returns during QE2 and QE3 announcement. This can be attributed to the fact that the construction industry is cyclical in nature and will do well when the economy is thriving. The contraction in economic activity after the financial crisis should have led to the consumer goods industry achieving negative abnormal returns, but this is not the case. The positive CARs in this sector can be explained by the fact that even if consumers were facing constraints on their disposable incomes, they still had to find ways to survive like making use of credit facilities. In addition, in order to accommodate cash-strapped consumers and remain competitive, retailers had to review their strategies. These strategies include diversifying their range of products and services and using multi-channel approaches. This is also the case for the consumer services industry.

The South African Financial Sector has a limited exposure to foreign assets. Therefore, the impact from QE should have been negligible. However, the performance of this industry on the JSE is dependent on the direction of interest rates in South Africa. Our analysis shows that

most of the individual sectors were losing during every QE announcement. This can therefore be attributed to higher interest and inflation rates and a weaker rand.

Owing to the dominance of the US economy and finance in global markets, spill overs of its monetary policy to the rest of the world are not surprising. We find that the impact of QE1 announcement was negative. However, by the time QE2 was being done, the global macro financial environment was less dire and therefore there was no great impact to EMEs. Positive US QE shock brought down long-term yields in the US making investors reach for yields in emerging markets. In search for higher yielding assets in emerging markets, this caused capital flows to accelerate in these economies, bidding up asset prices such as stock prices and exchange rate and causing a decrease in long-term yields.

The spill overs of QE to emerging markets were affected by the liquidity of the emerging economy and its fundamentals. In SA, domestic factors could have hampered the extent of the effect of QE on the JSE. The economy is faced with a large current account deficit, limited foreign currency reserves and low official interest rates. The threats of sovereign downgrade also had an impact on how foreign investors view SA. However, not all is negative on the domestic front. The World Economic Forum Global Competitive 2010 report listed South Africa as the first out of 138 countries when it comes to regulation of securities exchange; bank soundness came sixth while financing through the local equity market and the availability of financial services both came in seventh (JSE, 2010). Therefore, capital flows to SA were beneficial in relaxing the external financing environment.

The portfolio inflows from QE masked the underlying problems in SA's economy. Therefore, if developed markets were to perform QE again, policy makers in SA should also focus on ensuring that SA's fundamentals are not left unattended. Improving the country's fundamentals would help ensure that tail-risks are avoided when normalisation happens.

In general, during the crisis, inflows turned to outflows but recovered in the second quarter of 2009. This recovery took place as QE was being implemented. The effect on the rand appreciation and the abnormal returns of companies were much higher during the first announcement than in the second and third announcement. With regard to investing in the JSE using indices, the small caps index received higher weighting in both portfolios. This is due to having the lowest risk compared to all the indices on our portfolio. It can also be an indication

that small companies can make big moves and therefore have a high potential of growing their returns.

This research concludes that QE1 had the greatest impact on the JSE and its impact was negative. QE2 had a positive impact on the JSE since most companies and sectors had significant positive CARs. The impact of QE3 on sector abnormal returns was almost neutral. This study only did an exploratory analysis on the macroeconomic and financial indicators. This provides further areas of study where one can test for the relationship between macroeconomic variables and stock returns with an emphasis of the QE period. Considering the SA economy had not improved much by the end of 2012, a further area of research that can be considered is the impact of tapering news on the listed companies and sector.

References

- Advantage Asset Managers 2010. *Momentum Collective Investment*. Available: <http://uat.momentuminv.co.za/docs/default-source/momentum-mom-key-market-performance-drivers-2010/Key Market Performance Drivers - August 2010.pdf?sfvrsn=0> [2017, February 3].
- Aizenman, J., Binici, M. & Hutchison, M. 2014. The transmission of Federal reserve tapering news to emerging financial markets. *National Bureau of Economic Research*. Working paper 19980.
- Altavilla, C., Carboni, G. & Motto, R. 2015. Asset purchase programmes and the financial markets: Lessons from the euro area. *European Central Bank Working Paper Series*. No. 1864.
- Appiah-Kusi, J. & Menyah, K. 2003. Return predictability in African stock markets. *Review of Financial Economics*. 12(3):247-270.
- Baba, N., Nishioka, S., Oda, N., Shirakawa, M., Ueda, K. & Ugai, H. 2005. Japan's deflation, problems in the financial system and monetary policy. *Monetary and Economic Studies*. 23(1):47-111.
- Baumeister, C. & Benati, L. 2012. Unconventional monetary policy and the great recession: Estimating the macroeconomic effects of a spread compression at the zero lower bound. *Bank of Canada*. Working paper No. 2012-21.
- Beckworth, D. & Hendrickson, J.R. 2014. Transaction Asset Shortage. (Unpublished).
- Bernanke, B.S. 2012. Monetary policy since the onset of the crisis. *Monetary Policy since the Onset of the Crisis*. August 31. Federal Reserve Bank.
- Bernanke, B.S. & Gertler, M. 2001. Should central banks respond to movements in asset prices? *American Economic Review*. 91(2):253-257.
- Bernanke, B.S. & Kuttner, K.N. 2005. What explains the stock market's reaction to Federal Reserve Policy? *Journal of Finance*. 60(3):1221-1257.
- Bernanke, B.S., Reinhart, V.R. & Sack, B.P. 2004. Monetary policy alternatives at the zero bound: An empirical assessment. *Brookings Papers on Economic Activity*. 2004(2):1-100.
- Bhattarai, S., Chatterjee, A. & Park, W.Y. 2015. *Effect of US quantitative easing on emerging market economies*.
- Bloomberg L. P. 2016. *Share prices from 3 January 2008 to 31 December 2014 [Raw Data]*. Available: Bloomberg Databases [2016, June 30].
- Bonga-Bonga, L. & Makakabule, M. 2010. Modelling stock returns in the South African stock exchange: A non-linear approach. *European Journal of Economics, Finance and Administrative Sciences*. 19:168-177.
- Bordo, M.D. 2014. Exiting from low interest rates to normality: An historical perspective. *Hoover Institution Economic Working Papers*. 14110:1-24.
- Bouraoui, T. 2015. The effect of reducing quantitative easing on emerging markets. *Applied Economics*. 47(15):1562-1573.
- Bowman, D., Londono, J.M. & Sapriza, H. 2015. U.S. unconventional monetary policy and transmission to emerging market economies. *Journal of International Money and Finance*. :27-59.

- Breedon, F., Chadha, J.S. & Waters, A. 2012. The financial market impact of UK quantitative easing. *Oxford Review of Economic Policy*. 28(4):702-728. DOI:10.1093/oxrep/grs033.
- Bridges, J. & Thomas, R. 2012. The impact of QE on the UK economy - some supportive monetarist arithmetic. *Bank of England Working Paper Series*. No. 442 DOI:10.1.1.231.4153&rep=rep1&type=pdf.
- Burns, A., Kida, M., Lim, J., Mohapatra, S. & Stocker, M. 2014. *Unconventional monetary policy normalisation and emerging market capital flows* [Quantitative easing]. Available: voxeu.org/article/tapering-and-emerging-market-capital-flows [2016, June 18].
- Cameron, A.C. & Trivedi, P.K. 2009. Data Management. In *Microeconometrics using Stata*. 1st ed. TX: Stata Press. 179-181.
- Carpenter, S., Demiralp, S., Ihrig, J. & Klee, E. 2015. Analyzing Federal Reserve Asset Purchase: From whom does the Fed buy? *Journal of Banking and Finance*. 52:230-244.
- Chen, H., Vasco, C. & Andrea, F. 2012. The macroeconomic effects of large-scale asset purchase programs. *The Economic Journal*. 122(564):289-315.
- Chen, J., Mancini-Griffoli, T. & Sahay, R. 2014. Spillovers from United States monetary policy on emerging markets: Different this time? *International Monetary Fund*. Working paper 14/240.
- Chung, H., Laforte, J., Reifschneider, D. & Williams, J. 2011. Estimating the macroeconomic effects of the Fed's assets purchases. *FRBSF Economic Letter*. 3:1-5.
- Curdia, V. & Woodford, M. 2011. The central-bank balance sheet as an instrument of monetary policy. *Journal of Monetary Economics*. 58(1):54-79.
- D'Amico, S., English, W., Lopez-Salido, D. & Nelson, E. 2012. The Federal Reserve's large-scale asset purchase programs: Rationale and effects. *The Economic Journal*. 122(564):F415-F446. DOI:10.1111/j.1468-0297.2012.02550.x.
- Eggertsson, G. & Woodford, M. 2003. The zero bound on interest rates and optimal monetary policy. *Brookings Papers on Economic Activity*. 1:139-211.
- Fawley, B.W. & Neely, C.J. 2013. Four stories of quantitative easing. *Federal Reserve Bank of St. Louis Review*. 95(1):51-88.
- Federal Reserve Bank 2016. *Monetary Policy*. Available: https://www.federalreserve.gov/monetarypolicy/bst_recenttrends.htm [2016, April 4].
- Fin24 2017. *JSE on a knife-edge*. Available: <http://www.fin24.com/Markets/Technical-Analysis/JSE-on-a-knife-edge-20100822> [2017, February 1].
- Fratzscher, M., Lo Duca, M. & Straub, R. 2016. On the international spillovers of US quantitative easing. *The Economic Journal*.
- FTSE 2013. *FTSE JSE Index Series*. Available: www.ftse.com/Analytics/Booksites/JSE/Appendix.pdf [2016, September 14].
- Gagnon, J., Raskin, M., Remache, J. & Sack, B. 2011. The financial market effects of the Federal Reserve's large-scale asset purchases. *International Journal of Central Banking*. 7(1):3-43.
- Gertler, M. & Karadi, P. 2013. QE 1 vs. 2 vs. 3...: A framework for analyzing large scale asset purchases as a monetary policy tool. *International Journal of Central Banking*. 9(S1):5-53. DOI:10.1.1.296.9280.

- Grater, E. & Struweg, J. 2015. Testing the weak form efficiency in the South African market. *Journal of Economic and Financial Sciences*. 8(2):621-632.
- Gruss, B. 2014. After the boom - commodity prices and the economic growth in Latin America and the Caribbean. *IMF Working Paper*. WP/14/154:1-43.
- Haitsma, R., Unalmis, D. & de Haan Jakob 2016. The impact of ECB's conventional and unconventional monetary policies on the stock markets. *Journal of Macroeconomics*. 48:101-116.
- Haugen, R.A. & Baker, N.L. 1996. Commonality in The Determinants Of Expected Stock Returns. *Journal of Financial Economics*. 41(3):401-439. DOI:[http://dx.doi.org/10.1016/0304-405X\(95\)00868-F](http://dx.doi.org/10.1016/0304-405X(95)00868-F).
- Hausman, J. & Wongswan, J. 2011. Global asset prices and FOMC announcement. *Journal of International Money and Finance*. 30:547-571.
- Helbling, T., Mercer-Blackman, V. & Cheng, K. 2008. Riding a wave. *Finance and Development*. 45(1):10-15.
- Holler, J. 2014. Event-study methodology and statistical significance. In *Event-study methodology and statistical significance*. 1st ed. Germany: O1WIR Publisher for Economics, Computer Science and Law. 5-10.
- Igan, D., Kabundi, A., De Simone, F.N. & Tamirisa, N. 2016. Monetary policy and balance sheets. *Journal of Policy Modelling*. 39(1):169-184.
- Industrial Development Corporation 2011. *Economic Trends*. Available: <https://www.idc.co.za/images/download-files/research-reports/Key-trends-in-SA-economy-2nd-quarter-2011.pdf> [2017, January 18].
- International Monetary Fund 2013. *IMF multilateral policy issues report*. Washington, D.C.: International Monetary Fund.
- International Monetary Fund 2017. *IMF Data Access to Macroeconomic and Financial Data*. Available: <http://data.imf.org/?sk=5DABAFF2-C5AD-4D27-A175-1253419C02D1&ss=1409151240976> [25 January 2017].
- Jefferis, K. & Smith, G. 2005. The changing efficiency of the African stock markets. *South African Journal of Economics*. 73(1):54-67. DOI:10.1111/j.1813-6982.2005.00004.x.
- Jordaan, J.C. 2016. An estimation of the impact of the 2012 platinum-sector strike on the South African economy. *South African Journal of Economic and Management Sciences*. 19(2):302-320.
- Joyce, M.A.S., Lasaosa, A., Stevens, I. & Tong, M. 2011. The financial impact of quantitative easing in the United Kingdom. *International Journal of Central Banking*. 7(3):113-161.
- Joyce, M.A.S., Liu, Z. & Tonks, I. 2014. Institutional investor portfolio allocation, quantitative easing and the global financial crisis. *Bank of England Working Paper Series*. No.510.
- JSE 2017. *Equity markets overview for 2010*. Available: ir.jse.co.za/phoenix.zhtml?c=198120&p=irol-newsArticle&ID=1579802 [2017, February 28].
- JSE 2017. *JSE takes honours in financial world cup but SA does badly*. Available: www.jse.co.za/news/jse-takes-honours-in-financial-world-cup-but-sa-does-badly [2017, February 27].

- Kantor, B. 2012. *Blog on the SA economy* [SA Financial Markets]. Available: <http://www.zaeconomist.com/page/12/> [2017, February 2].
- Kaplan, P.D., Idzorek, T., Gambera, M., Yamaguchi, K., Xiong, J. & Blanchett, D.M. 2009. The history and economics of stock market crashes.
- Kimura, T., Kobayashi, H., Muranaga, J. & Ugai, H. 2002. The effect of the increase in monetary base of Japan's economy at zero interest rates: An empirical analysis. *Bank for International Settlements*. 19:276-312.
- Kobayashi, T., Spiegel, M. & Yamoshi, N. 2006. Quantitative easing and Japanese bank equity values. *Journal of the Japanese and International Economies*. 20(4):699-721. DOI:<http://dx.doi.org/10.1016/j.jjie.2006.06.006>.
- Kontonikas, A. & Iannidis, C. 2005. Should monetary policy respond to asset price misalignments. *Economic Modelling*. 22(6):1105-1121. DOI:<http://dx.doi.org/10.1016/j.econmod.2005.07.004>.
- Kontonikas, A. & Iannidis, C. 2008. The impact of monetary policy on stock prices. *Journal of Policy Modelling*. 30(1):33-53. DOI:<http://dx.doi.org/10.1016/j.jpolmod.2007.06.015>.
- Kontonikas, A. & Kostakis, A. 2013. On monetary policy and stock market anomalies. *Journal of Business Finance and Accounting*. 40(7):1009-1042. DOI:10.1111/jbfa.12028.
- Kontonikas, A., MacDonald, R. & Saggi, A. 2013. Stock market reactions to FED Funds Rate surprises: State dependence and the financial crisis. *Journal of Banking and Finance*. 37(11):4025-4037. DOI:10.1016/j.jbankfin.2013.06.010.
- Kozicki, S., Santor, E. & Suchanek, L. 2011. Unconventional monetary policy: The international experience with central bank asset purchases. *Bank of Canada Review*. 2011(Spring):13-25.
- Krishnamurthy, A. & Vissing-Jorgensen, A. 2011. The effect of quantitative easing on interest rates. *Brookings Papers on Economic Activity*. :215-265.
- Labonte, M. 2014. *Federal Reserve: Unconventional monetary policy options*. (R42962). Congressional Research Service.
- Lavigne, R., Sarker, S. & Vasistha, G. 2014. Spillover effects of quantitative easing on Emerging Market Economies. *Bank of Canada Review*. 2014(Autumn).
- Magnusson, M. & Wydick, B. 2002. How efficient are Africa's emerging stock markets? *Journal of Development Studies*. 38(4):141-156.
- Mail & Guardian 2009. *SA is not in recession, says Manuel*. mg.co.za/article/2009-02-26-sa-is-not-in-a-recession-says-manuel.
- Montecino, J.A. & Epstein, G. 2015. The political economy of QE and the Fed: Who gained, who lost and why did it end? *Political Economy Research Institute*. Working paper 408 DOI:10.1.1.730.5023.
- National Treasury 2009. *Medium-term budget policy statement*. Pretoria: National Treasury.
- Ncube, M. & Hausken, K. 2013. Transmission channels for QE and effects on interest rates. In *Quantitative easing and its impact in the US, Japan, the UK and Europe*. Springer New York. 5-6. 10.1007/978-1-4614-9646-5.
- Oda, N. & Ueda, K. 2007. The effects of the Bank of Japan's zero interest commitment and quantitative monetary easing on the yield curve: A macro-finance approach. *The Japanese Economic Review*. 58(3):303-328. DOI:10.1111/j.1468-5876.2007.00422.x.

- Okina, K. & Shiratsuka, S. 2004. Policy duration effect under zero interest rates: An application of wavelet analysis. *CESifo Working Paper Series*. No. 1138.
- Olawale, A., Olusegun, S. & Taofik, A. 2014. Statically significant relationships between returns on FTSE 100, S&P 500 market indexes and macroeconomic variables with emphasis on unconventional monetary policy. *International Journal of Statistics and Applications*. 4(6):249-268. DOI:10.5923/j.statistics.20140406.02.
- Old mutual wealth 2013. *A brief history of the rand dollar exchange rate*. Available: www.omwealth.co.za/pdfs/default/Articles/A-brief-history.pdf [2017, January 28].
- Peersman, G. & Smets, F. 2005. The industry effects of monetary policy in the Euro *The Economic Journal*. 115(503):319-342. DOI:10.1111/j.1468-0297.2005.00991.x.
- Princeton University 2008. *Data and Statistical Services*. Available: http://dss.princeton.edu/online_help/stats_packages/stata/eventstudy.html [14 December 2016].
- PWC 2012. *SA Mine: Highlighting trends in the South African mining industry*. PWC.
- Ricketts, L.R. 2011. Quantitative easing explained. *The Liber8 Economic Information Newsletter, Federal Reserve Bank of St Louis*.
- Rizky, Y. 2015. Technical note: The effect of Fed's quantitative easing policy on the performance of listed companies and the banking sector in Indonesia. *Australasian Accounting, Business and Finance Journal*. 9(4):71-81. DOI:10.14453/aabfj.v9i4.6.
- Rosengren, E.S.2015. Lessons from the U.S. experience with quantitative easing. *The Peterson's Institute for International Economics and Moody's Investor's Services 8th Joint Event on Sovereign Risk and Macroeconomics*. Thursday February 5 2015. Boston: Federal Reserve Bank of Boston.
- Salaber, J.M. 2009. Sin stock returns over the business cycle. *Ssrn*. DOI:dx.doi.org/10.2139/ssrn.1443188.
- Shirakawa, M. 2002. One year under 'quantitative easing'. *IMES Discussion Paper Series*. NO. 2002-E-3.
- Smirlock, M. & Yawitz, J.B. 1985. Asset returns, discount rate changes and market efficiency. *Journal of Finance*. 40:1141-1158. DOI:10.1111/j.1540-6261.1985.tb02368.x.
- Smith, G., Jefferis, K. & Ryoo, H. 2002. African stock markets: Multiple variance ratio tests of random walks. *Applied Financial Economics*. 12(7):475-484.
- South African Reserve Bank 2009. *Quarterly Bulletin Publication*. Available: www.resbank.co.za/Lists/News%20and%20Publications/Attachments/4060/Quarterly%20Economic%20Review.pdf; [2017, January 18].
- South African Reserve Bank 2010. *Quarterly Bulletin Publication*. Available: www.resbank.co.za/Lists/News%20and%20Publications/Attachments/3641/Quarterly%20Economic%20Review.pdf; [2017, January 18].
- South African Reserve Bank 2012. *Quarterly Bulletin Publications*. Available: www.resbank.co.za/Lists/News%20and%20Publications/Attachments/5133/02Quarterly%20Economic%20Review.pdf [2017, February 20].
- StatsSA 2017. *Publications*. Available: <http://www.statssa.gov.za/publications/P0441/P04413rdQuarter2010.pdf> [2017,February 18].

- Ugai, H. 2007. Effects of the quantitative easing policy: A survey of empirical analyses. *Monetary and Economic Studies*. 25(1):1-48.
- Unalmis, D. & Unalmis, I. 2015. *The effects of conventional and unconventional monetary policy surprises on asset markets in the United States*. 62585. MPRA.
- Van Heerden, D., Rodrigues, J., Hockly, D., Lambert, B., Taljard, T. & Phiri, A. 2013. Efficient Market Hypothesis in South Africa: Evidence from a threshold autoregressive (TAR) model. (Unpublished).
- Verick, S. & Islam, I. 2010. The great recession of 2008-2009: Causes, consequences and policy responses.
- Voutsinas, K. & Werner, R. 2011. New evidence on the effectiveness of quantitative easing in Japan. *CFS Working Paper*. 2011/30.
- VoxEU.org 2016. Introduction. In *Quantitative Easing: Evolution of economic thinking as it happened on Vox*. W. Haan, Ed. London: Centre for Economic Policy Research. 1-16.
- Weale, M. & Wieladek, T. 2014. What are the macroeconomic effects of asset purchases? *International Dimensions of Conventional and Unconventional Monetary Policy*. April 30 2014.
- Wu, J.C. & Xia, F.D. 2016. Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit and Banking*. 48(2-3):253-291.
- Yu, E. 2016. Did quantitative easing work? *Economic Insights*. 1(1):5-13.

Appendix

Appendix A: Stock and Indices description

A-1: Stock Names

Table 14: Stock Names

Ticker	Firm Name
AVI	AVI LTD
ABL	African Bank Investments Ltd
ACE	Accentuate Ltd
ACP	Acucap Properties Ltd
ADI	Adaptit Holdings Ltd
AIP	Adcock Ingram Holdings
ADR	Adcorp Holdings Ltd
ANA	Adrenna Prop Group Ltd
ADH	Advtech Ltd
ADW	African Dawn Capital
AFE	AECI Ltd
AEE	African Equity Empowerment
AEG	Aveng Group Ltd
AOO	African and Overseas Enterprises Ltd
AOVP	African and Overseas Enterprises Ltd
AEA	African Eagle Res Plc
AON	African ans Overseas Enterprise Ltd
AFT	Afrimat Ltd
ACT	Afrocentric Inc Corp
AFX	African Oxygen Ltd
AHL	Ah-Vest Ltd
ALH	Alaris Holdings Limited
AET	Alert Steel Holdings
AEL	Allied Electronics Corp-A
AEN	Allied Electronics Corp-N
AME	African Media Entertainment Ltd
AER	Amalgamated Elec Corp Ltd
ANG	Anglogold Ashanti Ltd
AGL	Anglo American Plc
AMS	Anglo American Platinum Corporation
ANS	Ansys
ARH	Arb Holdings Ltd
AQP	Aquarius Platinum Ltd
ACL	Arcelormittal SA Ltd
ART	Argent Industrial Ltd
ARI	African Rainbow Minerals
APN	Aspen Pharmacare Hldgs
ASR	Assore Ltd
ARL	Astral Foods
APK	Astrapak Ltd
ATL	Atlatsa Resources Corp

Ticker	Firm Name
AEG	Aveng Ltd
AWT	Awethu Beverages Ltd
BGA	Barclays Africa Group Ltd
BAW	Barloworld Ltd
BSR	Basil Read Holdings Ltd
BTI	British AM. Tobacco
BCX	Business Connexion Group Ltd
BEG	Beige Holdings Ltd
BEL	Bell Equipment Holdings
BVT	The Bidvest Group Ltd
BIL	BHP Billiton Plc
BLU	Blue Label Telecoms Ltd
BCF	Bowler Metcalf Limited
BAT	Brait
BIK	Brikor Ltd
BRN	Brimstone Investment Corporation
BRT	Brimstone Investment Corporation
BSS	BSI Steel Ltd
BDM	Buildmax Limited
BWI	B & W Instrument & Elec LD
CGR	Calgro M3 Holdings Ltd
CDZ	Cadiz Holdings Ltd
CAC	CAFCA Ltd
CPI	Capitec
CPF	Capital Property Fund Limited
CRG	Cargo Carriers Limited
CSB	Cashbuild Limited
CAT	Caxton & CTP Publishers & Printers
CATP	Caxton & CTP Publishers & Printers
CBH	Country Bird Holdings
CRD	Central Rand Gold Ltd
CSP	Chemical Specialities Ltd
CMO	Chrometco
CIL	Consolidated Infrastructure Group
CLH	City Lodge Hotels Limited
CLS	Clicks Group Ltd
CLI	Clientele Ltd
CMH	Combined Motor Holdings Ltd
CML	Coronation Fund Managers Ltd
CZA	Coal of Africa
CGN	Cognition Holdings Ltd
COM	Comair Ltd
CCL	Compu Clearing Outsourcing Ltd
CND	Conduit Capital Ltd
CNL	Control Instruments Group Ltd
CKS	Crookes Brothers Ltd

Ticker	Firm Name
CSG	CSG Holdings Limited
CSP	Chemical Specialities Ltd Pref
CUL	Culliana Holdings Ltd
DTC	Datatec Limited
DAW	Distribution and Warehouse Network Ltd
DCT	Datacentrix Holdings Ltd
DRN	Delrand Resources Ltd
DTA	Delta Emd Limited
DMC	Diamond Corp Plc
DGC	Digicore Holdings Limited
DSY	Discovery Holdings Ltd
DST	Distell
DRD	DrdGold Ltd
EMH	E Media Holdings Ltd - N
EPS	Eastern Platinum Limited
ECS	Ecsponent Limited
EHS	Evraz Highveld Steel & Van
ELR	Elb Group Limited
ELI	Ellies Holdings Ltd
EMI	Emira Estate Investment Trusts
ENX	Enx Group Ltd
EOH	EOH Ltd
EQS	Eqstra Holdings Ltd
ERB	Erbacon Inv Holdings
ESR	Esor Limited
EXX	Exxaro Resources Limited
FVT	Fairvest Property Holdings Limited
FBR	Famous Brands Limited
FGL	Finbond Group Ltd
FSR	Firststrand Limited
FUU	First Uranium Corp
FPT	FountainHead Prop Trust
GFI	Goldfields Limited
GIJ	Gijima Group Ltd
GGM	Goliath Gold Mining
GDN	Gooderson Leisure Corp
GPL	Grand Parade Inv Ltd
GND	Grindrod Limited
GRF	Group Five Ltd
GRT	Growthpoint Properties Ltd
HAR	Harmony Gold Mining Company Ltd
HCI	Hosken Consolidated Investments Limited
HPA	Hospitality Prop Fund - A
HPB	Hospitality Prop Fund - B
HWN	Howden Africa Holdings Limited
HDC	Hudaco Industries Limited

Ticker	Firm Name
HUG	Huge Group Ltd
HLM	Hulamin Ltd
HWA	Hwange Colliery Company Ltd
HYP	Hyprop Investments Limited
ILA	Iliad Africa Limited
ILV	Illovo Sugar Limited
ILE	Imbalie Beauty Limited
IMP	Impala Platinum Holdings Limited
IPL	Imperial Holdings Ltd
IDQ	Indequity Group Limited
ING	Ingenuity Property Inv Ltd
ISB	Insimbi Ref & Alloy Sup Ltd
IWE	Interwaste Holdings Ltd
ITU	Intuprop
IVT	Invicta Holdings Limited
INL	Investec Limited
INP	Investec Plc
ISA	ISA Holdings Ltd
ITE	Italtile Ltd
JSC	Jasco Electronics Holdings Limited
JDG	JD Group Ltd
JSE	JSE Ltd
JBL	Jubilee Platinum Plc
KAP	KAP Industrial Holdings
KDV	Kaydav Group Ltd
KEH	Keaton Energy Holdings
KEL	Kelly Group Ltd
KIO	Kumba Iron Ore Ltd
LAB	Labat Africa Limited
LEW	Lewis Group Limited
LBH	Liberty Holdings Ltd Ord
LHG	Litha Healthcare Group Ltd
LON	Lonmin
LNF	London Finance an Investment Group
MAS	Masonite (Africa) Limited
MSM	Massmart Holdings Ltd
MZR	Mazor Group Ltd
MED	Middle East Diamond resLtd
MDC	Mediclinic Int
MRF	Merafe Resources Ltd
MTA	Metair Investments Ord
MML	Metmar Ltd
MFL	Metrofile Holdings Ltd
MRI	Mine Restoration Investments Ltd
MMH	Miranda Mineral Holdings
MIX	Mix Telematics Hldgs LD

Ticker	Firm Name
MMG	Micromega Holdings Ltd
MMI	MMI Holdings Ltd
MND	Mondi Ltd
MNP	Mondi Plc Ltd
MNY	Moneyweb Holdings Ltd
MOR	Morvest Business Group Ltd
MUR	Murray & Roberts Holdings Ltd
MRP	Mr Price Group Limited
MTN	MTN Group Ltd
MST	Mustek Limited
NPK	Nampak
NPN	Naspers Ltd
NED	Nedbank Group
NT1	Net 1 UEPS INC
NTC	Netcare Ltd
NHM	Northam Platinum Ltd Npl
NCS	Nictus Beperk
NUT	Nutritional Holdings Ltd
NWL	Nu-World Holdings Limited
OAO	Oando Plc
OAS	Oasis Crescent Prop Fund
OCE	Oceana Group Ltd
OCT	Octodec Investments Limited
OML	Old Mutual Plc
OMN	Omina Holdings Limited
OLG	Onelogix Group Limited
ORE	Orion Real estate Ltd
PGL	Pallinghurst Resources Ltd
PAN	Pan African Resource plc
PGR	Peregrine Holdings Ltd
PET	Petmin Ltd
PHM	Phumelela gaming and leisure Ltd
PIK	Pick n Pay Limited
PWK	Pick n Pay Holdings Limited
PNC	Pinnacle Holdings Ltd
PFG	Pioneer Food Group Ltd
PPC	PPC Ltd
PCT	Prescient Limited
PMV	Primeserv Group Ltd
PSG	PSG Group Ltd
PSV	PSV Holdings Ltd
PPE	Purple Group Ltd
PPR	Putprop Ltd
RBW	Rainbow Chicken
RCL	RCL Foods Limited
RAR	Rare Holdings Ltd

Ticker	Firm Name
RBX	Raubex Group Ltd
RBA	RBA Holdings Ltd
RDF	Redefine Properties Ltd
REI	Reinet Investment SCA
REM	Remgro Limited
RES	Resilient Property Income Fund
RLO	Reunert Limited
RTO	Rex-Truefrom clothing company Limited
CFR	Compagnie Fin Richemont
RMH	RMB Holdings Limited
RDI	Rockwell Diamonds Incor
RLF	Rolfes Technology Hldngs
SOH	South Ocean Holdings Ltd
SAC	SA Corporate Real Estate Limited
SAB	Sabmiller
SBV	Sabvest Limited
SVN	Sabvest Limited
SAH	South African Coal Min
SCL	Sacoil Holings Ld
SLM	Sanlam Limited
SNT	Santam
SNV	Santova Limited
SAP	Sappi Limited
SFN	Sasfin Holdings Limited
SOL	Sasol Limited
SKY	Sea Kay Holdings Ltd
SHP	Shoprite Holdings Ltd
SVB	Silverbridge Hldgs Ltd
SOV	Sovereign Food Investments Limited
SPA	Spanjaard Limited
SPP	The Spar Group Ltd
SUR	Spur Corporation Ltd
SBK	Standard Bank group Ltd
SSK	Stefanutti Stocks Hld LD
SNH	Steinhoff Int Hldgs N.V
SCP	Stellar Capital Partners Ltd
STA	Stratcorp Limited
SUI	Sun International Ltd
SPG	Super Group Ltd
SYC	Syfrets and Commercial Union Property Fund
TAS	Taste Holdings Ltd
TAW	Tawana Resources Ltd
TLM	Telemaster Holdings Ltd
TKG	Telkom SA Ltd
TFG	The Foschini Group Ltd
TBS	Tiger Brands Ltd

Ticker	Firm Name
TON	Tongaat Hulett Ltd
TDH	Tradehold Ltd
TMT	Trematon Capital Investments Limited
TRE	Trencor Limited
TPC	Transpaco Limited
TSX	Trans Hex Group Limited
TRU	Truworths International Ltd
TSH	Tsogo Sun Holdings Ltd
VLE	Value Group Ltd
VMK	Verimark Holdings Ltd
VIL	Village Main Reef Ltd
VKE	Vukile Property Fund Limited
VUN	Vunani Ltd
WBO	Wilson Bayly Holmes_Ovcon Ltd
WEA	WG Wearne Ltd
WSL	Wescoal Holdings Ltd
WEZ	Wesizwe Platinum Ltd
WHL	Woolworths Hldgs Ltd
WNH	Winhold Limited
WKF	Workforce Holdings Ltd
YRK	York Timber Holdings Ltd
ZED	Zeder Investments Ltd
ZSA	Zurich Insurance Co SA

A – 2: Indices

Table 15: Index names

Ticker	Index Name
ALSI	All Share Index
Top40	Top40
FINDI30	Financial and Industrial 30
RESI20	Resource 20
FINI15	Financial 15
INDI25	Industrial 25
JASIN	Industrials
JALEX	All Share ex Resources
JSMLC	Small Caps
JBNKS	Banks
MIDCAP	Mid-Caps
JMNNG	Mining
JGOLD	Gold
JPLAT	Platinum

Appendix B. QE and Macroeconomy

(A) GDP

The first indicator we look at is the GDP growth rate. **Error! Reference source not found.** below shows the growth rate of GDP from 2008 to 2014. What is not visible from the graph is that South Africa was experiencing a sustained acceleration in economic growth up until the global financial crisis of 2008-2009. The decrease in 2008/2009 with 2009 being declared as the first year the world was experiencing a recession since World War II (Verick & Islam, 2010). However, a period of recovery followed and this is seen from the positive growth rates from 2010.

Figure 4: SA quarterly GDP growth (%) and QE dates



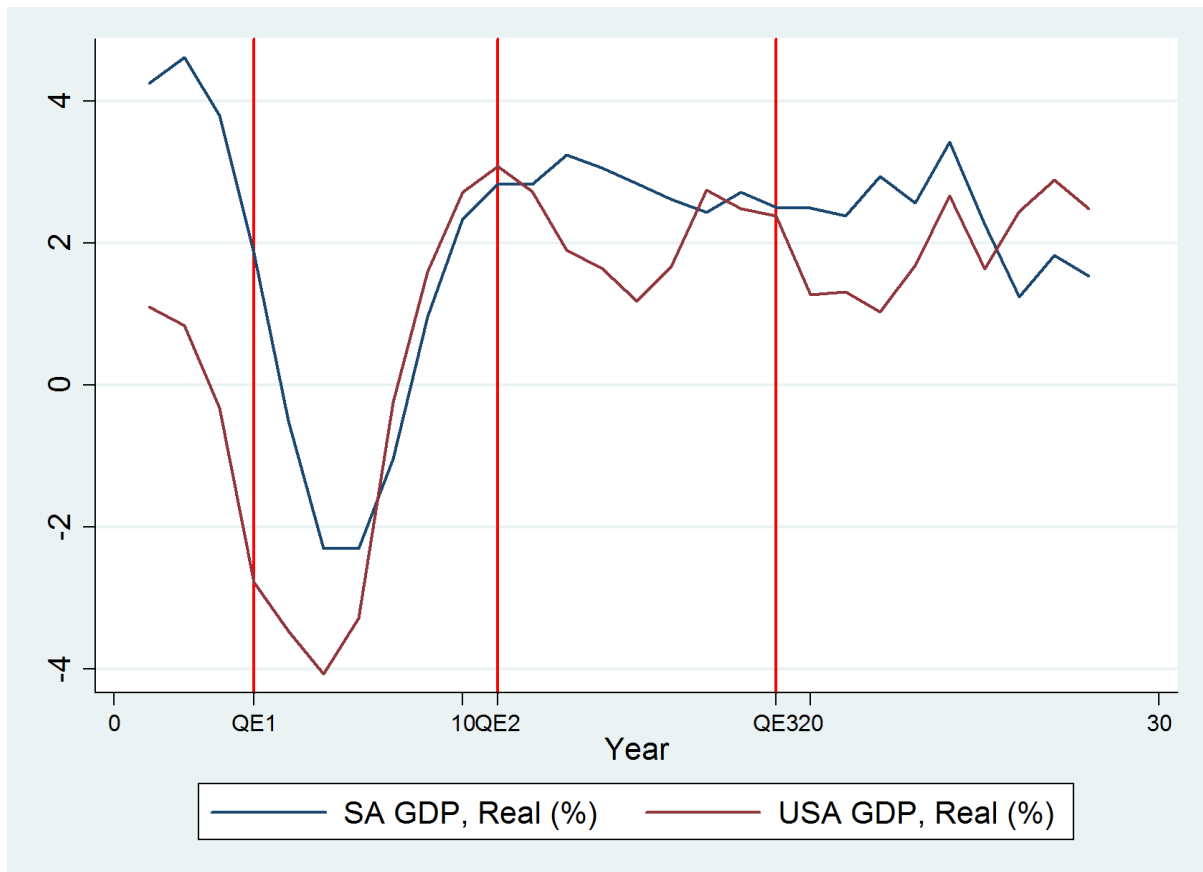
In the last quarter of 2008, SA's GDP growth rate dropped to -1.8% and declined further to -6.4% in the first quarter of 2009 and then to -3.2% in the second quarter (SARB Quarterly bulletin, 2009). These figures represent a technical recession despite the Finance Minister at that time, Trevor Manuel, having the view that SA would not be affected by the global recession (Mail & Guardian, 2009).

When analysing if QE2 affected GDP, we look at the GDP growth in the third quarter of 2010 since QE2 was announced in the third quarter of 2010. GDP growth increased by 2.6% in the third quarter (STATSA, 2010). Contributions to this growth were made by the following industries: mining and quarrying, motor trade, agriculture, fishing, finance and real estate.

There was slow growth in the economy during the third quarter of 2012. Real GDP grew at only 1.2%. This was affected mostly by the contraction in the mining industry.

Our correlation matrix suggests that GDP in SA and in the USA, are positively correlated (98.6%). This means that an increase in the USA GDP would imply that South Africa's GDP is also increasing. Figure 6 below shows how GDP growth in the US and GDP in SA compare.

Figure 5: Comparison of quarterly GDP growth for the US and SA



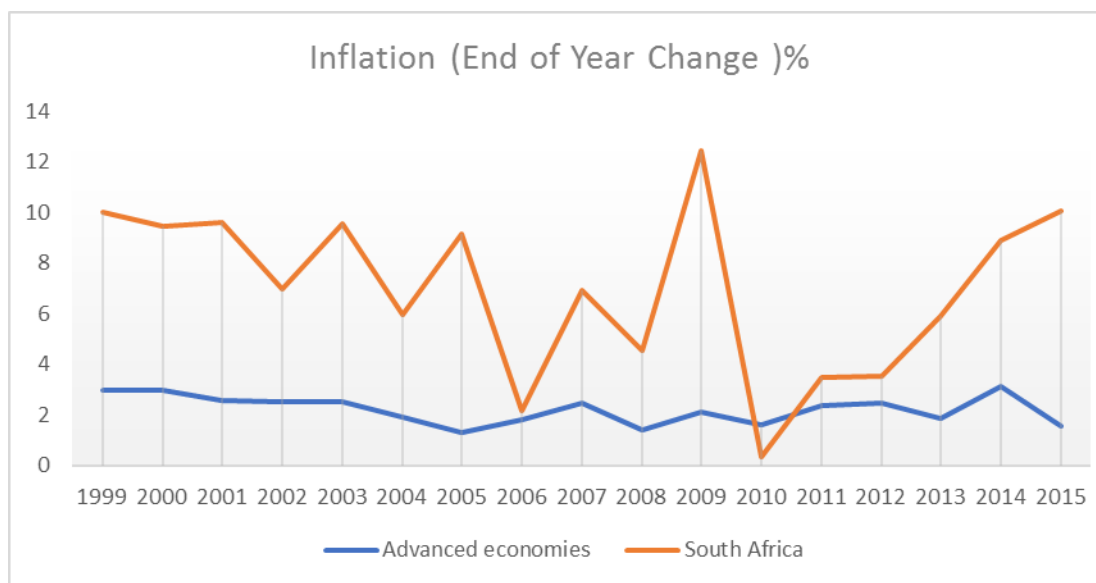
Real GDP in SA and Real GDP in USA seem to be moving in the same direction. Before QE1, GDPs in both countries were going down. The subprime mortgage crisis and the banking liquidity crisis prior to 2008 had led to the contraction of real GDP in 2008. In SA, negative domestic developments contributed to the contraction. These included the debt-fuelled consumption boom, a surge in inflation during 2007 and 2008 that reduced competitiveness and pushed up interest rates and the fact that key infrastructure such as electricity could not keep up with demand (National Treasury, 2009). Phase two and three of QE did not seem to have much impact on SA real GDP but the US real GDP went down during the quarter in which both phases of QE were announced.

(B) Inflation

Inflation in SA had remained above the target range for 21 consecutive months and exceeded the upper limit by 7.6 percentage points when it peaked in August 2008. Prior to this period, SA was experiencing an economic expansion which led to an increase in spending fuelled by increasing debt levels. This placed an upward pressure on prices. In 2009, a combination of higher interest rates, international recession and new government credit regulations restrained inflation to 7.1 percent. It continued to fall in 2010 despite beginning to recover to level of 4.3%. As the recovery, has continued, inflation has risen to stay within the target band.

Figure 6 below shows that South Africa follows the global inflation trend with a lag.

Figure 6: Month-on-month inflation rates (%) for SA and the US

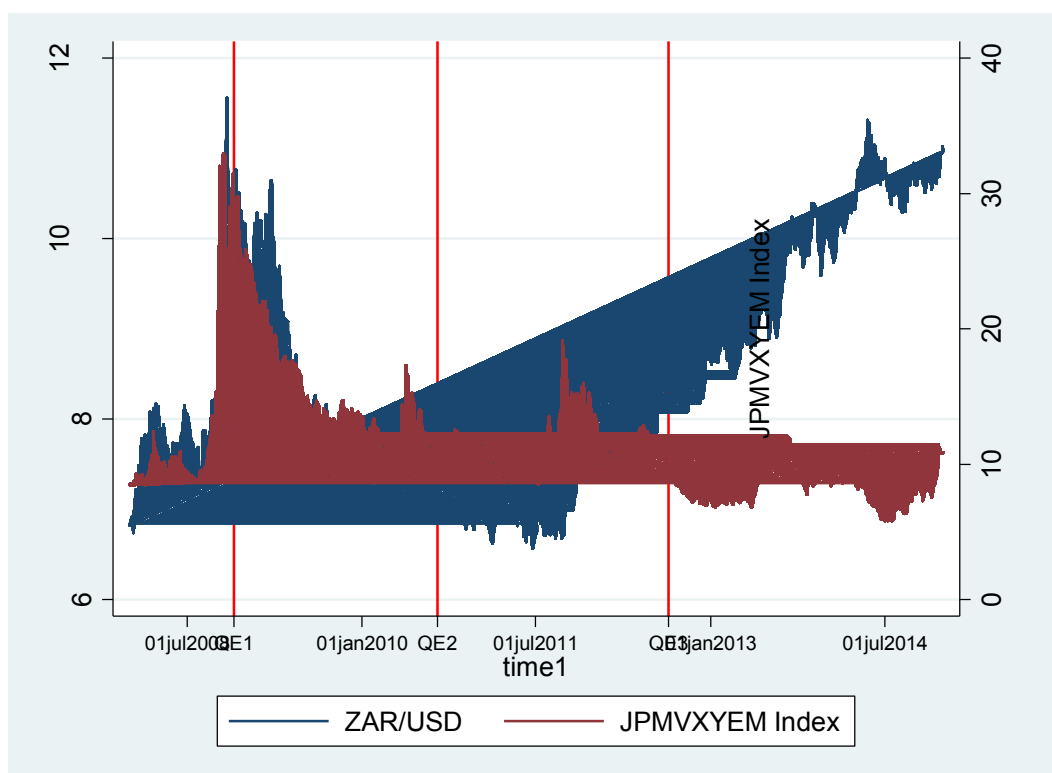


The graph above shows that SA inflation is very volatile. Disinflationary forces at work in the global economy spill over to SA and push down the inflation rate. Expansionary monetary policy is expected to increase inflation expectations.

(C) Exchange rate

Currency depreciation is an inevitable consequence of monetary easing (Santor & Suchanek 2013). Significant volatility of the rand was experienced in October 2008. This was due to deterioration of export commodity prices and intensity of investors risk aversion. This unfortunately led to the disposal of domestic equity and debt securities by non-residents. Figure 7 shows the relationship between the ZAR/USD exchange and the index that measures the volatility of emerging market currencies. In October 15, 2008, the rand experienced its worst daily change when it lost around 17.25% of its value (Old Mutual Wealth , 2009).

Figure 7: Nominal exchange rate and volatility of EM currencies



The year 2010 saw the rand strengthening against the dollar from July 2009. During 2010, the rand remained extremely volatile with an appreciating trend. The weighted average exchange rate decreased by 0.6% in both July and August. Factors that support this trend include an improvement in the current deficit, strong foreign capital inflows, higher commodity prices, dollar weakness, domestic economy recovery and a benign inflation outlook.

Easier monetary policy stance of other central banks and the growth of the local bond market supported the rand in the beginning on the third quarter of 2012. However, the rand started losing ground from September 2012 following some local developments like labour unrest, downgrading of the country's sovereign ratings, rising trade deficit and indications of a renewed pickup in inflation (SARB, 2012). Following the Fed's speech on providing additional policy accommodations (a signal to QE3) the rand weakened against its major trading partners.

(D) Portfolio investments

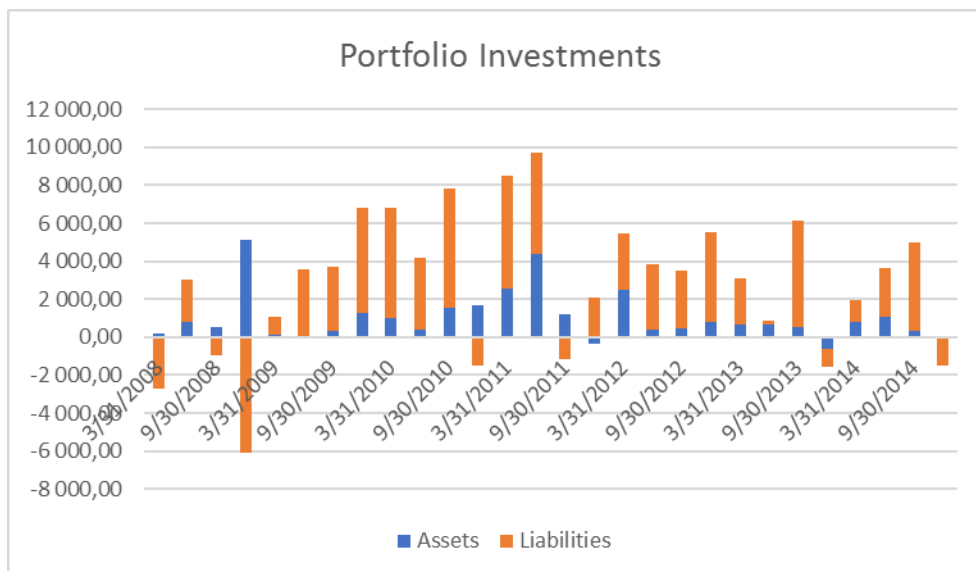
Figure 8 provides the trend of portfolio flows into South Africa between 2008 and 2014. The foreign direct investment (FDI) into SA was R3.3 billion in the fourth quarter of 2008 which

was substantially less than in the third quarter (R22.4 billion). Most of these can be attributed to the acquisition of equity in SA companies by non-residents (SARB, 2009). Foreign portfolio investment recorded an outflow as non-resident investors reduced their holdings in South African equity and debt. On an annual basis, an inflow of R97.4 billion had been recorded for 2007 but this reverted to an outflow of R68.1 billion in 2008. This was the first annual outflow registered since 2001 (SARB, 2010).

The financial account recorded capital inflows of R195.1 billion in 2008 compared to the net inflows of R193.8 registered in 2007. In the third quarter of 2010, SA attracted inflows amounting to R27.6 billion. The net cumulative inflow for the first three quarters of 2010 was R98.7 billion compared to R92.4 billion for the same period in 2009 (SARB, 2010). Most of the inflows recorded in the financial account in the third quarter of 2010 were in the bond market.

Since the fourth quarter of 2009, non-resident investors had an increased appetite for South African debt. Between the second and third quarter of 2010, these acquisitions had more than doubled. Acquisitions on the domestic equity front had also increased somewhat and this was partly due to a rights issue by a South African gold-mining company (SARB, 2010).

Figure 8: Portfolio investments



Stable conditions in the financial markets globally encouraged individual and institutional investors to increase their offshore portfolio investments. The strengthening of the rand also contributed to this.

The third quarter of 2012 saw an increase in portfolio investments of 27.5 billion compared to R22.7 billion in the second quarter. However, investors substituted their listed equity investments with domestically issued debt. Interest in the bond market was also heightened by the issuance of an international bond by a state-owned enterprise

(E) Equity market

Total equity capital in the domestic and international primary share markets by companies listed by the JSE was at R76.7 billion in 2008 which was its lowest annual level since 2008 (SARB, 2009). This decrease is attributed the downward pressure on share prices due to the turmoil in the financial markets. A record-high of R33.4 billion was seen in the net sales of non-residents in the fourth quarter of 2008 compared to R17.1 billion in the third quarter. This intense selling of South African shares increased global risk aversion and slowed down economic growth.

During the third quarter of 2010, SA companies stepped up acquisitions and capitalisations on their subsidiaries abroad. This was especially the case in the mining, property and health-sectors.

Equity capital raised in 2010 on the JSE was R50.7 billion which is 48% lower than what was raised in 2009. Despite share prices drifting higher, lower volumes were traded. This caused a decline in turnover leading to a decline in market liquidity. The exposure of non-residents to the local share market remained restrained for most of 2010. For the first ten months of 2010, cumulative net sales of South African listed shares by non-residents was R21.7 billion compared to R70.7 billion over the same period in 2009. The industrial sector performed best as the domestic-orientated constituents benefited from the appreciating value in the rand.

Despite improvement in the domestic equity in 2012, non-residents continued to be net sellers of domestic listed shares and this could be attributed to the depressed global economic performance and the unrest in the mining sector.

Figure 9: Performance of JSE all share index and S&P 500 index

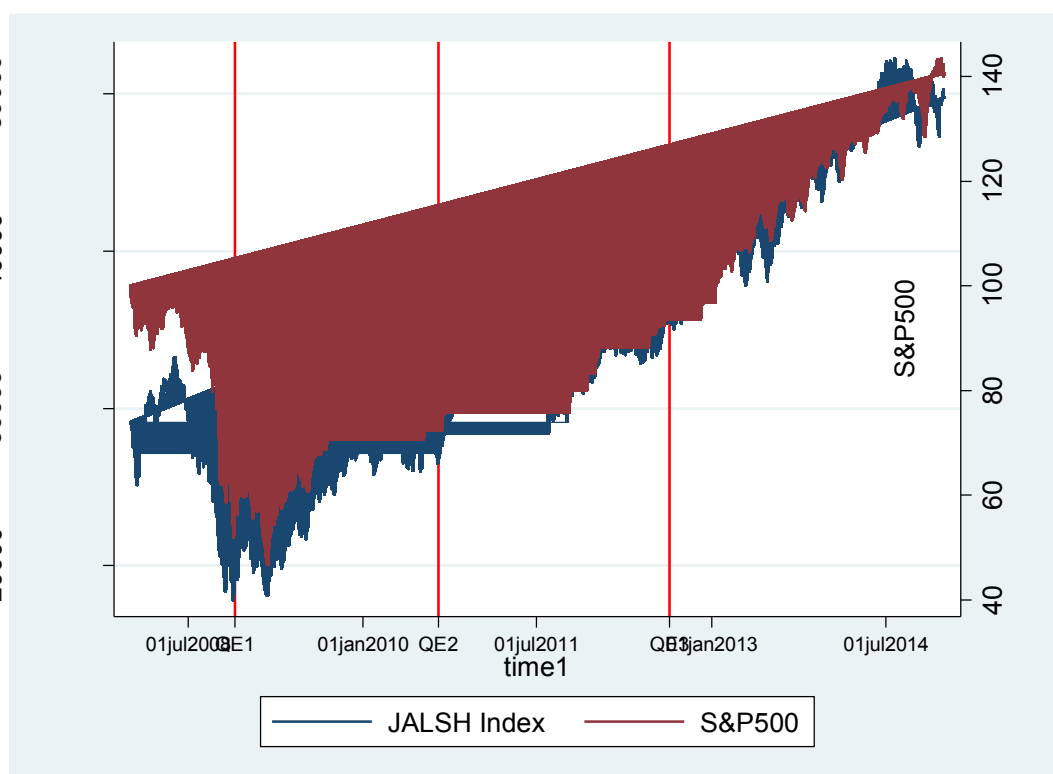


Figure 9 above shows the performance of the JSE All Share index and the S&P 500. Correlation between these two indices is estimated at 97.25% (see appendix). Global financial meltdown began on 15th September 2008 when Lehman Brothers collapsed. The S&P 90 (the precursor of S&P 500) fell by 86 percent on a month-end basis (Kaplan et al., 2009). By November 2008, both S&P 500 and the JSE all share index had reached a record low. Both indices go up after QE1 announcement and this seems to be the impact when QE is announced.

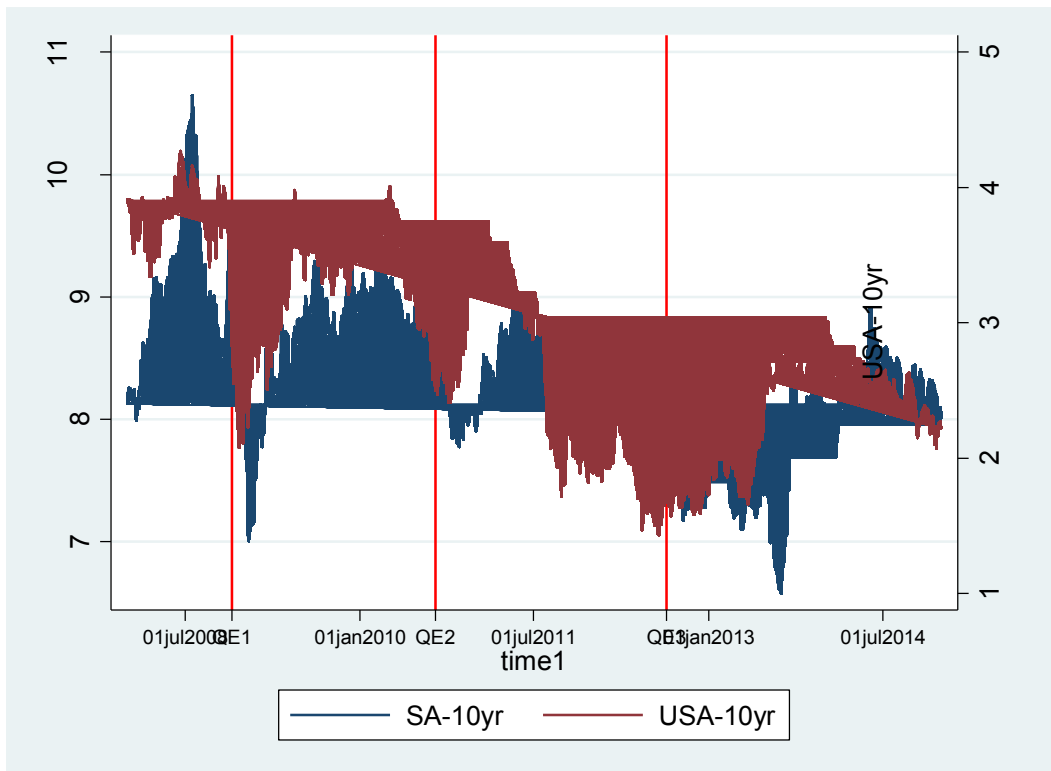
(F) Bond Market

During the fourth quarter of 2008, non-resident net sales were at R26.2 billion compared to an amount of R21.7 billion in October 2008 (SARB, 2009). This reduction in bond holdings could be attributed to flight by international investors to familiarity, liquidity considerations and declining bond yields with the hope of improvement in inflation expectations.

In 2010, the bond market benefited significantly from capital inflows as non-residents sought to gain from higher yields. Net purchases of domestic bonds in the third quarter stood at R41.1 billion following from R20.1 billion in the second quarter (SARB, 2010). Factors in 2010 that helped drive down bond yields were continued provision of liquidity to the financial system and foreign appetite of South African bonds due to their yield advantage, a lower interest rate environment, a stronger rand and lower inflation (Industrial Development Corporation, 2016).

In August 2012, bond yields came under upward pressure as the Marikana mining strike began and the rand value depreciated. Inclusion of SA bonds to the Citibank WGBI did not yield great results as this was overshadowed by the downgrade of the country's sovereign credit ratings by Moody's and Standard and Poor's (S&P). Acquisition for local debt by non-residents remained strong through most of 2012.

Figure 10: Correlations of the 10-year Treasury bond yields for SA and US



The correlation between the SA 10-year bond and the USA 10-year bond is estimated at 63.46%. From Figure 10 above we can see that both bond yields move almost in a similar direction. The aim of QE was to bring the USA yields down and this can also be seen from the graph above.

Appendix C: Results for Cumulative Abnormal Returns for Companies

Table 16: Cumulative Abnormal Returns QE1 - Companies

	Ticker	Sector name	Stock returns	CAR	t-test
1	ACL	Industrial Metals & Mining	0,0087	-0,0013	-0,0067
2	ACP	Real Estate Investment Trusts	0,0072	0,0102	0,1497
3	ACT	Health care Equipment & Services	-0,0506	-0,1655	-2,5029**
4	ADH	General Retailers	0,0031	0,0086	0,503
5	ADI	Software & Computer Services	0	-0,0921	-4,8708***
6	ADR	Support Services	0	0,0442	1,7698*
7	AEE	General Industries	0,0156	-0,0314	-0,8048
8	AEG	Construction & Materials	0,0563	0,0516	0,5564
9	AEL	Electronic & Electrical Equipment	0,1362	0,0458	0,3621
10	AEN	Electronic & Electrical Equipment	0,0398	0,0458	0,5675
11	AER	Electronic & Electrical Equipment	0	-0,0361	-0,3999
12	AFE	Chemicals	0,0228	0,0291	0,9819
13	AFT	Construction & Materials	-0,02	-0,1547	-10,5228***
14	AFX	Chemicals	-0,0048	-0,1339	-2,0260**
15	AGL	Industrial Metals & Mining	0,1374	-0,0019	-0,0379
16	AME	Media	0	0,1568	1,6498*
17	AMS	Mining	0,0478	0,008	0,0883
18	ANA	Real Estate Investment & Services	0	-0,1124	-3,5503***
19	ANG	Mining	-0,0463	0,1389	0,8189
20	AON	General Retailers	0	0,0014	0,2896
21	AOO	General Retailers	0	-0,0339	-
22	AOVP	General Retailers	0	-0,2373	733,2610***
23	APK	General Industries	0,0142	0,0468	-6,9668***
24	APN	Pharmaceuticals & Biotechnology	0	-0,0687	1,7028*
25	AQP	Mining	0,0892	0,0997	-1,9460*
26	ARH	Electronic & Electrical Equipment	0,0892	0,0997	1,9542*
27	ARI	Industrial Metals & Mining	0	-0,0366	-1,8383*
28	ARL	Food Producers	0,0311	-0,0566	-0,6342
29	ART	Food Producers	0,0037	0,039	0,444
30	ART	Industrial Metals & Mining	0,0364	0,0885	1,4183
31	ASR	Industrial Metals & Mining	0,0417	0,1268	2,5848***
32	ATL	Mining	-0,1004	0,0043	0,0179
33	AVI	Food Producers	0,0282	-0,0366	-0,5853
34	AWT	Beverages	0	0,2447	2,1239**
35	BAT	General Financial	0,0162	0,0125	0,5854
36	BAW	General Industries	0,0127	-0,0086	-0,1202
37	BCF	General Industries	-0,0238	-0,047	-0,8946
38	BCX	Software & Computer Services	0,0133	-0,0884	-3,0741***
39	BDM	Construction & Materials	0,0526	-0,0013	-0,0076
40	BEL	Industrial Engineering	-0,0401	-0,2589	-3,6005***
40	BGA	Banks	0,0625	-0,0221	-0,7229

	Ticker	Sector name	Stock returns	CAR	t-test
--	---------------	--------------------	----------------------	------------	---------------

41	BIL	Industrial Metals & Mining	0,1972	0,1493	1,5153
42	BLU	Mobile Communications	0,0326	0,0216	0,3862
43	BRN	Equity Investment Instruments	0,0411	-0,0263	-0,3228
44	BRT	Equity Investment Instruments	-0,03	-0,0244	-0,9033
45	BSR	Construction & Materials	-0,0172	0,0303	0,3776
46	BVT	General Industries	0,0108	-0,135	-3,7578***
47	CAC	Electronic & Electrical Equipment	0	0	0
48	CAT	Media	-0,0417	-0,171	-2,6502***
49	CATP	Media	0	0	0
50	CCL	Software & Computer Services	0	-0,0404	-3,8111***
51	CDZ	General Financial	0	-0,0861	-1,9851**
52	CFR	Leisure Goods	0,0599	-0,0713	-1,4091
53	CGN	Software & Computer Services	0	-0,1988	-1,5762
54	CGR	Construction & Materials	-0,0408	-0,1749	-0,9519
55	CKS	Food Producers	0	0,0501	9,5306***
56	CLH	Travel & Leisure	0,029	0,0218	0,5387
57	CLS	Food & Drug Retailers	0,0352	-0,0892	-2,4579**
58	CMH	General Retailers	0	0,075	4,8727***
59	CML	General Financial	0,0289	0,0102	0,1771
60	CND	General Financial	-0,111	0,0933	0,5138
61	COM	Travel & Leisure	0,0125	-0,1179	-1,0167
62	CPF	Real Estate Investment Trusts	0,0101	0,0416	1,2737
63	CPI	Banks	-0,0081	-0,0585	-2,7995***
64	CRD	Mining	0	-0,079	-2,6457***
65	CRG	Industrial Transportation	0	0,003	3,7159***
66	CSB	General Retailers	0,0099	-0,066	-2,4075**
67	CUL	Travel & Leisure	0	0,0637	29,8918**
68	CZA	Industrial Metals & Mining	0,0952	-0,0321	-0,2746
69	DAW	Construction & Materials	-0,0357	-0,1862	-2,7126***
70	DCT	Software & Computer Services	0,0353	-0,0385	-0,4922
71	DGC	Electronic & Electrical Equipment	0,0333	0,0425	0,3997
72	DRD	Mining	0,025	0,2246	1,5813
73	DST	Beverages	0,0435	-0,0409	-0,7499
74	DSY	Life Insurance	0,0114	-0,0241	-0,5464
75	DTA	Chemicals	-0,0588	0,0055	0,056
76	DTC	Software & Computer Services	0,0292	-0,0512	-1,7893*
77	EHS	Industrial Metals & Mining	0,0907	0,0033	0,0267
78	ELI	Electronic & Electrical Equipment	0,0494	-0,2238	-1,2733
79	ELR	Support Services	0	-0,0338	-3,8407***
80	EMH	Personal Goods	-0,0204	0,0448	1,352
81	EMI	Real Estate Investment & Services	0,0233	0,0502	1,3492
82	ENX	Support Services	0	-0,064	-2,5807***
83	EOH	Software & Computer Services	-0,0073	-0,0163	-1,8745*
84	EPS	Mining	0	0,2101	1,0643
85	ESR	Construction & Materials	0,0455	-0,1173	-2,3054**

	Ticker	Sector name	Stock returns	CAR	t-test
--	---------------	--------------------	----------------------	------------	---------------

86	EXX	Mining	0,1619	0,1028	1,0095
87	FBR	Travel & Leisure	0	-0,0074	-0,6766
88	FGL	Banks	0	-0,0608	-0,3624
89	FPT	Real Estate Investment & Services	0,0059	0,0463	1,0177
90	FSR	Banks	0,0631	0,0613	2,4850**
91	FVT	Real Estate Investment & Services	0	-0,0749	-1,0239
92	GFI	Mining	0,0308	0,2633	1,4362
93	GGM	Industrial Metals & Mining	0	-0,0618	-4,4202***
94	GIJ	Software & Computer Services	0,0426	-0,0762	-1,9268*
95	GND	Industrial Transportation	-0,0254	-0,1296	-2,1784**
96	GRF	Construction & Materials	0,0538	0,0698	1,2202
97	GRT	Real Estate Investment Trusts	0,0993	-0,0287	-0,2589
98	HAR	Mining	0,0101	0,2527	1,3007
99	HCI	Equity Investment Instruments	-0,0056	-0,0345	-2,3598**
100	HDC	Industrial Engineering	0,0177	-0,0662	-2,0211**
101	HPA	Real Estate Investment Trusts	0,0009	0,0564	1,8069*
102	HPB	Real Estate Investment Trusts	0	0,0038	0,0685
103	HWA	Mining	-0,053	0,014	0,2973
104	HWN	Industrial Engineering	0	-0,1637	-1,7916*
105	HYP	Real Estate Investment Trusts	0,0271	0,0494	1,5641
106	ILA	Support Services	-0,0579	-0,1376	-2,1733**
107	ILV	Food Producers	0,0526	-0,0052	-0,0794
108	IMP	Mining	0,1047	0,1662	5,5105***
109	ING	Real Estate Investment & Services	0	0,0096	1,6234
110	INL	General Financial	0,0058	-0,0903	-0,6189
111	INP	General Financial	0,0591	-0,0209	-0,1908
112	IPL	Industrial Transportation	0,0159	-0,0688	-0,9615
113	ITE	General Retailers	-0,0364	-0,0272	-0,7597
114	ITU	Real Estate Investment & Services	0,0343	-0,0569	-1,1024
115	IVT	Industrial Engineering	0	0,006	0,1633
116	JBL	Mining	0,05	0,0208	0,4088
117	JDG	General Retailers	0,0282	-0,0743	-2,1261**
118	JSC	Electronic & Electrical Equipment	0,0333	-0,0534	-1,4744
119	JSE	General Financial	0,0199	-0,0803	-4,0127***
120	KAP	General Industries	-0,04	-0,0874	-1,7306*
121	KDV	Construction & Materials	0,1765	-0,0271	-0,096
122	KIO	Industrial Metals & Mining	0,1259	0,037	0,225
123	LBH	Life Insurance	0,0306	-0,0251	-0,4089
124	LEW	General Retailers	0,0005	-0,0127	-0,1995
125	LHG	Pharmaceuticals & Biotechnology	0	-0,0445	-2,1807**
126	LNF	General Financial	0	-0,0004	-0,2682
127	LON	Mining	0,0317	-0,0445	-1,1382
128	MAS	Construction & Materials	0	-0,0657	-3,2433***
129	MDC	Health care Equipment & Services	0,0164	-0,0244	-5,6915***
130	MED	Mining	0	-0,3574	-1,1784

	Ticker	Sector name	Stock returns	CAR	t-test
--	---------------	--------------------	----------------------	------------	---------------

131	MFL	Support Services	0,0482	-0,054	-0,4548
132	MIX	Support Services	0,0169	-0,1269	-3,2082***
133	MMG	Support Services	0	0,0487	5,1293***
134	MMI	Life Insurance	0,01	-0,0541	-1,6113
135	MML	Industrial Metals&Mining	0,0577	-0,0382	-0,4311
136	MND	Forestry&Paper	0,0172	-0,1669	-1,5479
137	MNP	Forestry&Paper	0,0171	-0,0866	-0,8137
138	MOR	Software & Computer Services	-0,0256	-0,1679	-1,2376
139	MRF	Industrial Metals&Mining	-0,0313	-0,1402	-0,7695
140	MRP	General Retailers	0,0403	-0,1397	-3,7830***
141	MSM	General Retailers	0,0256	-0,0969	-2,1285**
142	MST	Technology Hardware & Equipment	0,1355	-0,0515	-0,2464
143	MTA	Automobiles & Parts	0	-0,0209	-0,6193
144	MTN	Mobile Communications	0,006	-0,1431	-1,8354*
145	MUR	Construction & Materials	0,017	0,1009	0,9992
146	MZR	Construction & Materials	0	-0,0056	-0,2142
147	NCS	General Retailers	0	0,0223	12,9641***
148	NED	Banks	0,0291	-0,0549	-1,0438
149	NHM	Mining	0,0092	-0,2996	-5,2398***
150	NPK	General Industries	-0,0423	-0,1116	-1,3459
151	NPN	Media	0	-0,101	-1,4463
152	NTC	Health care Equipment & Services	0,0343	-0,0133	-0,243
153	NWL	Household Goods and Home Construction	0	-0,0742	-2,4528**
154	OAD	Oil Equipment & Services	0	-0,0769	-1,0783
155	OCE	Food Producers	0,0223	0,02	0,9476
156	OCT	Real Estate Investment & Services	0,0098	0,0197	1,1336
157	OLG	Industrial Transportation	0	0,1259	1,0022
158	OML	Life Insurance	0,0425	-0,2462	-2,9582***
159	OMN	Chemicals	0,0134	-0,1089	-2,9531***
160	ORE	Real Estate Investment & Services	0	0,2112	1,5803
161	PAN	Mining	-0,08	-0,0248	-0,1708
162	PCT	Equity Investment Instruments	-0,0909	-0,1101	-0,6682
163	PET	Industrial Metals&Mining	0	-0,0432	-1,0008
164	PGR	General Financial	0,0248	-0,1292	-5,6991***
165	PHM	Travel & Leisure	0	-0,0647	-1,7751*
166	PIK	Food & Drug Retailers	0,0509	-0,1106	-1,8213*
167	PMV	Support Services	0,0667	0,0734	1,1131
168	PNC	Technology Hardware & Equipment	-0,03	-0,0764	-1,2482
169	PPC	Construction & Materials	0,0645	-0,0663	-1,4355
170	PPE	Equity Investment Instruments	-0,0667	0,2569	1,3587
171	PPR	Real Estate Investment & Services	0	0,0048	16,9528***
172	PSG	General Financial	0,0385	-0,0223	-0,4826
173	RBW	Food Producers	-0,0257	0,0295	0,3451
174	RBX	Construction & Materials	-0,0144	-0,0779	-1,2323

	Ticker	Sector name	Stock returns	CAR	t-test
--	---------------	--------------------	----------------------	------------	---------------

175	RCL	Food Producers	-0,0257	0,0295	0,345
176	RDF	Real Estate Investment Trusts	0,0364	0,0426	1,2709
177	RDI	Mining	0	-0,2711	-1,4778
178	REM	General Industries	0,0137	-0,0668	-3,7251***
179	RES	Real Estate Investment Trusts	0,0158	0,001	0,0938
180	RLF	Chemicals	-0,0672	-0,1135	-1,4727
181	RLO	Electronic & Electrical Equipment	0,0753	0,0745	2,5920***
182	RMH	Banks	0,0667	-0,0249	-0,512
183	RTO	General Retailers	0	-0,1114	-6,6981***
184	SAB	Beverages	0,0081	-0,0547	-1,3554
185	SAC	Real Estate Investment Trusts	0,0173	0,0478	1,0053
186	SAP	Forestry&Paper	0,0423	-0,1253	-2,0075**
187	SBK	Banks	0,0738	-0,0269	-0,6847
188	SBV	Equity Investment Instruments	0	0,0055	1,1871
189	SCL	Oil Equipment & Services	0	-0,1532	-1,2243
190	SCP	Equity Investment Instruments	0,0091	0,0082	0,5572
191	SFN	General Financial	0	-0,0348	-0,3627
192	SHP	Food & Drug Retailers	0,0413	-0,1417	-2,5130**
193	SLM	Life Insurance	0,0356	-0,0991	-1,7752*
194	SNH	Household Goods and Home Construction	0,0187	-0,1855	-6,3019***
195	SNT	Nonlife Insurance	0,0156	-0,0482	-3,1134***
196	SNV	Support Services	0,4	0,179	0,3951
197	SOH	Electronic & Electrical Equipment	0,0154	-0,1268	-2,4709**
198	SOL	Chemicals	0,1131	0,0383	0,4767
199	SOV	Food Producers	0,0417	0,0467	0,467
200	SPA	Chemicals	0	-0,0637	-6,0731***
201	SPG	Support Services	0,0185	-0,0482	-0,5028
202	SPP	Food & Drug Retailers	0,021	-0,0202	-1,8057*
203	SSK	Construction & Materials	0,0214	0,0309	0,9845
204	SUI	Travel & Leisure	0,0841	-0,0053	-0,0632
205	SUR	Travel & Leisure	-0,0203	-0,0749	-2,0073**
206	SVN	Equity Investment Instruments	0	0	0
207	SYC	Real Estate Investment & Services	0,0063	-0,0287	-0,843
208	TAS	General Retailers	-0,1307	0,2362	0,762
209	TAW	Mining	0	0,8046	1,074
210	TBS	Food Producers	0,0481	-0,0289	-0,9449
211	TDH	Real Estate Investment & Services	0	-0,0258	-2,1996**
212	TFG	General Retailers	0,0465	-0,0315	-0,5945
213	TKG	Fixed Line Telecommunications	0,0224	0,0066	0,5296
214	TMT	Equity Investment Instruments	0	-0,1057	-4,2332***
215	TON	Food Producers	-0,0117	-0,0506	-1,3429
216	TPC	General Industries	0	-0,0835	-3,4003***
217	TRE	Industrial Transportation	0	-0,1321	-3,6629***
218	TRU	General Retailers	0,0148	-0,1144	-5,2730***

	Ticker	Sector name	Stock returns	CAR	t-test
--	---------------	--------------------	----------------------	------------	---------------

219	TSH	Travel & Leisure	0,0839	0,0334	0,4162
220	TSX	Mining	0,0278	-0,0074	-0,5248
221	VIL	Mining	0	-0,0421	-4,6658***
222	VKE	Real Estate Investment & Services	0,0167	0,0198	1,093
223	VLE	Industrial Transportation	0	-0,0731	-4,8484***
224	VMK	General Retailers	0	-0,0296	-0,2265
225	WBO	Construction & Materials	0,0069	0,0216	0,3879
226	WEZ	Mining	-0,0043	-0,0239	-0,3958
227	WHL	General Retailers	0,056	0,0469	0,7352
228	WNH	Support Services	0	0,0711	0,6452
229	WSL	Mining	-0,0143	-0,0999	-1,0637
230	YRK	Forestry&Paper	0	0,0419	0,6754
231	ZED	General Financial	-0,0322	0,0551	0,3656
232	ZSA	Nonlife Insurance	0	0,0049	10,8339***

*** p<0.01, ** p<0.05, * p<0.1

Table 17: Cumulative Abnormal Returns QE2 – Companies

	Ticker	Sector Name	Stock returns	CAR	t-stat
1	ACL	Industrial Metals&Mining	-0,0112	-0,0265	-3,7192***
2	ACP	Real Estate Investment Trusts	-0,005	-0,0063	-0,9729
3	ACT	Health care Equipment & Services	0	-0,0254	-0,2113
4	ADH	General Retailers	0	0,0074	0,665
5	ADI	Software & Computer Services	0	0,0159	0,6241
6	ADR	Support Services	0,0126	-0,0066	-0,2308
7	AEE	General Industries	0	-0,0278	-0,669
8	AEG	Construction & Materials	0,0169	0,0222	0,8525
9	AEL	Electronic & Electrical Equipment	0,0117	0,0016	0,0565
10	AEN	Electronic & Electrical Equipment	-0,0141	0,0086	0,3088
11	AER	Electronic & Electrical Equipment	-0,0253	-0,0365	-1,2479
12	AFE	Chemicals	-0,0029	0,0067	0,6026
13	AFT	Construction & Materials	0,0032	-0,0285	-1,3411
14	AFX	Chemicals	-0,0227	-0,061	-11,3661***
15	AGL	Industrial Metals&Mining	0,0134	-0,0118	-0,3714
16	AME	Media	0	0,0051	0,2467
17	AMS	Mining	-0,0194	0,0177	0,6959
18	ANA	Real Estate Investment & Services	0	0,0084	1,1244
19	ANG	Mining	-0,0122	-0,0012	-0,0521
20	AON	General Retailers	0	-0,0165	-1,568
21	AOO	General Retailers	0	-0,0024	-11,1530***
22	AOVP	General Retailers	0	0	0
23	APK	General Industries	0	-0,0766	-1,57
24	APN	Pharmaceuticals & Biotechnology	-0,0002	0,0048	0,1086
	Ticker	Sector Name	Stock returns	CAR	t-stat

25	AQP	Mining	0,0076	0,0494	7,7636***
26	ARH	Electronic & Electrical Equipment	0	-0,0125	-0,2446
27	ARI	Industrial Metals&Mining	-0,0268	-0,0083	-0,198
28	ARL	Food Producers	0,0005	0,0131	1,5484
29	ART	Industrial Metals&Mining	0	-0,0257	-1,1913
30	ASR	Industrial Metals&Mining	0	-0,0104	-0,2441
31	ATL	Mining	0	0,0083	0,1089
32	AVI	Food Producers	-0,0004	-0,0207	-0,956
33	AWT	Beverages	0	0	0
34	BAT	General Financial	0,019	0,0329	1,4661
35	BAW	General Industries	0,0036	0,0064	0,3538
36	BCF	General Industries	-0,0047	-0,0077	-1,0112
37	BCX	Software & Computer Services	0	0,0048	1,1179
38	BDM	Construction & Materials	0,0345	0,1171	1,4164
39	BEL	Industrial Engineering	0	0,0074	1,1202
40	BGA	Banks	-0,004	0,0033	0,1313
41	BIL	Industrial Metals&Mining	-0,0147	-0,0096	-0,3984
42	BLU	Mobile Communications	-0,0217	0,0583	0,8433
43	BRN	Equity Investment Instruments	0	0,0108	1,2588
44	BRT	Equity Investment Instruments	0	0,0086	21,7800***
45	BSR	Construction & Materials	-0,0043	-0,0033	-1,1464
46	BVT	General Industries	-0,0019	-0,0014	-0,2918
47	CAC	Electronic & Electrical Equipment	0	0	0
48	CAT	Media	-0,014	-0,0163	-1,2745
49	CATP	Media	0	0	0
50	CCL	Software & Computer Services	0,0245	0,0136	0,4508
51	CDZ	General Financial	-0,0149	-0,0187	-0,4992
52	CFR	Leisure Goods	-0,0018	-0,0196	-1,1121
53	CGN	Software & Computer Services	0	-0,0066	-0,4747
54	CGR	Construction & Materials	-0,0682	-0,0201	-0,1814
55	CKS	Food Producers	0	-0,018	-1,3749
56	CLH	Travel & Leisure	-0,0081	-0,0206	-3,4117***
57	CLS	Food & Drug Retailers	0,0161	0,0453	9,7179***
58	CMH	General Retailers	0	-0,0076	-1,1697
59	CML	General Financial	-0,0047	-0,0054	-0,4113
60	CND	General Financial	0,0399	0,0507	0,8442
61	COM	Travel & Leisure	0	-0,0074	-0,3125
62	CPF	Real Estate Investment Trusts	-0,0013	-0,0035	-0,5024
63	CPI	Banks	0,0023	-0,0071	-0,7614
64	CRD	Mining	0	0,1208	1,1561
65	CRG	Industrial Transportation	0,0278	0,0245	0,7625
66	CSB	General Retailers	0	-0,0012	-0,0935
67	CUL	Travel & Leisure	0	0,0409	4,6370***
68	CZA	Industrial Metals&Mining	-0,0124	0,0089	0,2415
69	DAW	Construction & Materials	0	0,0066	0,8469
70	DCT	Software & Computer Services	0	-0,0133	-0,8978
Ticker Sector Name			Stock returns	CAR	t-stat

71	DGC	Electronic & Electrical Equipment	0,0196	0,0073	0,2275
72	DRD	Mining	0,0099	0,0429	2,6718***
73	DST	Beverages	-0,0099	-0,0421	-3,9580***
74	DSY	Life Insurance	0,0073	-0,0259	-0,6316
75	DTA	Chemicals	0,0056	-0,0414	-0,9492
76	DTC	Software & Computer Services	0,0055	0,0233	0,5205
77	EHS	Industrial Metals&Mining	-0,0111	-0,0154	-0,6606
78	ELI	Electronic & Electrical Equipment	0	0,0196	0,2153
79	ELR	Support Services	0	-0,0013	-0,5094
80	EMH	Personal Goods	-0,0182	-0,0166	-0,7933
81	EMI	Real Estate Investment & Services	0	-0,0029	-0,6967
82	ENX	Support Services	0	0,0637	0,8046
83	EOH	Software & Computer Services	-0,0044	-0,0005	-0,0276
84	EPS	Mining	0	0,1522	0,8487
85	ESR	Construction & Materials	0,0213	-0,0388	-0,4697
86	EXX	Mining	-0,0049	-0,0023	-0,2625
87	FBR	Travel & Leisure	0,0104	0,0042	0,3212
88	FGL	Banks	0	-0,0371	-2,0214**
89	FPT	Real Estate Investment & Services	0	0,0005	0,0267
90	FSR	Banks	-0,0096	0,0011	0,0471
91	FVT	Real Estate Investment & Services	0	-0,0094	-0,3057
92	GFI	Mining	0,0069	0,0287	1,0468
93	GGM	Industrial Metals&Mining	0	0,0521	0,7937
94	GIJ	Software & Computer Services	-0,061	-0,0461	-0,5993
95	GND	Industrial Transportation	-0,0026	0,0193	1,3324
96	GRF	Construction & Materials	-0,0197	0,0242	0,3314
97	GRT	Real Estate Investment Trusts	0,0048	0,0042	0,2532
98	HAR	Mining	-0,0061	0,0115	0,3362
99	HCI	Equity Investment Instruments	-0,0053	-0,0004	-0,0073
100	HDC	Industrial Engineering	0,0206	0,022	0,8894
101	HPA	Real Estate Investment Trusts	0,0106	0,02	0,6464
102	HPB	Real Estate Investment Trusts	0,022	0,0358	1,7048*
103	HWA	Mining	0	0,0163	1,6341
104	HWN	Industrial Engineering	0	-0,0704	-0,9606
105	HYP	Real Estate Investment Trusts	0,0015	0,004	1,8404*
106	ILA	Support Services	0,0205	-0,0071	-0,1317
107	ILV	Food Producers	0,013	0,0138	0,6981
108	IMP	Mining	-0,0254	-0,0228	-0,5234
109	ING	Real Estate Investment & Services	0	-0,0685	-0,8602
110	INL	General Financial	-0,01	0,0114	0,6579
111	INP	General Financial	-0,0158	0,003	0,0521
112	IPL	Industrial Transportation	0,0184	0,0285	1,2497
113	ITE	General Retailers	-0,0556	-0,0499	-0,489
114	ITU	Real Estate Investment & Services	0,0068	0,0147	0,5873
115	IVT	Industrial Engineering	0	-0,0113	-0,2738
116	JBL	Mining	0,0317	0,0194	0,3687
117	JDG	General Retailers	0,017	0,0297	1,8759*

			Stock returns	CAR	t-stat
--	--	--	----------------------	------------	---------------

118	JSC	Electronic & Electrical Equipment	0,0385	0,0364	0,8215
119	JSE	General Financial	-0,0076	-0,0057	-0,2724
120	KAP	General Industries	-0,005	0,0071	0,2854
121	KDV	Construction & Materials	0	-0,0088	-11,1530***
122	KIO	Industrial Metals&Mining	-0,0065	-0,0087	-0,3502
123	LBH	Life Insurance	-0,0139	-0,0163	-0,988
124	LEW	General Retailers	0,021	0,0217	0,6608
125	LHG	Pharmaceuticals & Biotechnology	0	0,009	0,2808
126	LNF	General Financial	0	0,1637	0,8777
127	LON	Mining	-0,0058	0,0349	1,2607
128	MAS	Construction & Materials	0	-0,0027	-0,6719
129	MDC	Health care Equipment & Services	-0,0076	-0,0158	-7,8499***
130	MED	Mining	0	0,0045	1,1568
131	MFL	Support Services	0	-0,0008	-0,3291
132	MIX	Support Services	-0,0217	-0,0318	-1,6975*
133	MMG	Support Services	0	0,0725	0,5944
134	MMI	Life Insurance	-0,0186	-0,0109	-0,5329
135	MML	Industrial Metals&Mining	-0,0411	0,0109	0,1287
136	MND	Forestry&Paper	0,0196	0,0284	0,5518
137	MNP	Forestry&Paper	0,0177	0,0172	0,3573
138	MOR	Software & Computer Services	0	0,0641	0,6207
139	MRF	Industrial Metals&Mining	-0,0154	0,0279	1,574
140	MRP	General Retailers	0,0332	0,0564	2,0094**
141	MSM	General Retailers	0,0391	0,0405	0,8547
142	MST	Technology Hardware & Equipment	0	0,0168	0,4246
143	MTA	Automobiles & Parts	-0,005	-0,0347	-1,3236
144	MTN	Mobile Communications	0,0019	-0,0097	-0,5757
145	MUR	Construction & Materials	-0,0238	0,012	0,228
146	MZR	Construction & Materials	0	0,0137	0,7386
147	NCS	General Retailers	0	-0,0236	-0,5947
148	NED	Banks	-0,0029	0,0082	0,6699
149	NHM	Mining	-0,0074	0,0043	0,1042
150	NPK	General Industries	0,0046	0,0058	0,426
151	NPN	Media	-0,0082	0,003	0,0597
152	NTC	Health care Equipment & Services	-0,0045	-0,0123	-1,489
		Household Goods and Home			
153	NWL	Construction	0	-0,0234	-2,4979**
154	OAO	Oil Equipment & Services	0	-0,0639	-0,8084
155	OCE	Food Producers	0	0	0,0095
156	OCT	Real Estate Investment & Services	-0,0006	-0,0031	-0,3901
157	OLG	Industrial Transportation	-0,03	0,1042	0,602
158	OML	Life Insurance	0,0107	-0,0181	-0,3757
159	OMN	Chemicals	0,0239	-0,0002	-0,0042
160	ORE	Real Estate Investment & Services	0	0,0101	0,3343
161	PAN	Mining	0,0526	0,0464	0,7618
162	PCT	Equity Investment Instruments	-0,1667	-0,1368	-0,6591
163	PET	Industrial Metals&Mining	0	0,0163	0,341

Ticker	Sector Name	Stock returns	CAR	t-stat
--------	-------------	---------------	-----	--------

164	PGR	General Financial	0,0368	0,0439	1,0168
165	PHM	Travel & Leisure	0	0,0052	1,3521
166	PIK	Food & Drug Retailers	0,0156	0,0132	0,7135
167	PMV	Support Services	0	-0,0189	-0,1446
168	PNC	Technology Hardware & Equipment	0,0109	0,0361	0,6993
169	PPC	Construction & Materials	-0,002	0,0009	0,0423
170	PPE	Equity Investment Instruments	0	-0,0065	-3,2563***
171	PPR	Real Estate Investment & Services	0	-0,0094	-0,4844
172	PSG	General Financial	0,0099	0,0067	0,509
173	RBW	Food Producers	0,0461	0,0561	1,0957
174	RBX	Construction & Materials	0,0057	-0,0024	-0,1067
175	RCL	Food Producers	0,0461	0,0561	1,0955
176	RDF	Real Estate Investment Trusts	0,0107	0,0133	1,1
177	RDI	Mining	0	-0,3564	-0,8744
178	REM	General Industries	-0,0065	-0,0027	-0,167
179	RES	Real Estate Investment Trusts	0,0007	0,0037	2,3255**
180	RLF	Chemicals	0	-0,0176	-3,5625***
181	RLO	Electronic & Electrical Equipment	-0,0044	-0,0039	-0,6698
182	RMH	Banks	0	0,0208	0,8088
183	RTO	General Retailers	0	-0,0106	-7,0679***
184	SAB	Beverages	-0,0159	-0,0143	-1,0874
185	SAC	Real Estate Investment Trusts	0,0098	-0,004	-0,2161
186	SAP	Forestry&Paper	0,003	-0,0353	-0,8305
187	SBK	Banks	-0,0045	-0,0145	-1,2975
188	SBV	Equity Investment Instruments	0	-0,0015	-2,5955***
189	SCL	Oil Equipment & Services	0,0127	0,0519	0,2846
190	SCP	Equity Investment Instruments	-0,0357	0,0511	0,4724
191	SFN	General Financial	0	-0,0115	-0,6444
192	SHP	Food & Drug Retailers	0,0099	0,0068	0,3341
193	SLM	Life Insurance	0,0009	0,0047	0,1861
194	SNH	Household Goods and Home Construction	-0,0011	0,0093	1,7801*
195	SNT	Nonlife Insurance	0	-0,0053	-0,7435
196	SNV	Support Services	-0,1429	-0,1743	-0,9806
197	SOH	Electronic & Electrical Equipment	0	-0,037	-1,4918
198	SOL	Chemicals	-0,0037	-0,0157	-1,0853
199	SOV	Food Producers	-0,0096	-0,0129	-3,5868***
200	SPA	Chemicals	0	0	0
201	SPG	Support Services	0	0,045	0,9324
202	SPP	Food & Drug Retailers	0,0081	0,0046	0,4379
203	SSK	Construction & Materials	-0,0051	0,0158	1,4062
204	SUI	Travel & Leisure	0,0088	0,0144	1,3024
205	SUR	Travel & Leisure	-0,0017	-0,0199	-0,5441
206	SVN	Equity Investment Instruments	0	0	0
207	SYC	Real Estate Investment & Services	0	-0,0007	-0,2022
208	TAS	General Retailers	0	-0,022	-0,4262
209	TAW	Mining	0	0,0014	0,1392
	Ticker	Sector Name	Stock returns	CAR	t-stat

210	TBS	Food Producers	0,0054	0,0372	4,0548***
211	TDH	Real Estate Investment & Services	0	-0,0236	-3,5530***
212	TFG	General Retailers	0,0207	0,0394	2,3486**
213	TKG	Fixed Line Telecommunications	0,0074	0,0296	3,0482***
214	TMT	Equity Investment Instruments	0,022	-0,0544	-0,5905
215	TON	Food Producers	0	-0,0186	-1,6925*
216	TPC	General Industries	-0,0179	-0,0375	-1,0956
217	TRE	Industrial Transportation	0	0,0396	0,7752
218	TRU	General Retailers	0,0291	0,0169	0,345
219	TSH	Travel & Leisure	0	-0,0193	-0,8661
220	TSX	Mining	0,0104	0,0104	0,4976
221	VIL	Mining	0	-0,0197	-41,7736***
222	VKE	Real Estate Investment & Services	0,0068	0,0018	0,0769
223	VLE	Industrial Transportation	0	-0,0005	-0,2693
224	VMK	General Retailers	0	0,0046	0,252
225	WBO	Construction & Materials	-0,0009	0,0437	0,481
226	WEZ	Mining	-0,0058	-0,0019	-0,0294
227	WHL	General Retailers	0,0211	0,041	2,0925**
228	WNH	Support Services	0	0,0238	1,3906
229	WSL	Mining	-0,0252	-0,0662	-0,4615
230	YRK	Forestry&Paper	-0,006	-0,0018	-0,1206
231	ZED	General Financial	0,0149	0,0213	1,4267
232	ZSA	Nonlife Insurance	0	0	2,2559**

*** p<0.01, ** p<0.05, * p<0.1

Table 18: Cumulative Abnormal returns QE3 – Companies

	Ticker	Sector Name	Sector returns	CAR	t-stat
1	ACL	Industrial Metals&Mining	-0,0109	-0,0386	-1,4872
2	ACP	Real Estate Investment Trusts	-0,0042	0,0118	0,4462
3	ACT	Health care Equipment & Services	0,0136	-0,0072	-0,3449
4	ADH	General Retailers	0	0,0273	0,7697
5	ADI	Software & Computer Services	0	0,0167	0,1648
6	ADR	Support Services	0,0015	-0,0163	-1,0001
7	AEE	General Industries	0,0333	-0,0002	-0,0034
8	AEG	Construction & Materials	-0,0277	-0,0389	-2,6193***
9	AEL	Electronic & Electrical Equipment	0,0009	0,0124	1,8712
10	AEN	Electronic & Electrical Equipment	-0,0013	0,0327	0,8206
11	AER	Electronic & Electrical Equipment	-0,0113	-0,1301	-1,7672**
12	AFE	Chemicals	-0,017	-0,0201	-0,7113
13	AFT	Construction & Materials	0	0,0484	1,2883
14	AFX	Chemicals	-0,0005	0,0145	1,0865
15	AGL	Industrial Metals&Mining	-0,0184	-0,0253	-1,1129
16	AME	Media	0	-0,0003	-2,0146**
	Ticker	Sector Name	Sector returns	CAR	t-stat

17	AMS	Mining	-0,0023	0,0695	4,7725***
18	ANA	Real Estate Investment & Services	0	0,0552	2,3580**
19	ANG	Mining	-0,0155	-0,008	-0,2589
20	AON	General Retailers	0,1515	0,1509	1,1197
21	AOO	General Retailers	0	0	0
22	AOVP	General Retailers	0,0012	0,0012	1,118
23	APK	General Industries	0,0061	0,0312	1,5346
24	APN	Pharmaceuticals & Biotechnology	-0,0007	0,0133	1,4743
25	AQP	Mining	-0,023	0,1223	1,351
26	ARH	Electronic & Electrical Equipment	0,0345	0,0387	1,3987
27	ARI	Industrial Metals&Mining	-0,021	-0,0424	-4,2459***
28	ARL	Food Producers	0	0,0197	2,7901***
29	ART	Industrial Metals&Mining	-0,0214	-0,0099	-0,5738
30	ASR	Industrial Metals&Mining	0,0032	0,0221	0,4272
31	ATL	Mining	0	0,0743	2,5975***
32	AVI	Food Producers	0,0172	0,0386	1,6607*
33	AWT	Beverages	0	0,1627	0,7005
34	BAT	General Financial	-0,0018	-0,0151	-3,0282***
35	BAW	General Industries	-0,0039	-0,0442	-2,3486**
36	BCF	General Industries	0	0,046	2,0642**
37	BCX	Software & Computer Services	0,0021	0,0725	1,9033*
38	BDM	Construction & Materials	0,1538	0,0125	0,0712
39	BEL	Industrial Engineering	-0,0311	-0,0146	-0,4689
40	BGA	Banks	-0,0143	0,0237	0,8384
41	BIL	Industrial Metals&Mining	0,0052	0,0142	0,6497
42	BLU	Mobile Communications	0,0131	0,1166	3,5549***
43	BRN	Equity Investment Instruments	0	-0,0173	-1,9601**
44	BRT	Equity Investment Instruments	0	-0,0275	-1,6049
45	BSR	Construction & Materials	-0,0146	-0,1527	-1,5574
46	BVT	General Industries	-0,0128	-0,0181	-1,2747
47	CAC	Electronic & Electrical Equipment	0	0	0
48	CAT	Media	0	0,0013	0,0304
49	CATP	Media	0	0,0032	8,2036***
50	CCL	Software & Computer Services	0	-0,0217	-0,7957
51	CDZ	General Financial	-0,0111	-0,0224	-0,9192
52	CFR	Leisure Goods	-0,0036	0,0037	0,1952
53	CGN	Software & Computer Services	-0,0179	-0,0205	-0,4588
54	CGR	Construction & Materials	-0,0127	-0,0452	-0,759
55	CKS	Food Producers	0	-0,0019	-0,6273
56	CLH	Travel & Leisure	-0,0043	0,0514	2,3919**
57	CLS	Food & Drug Retailers	-0,017	0,0087	0,4021
58	CMH	General Retailers	0	0,0434	1,1643
59	CML	General Financial	-0,0027	-0,0084	-0,5104
60	CND	General Financial	0	0,0764	1,2425
61	COM	Travel & Leisure	0	-0,0453	-1,2046
62	CPF	Real Estate Investment Trusts	0,0076	-0,0046	-0,1089
63	CPI	Banks	0,008	0,0226	1,2004
	Ticker	Sector Name	Sector returns	CAR	t-stat

64	CRD	Mining	-0,1667	-0,061	-0,3132
65	CRG	Industrial Transportation	0	-0,0012	-2,4461**
66	CSB	General Retailers	0,0065	0,0294	2,4864**
67	CUL	Travel & Leisure	0	-0,0692	-9,2134***
68	CZA	Industrial Metals&Mining	-0,0149	-0,1549	-3,5168***
69	DAW	Construction & Materials	0,0015	0,0071	0,35
70	DCT	Software & Computer Services	-0,0019	0,0531	2,7727***
71	DGC	Electronic & Electrical Equipment	-0,0165	-0,0419	-2,3480**
72	DRD	Mining	-0,0039	0,0424	0,9863
73	DST	Beverages	-0,0031	0,0024	0,0805
74	DSY	Life Insurance	-0,0189	0,0134	0,4621
75	DTA	Chemicals	-0,0538	0,0358	0,3533
76	DTC	Software & Computer Services	0,007	-0,0075	-0,3885
77	EHS	Industrial Metals&Mining	0	0,0245	1,2103
78	ELI	Electronic & Electrical Equipment	-0,0312	-0,0713	-2,2917**
79	ELR	Support Services	0,0238	-0,0305	-0,7598
80	EMH	Personal Goods	-0,0143	-0,0379	-2,1614**
81	EMI	Real Estate Investment & Services	0,0015	0,0112	0,8774
82	ENX	Support Services	0	0,0607	1,4724
83	EOH	Software & Computer Services	-0,0011	0,0258	1,0678
84	EPS	Mining	-0,0083	-0,0178	-0,6499
85	ESR	Construction & Materials	0,041	0,1531	1,1194
86	EXX	Mining	-0,0113	-0,0476	-1,5392
87	FBR	Travel & Leisure	0,0094	0,0372	3,9970***
88	FGL	Banks	0	-0,1292	-0,5428
89	FPT	Real Estate Investment & Services	0,0168	-0,0051	-0,2004
90	FSR	Banks	0,0018	-0,0032	-0,1918
91	FVT	Real Estate Investment & Services	0	-0,0338	-2,9172***
92	GFI	Mining	-0,0047	-0,0352	-1,4435
93	GGM	Industrial Metals&Mining	-0,025	-0,0125	-0,704
94	GIJ	Software & Computer Services	0,0476	0,0241	0,1787
95	GND	Industrial Transportation	0,0662	0,1209	2,2229**
96	GRF	Construction & Materials	-0,0049	0,0347	1,275
97	GRT	Real Estate Investment Trusts	0,0099	-0,006	-0,2869
98	HAR	Mining	0,0042	0,0127	0,1785
99	HCI	Equity Investment Instruments	-0,0106	0,009	0,3474
100	HDC	Industrial Engineering	0,0091	0,0237	1,1421
101	HPA	Real Estate Investment Trusts	0	0,0127	0,2787
102	HPB	Real Estate Investment Trusts	0	-0,1091	-1,5139
103	HWA	Mining	0	0,0322	94,0925***
104	HWN	Industrial Engineering	0	-0,0012	-0,112
105	HYP	Real Estate Investment Trusts	0,0035	0,0027	0,3167
106	ILA	Support Services	0,0019	0,0251	2,5514**
107	ILV	Food Producers	-0,004	0,0203	1,5514
108	IMP	Mining	-0,0069	0,0301	1,9395*
109	ING	Real Estate Investment & Services	0	-0,1247	-1,2157
110	INL	General Financial	-0,014	-0,0412	-2,3911**

	Ticker	Sector Name	Sector returns	CAR	t-stat
--	---------------	--------------------	-----------------------	------------	---------------

111	INP	General Financial	-0,0148	-0,0334	-1,141
112	IPL	Industrial Transportation	0,0172	0,0691	2,4794**
113	ITE	General Retailers	0,0141	-0,0139	-0,3675
114	ITU	Real Estate Investment & Services	-0,0023	-0,0074	-0,7953
115	IVT	Industrial Engineering	0,0001	0,0013	0,0767
116	JBL	Mining	0,0252	-0,0114	-0,1476
117	JDG	General Retailers	-0,0077	-0,0342	-2,5593**
118	JSC	Electronic & Electrical Equipment	0	0,0058	0,059
119	JSE	General Financial	-0,0034	-0,0252	-2,3118**
120	KAP	General Industries	0,0201	0,0016	0,0265
121	KDV	Construction & Materials	-0,0154	0,1449	0,88
122	KIO	Industrial Metals&Mining	-0,0031	-0,0152	-0,616
123	LBH	Life Insurance	0,0095	-0,0222	-0,9388
124	LEW	General Retailers	0,0089	0,0144	1,0566
125	LHG	Pharmaceuticals & Biotechnology	0,0053	-0,011	-0,3765
126	LNF	General Financial	0	0	0
127	LON	Mining	-0,0366	0,0272	0,4337
128	MAS	Construction & Materials	0	0,0101	4,6143***
129	MDC	Health care Equipment & Services	0,012	0,0033	0,1934
130	MED	Mining	0,1556	0,0294	0,0941
131	MFL	Support Services	-0,0278	-0,045	-0,9565
132	MIX	Support Services	-0,0039	0,0105	0,2559
133	MMG	Support Services	-0,05	0,0088	0,0602
134	MMI	Life Insurance	-0,0016	-0,0143	-1,2674
135	MML	Industrial Metals&Mining	0	0,0069	0,3566
136	MND	Forestry&Paper	-0,0152	-0,0392	-3,3997***
137	MNP	Forestry&Paper	-0,0167	-0,0392	-3,6910***
138	MOR	Software & Computer Services	-0,1	0,007	0,0463
139	MRF	Industrial Metals&Mining	-0,0122	-0,0192	-0,5221
140	MRP	General Retailers	-0,0056	0,0027	0,1219
141	MSM	General Retailers	0,003	0	-0,0024
142	MST	Technology Hardware & Equipment	-0,0017	-0,0121	-0,814
143	MTA	Automobiles & Parts	0,0222	0,116	2,7885***
144	MTN	Mobile Communications	-0,0033	0,0206	0,781
145	MUR	Construction & Materials	-0,0117	-0,0247	-1,2504
146	MZR	Construction & Materials	0	0,0048	1,8737*
147	NCS	General Retailers	0	0,1346	1,9085*
148	NED	Banks	0,0019	0,0073	0,4418
149	NHM	Mining	0,018	0,1431	2,4660**
150	NPK	General Industries	0,0097	0,012	0,4967
151	NPN	Media	-0,0124	-0,0181	-1,8217*
152	NTC	Health care Equipment & Services	-0,0153	-0,0185	-1,0143
153	NWL	Household Goods and Home Construction	0	0,0075	3,6466***
154	OAD	Oil Equipment & Services	0	-0,0226	-0,3248
155	OCE	Food Producers	-0,0009	-0,0216	-0,4554
156	OCT	Real Estate Investment & Services	0	0,0213	0,6354
	Ticker	Sector Name	Sector returns	CAR	t-stat

157	OLG	Industrial Transportation	-0,0159	0,005	0,1919
158	OML	Life Insurance	0,0013	-0,0035	-0,2011
159	OMN	Chemicals	0	0,0158	0,8663
160	ORE	Real Estate Investment & Services	0	-0,0857	-1,6821*
161	PAN	Mining	0	0,0441	2,1315**
162	PCT	Equity Investment Instruments	0	0,0186	1,3542
163	PET	Industrial Metals&Mining	-0,0227	-0,0596	-1,9581*
164	PGR	General Financial	0,0089	-0,0103	-0,5966
165	PHM	Travel & Leisure	0,0057	0,0335	7,8009***
166	PIK	Food & Drug Retailers	-0,009	0,0244	0,7976
167	PMV	Support Services	0	-0,0874	-1,5339
168	PNC	Technology Hardware & Equipment	0	-0,027	-1,5595
169	PPC	Construction & Materials	-0,0105	0,0642	3,9911***
170	PPE	Equity Investment Instruments	0	-0,037	-1,1089
171	PPR	Real Estate Investment & Services	0	-0,0173	-0,9642
172	PSG	General Financial	-0,0057	-0,0316	-1,7345*
173	RBW	Food Producers	0	0,0228	0,5513
174	RBX	Construction & Materials	0	0,007	0,765
175	RCL	Food Producers	0	0,0228	0,5513
176	RDF	Real Estate Investment Trusts	0,0033	-0,0139	-0,6059
177	RDI	Mining	0	0,0116	2,0954**
178	REM	General Industries	-0,0077	-0,0279	-3,8086***
179	RES	Real Estate Investment Trusts	0,0043	-0,0062	-0,5053
180	RLF	Chemicals	0	-0,1123	-1,5567
181	RLO	Electronic & Electrical Equipment	-0,0135	-0,0425	-2,2450**
182	RMH	Banks	-0,0022	-0,0118	-0,9296
183	RTO	General Retailers	0	0,0008	1,0044
184	SAB	Beverages	-0,001	-0,0047	-0,2666
185	SAC	Real Estate Investment Trusts	0,0107	0,0155	1,1649
186	SAP	Forestry&Paper	-0,0113	-0,0321	-1,6324
187	SBK	Banks	-0,0049	-0,0081	-0,6482
188	SBV	Equity Investment Instruments	0	-0,0115	-1,5462
189	SCL	Oil Equipment & Services	0	-0,065	-1,2987
190	SCP	Equity Investment Instruments	-0,0312	-0,0354	-0,7535
191	SFN	General Financial	0	0,0023	0,4874
192	SHP	Food & Drug Retailers	0,006	0,0457	3,8148***
193	SLM	Life Insurance	-0,0104	-0,0235	-3,5008***
194	SNH	Household Goods and Home Construction	0,0016	0,0164	2,1108**
195	SNT	Nonlife Insurance	0,0078	0,0304	1,6248
196	SNV	Support Services	-0,0575	0,0153	0,172
197	SOH	Electronic & Electrical Equipment	0	-0,1002	-1,8017*
198	SOL	Chemicals	-0,0028	0,0051	0,3985
199	SOV	Food Producers	0	0,0127	0,6243
200	SPA	Chemicals	0	-0,0248	-1,2532
201	SPG	Support Services	-0,0239	0,0037	0,0705
202	SPP	Food & Drug Retailers	-0,0004	0,018	0,4496
	Ticker	Sector Name	Sector returns	CAR	t-stat

203	SSK	Construction & Materials	0	0,0131	1,2032
204	SUI	Travel & Leisure	0,002	0,0186	4,7554***
205	SUR	Travel & Leisure	-0,0196	0,0208	0,5875
206	SVN	Equity Investment Instruments	0	-0,0035	-0,3822
207	SYC	Real Estate Investment & Services	-0,0111	0,021	0,5601
208	TAS	General Retailers	0,0363	-0,0629	-0,7811
209	TAW	Mining	0	-0,3015	-1,3693
210	TBS	Food Producers	0,0096	0,0252	1,0077
211	TDH	Real Estate Investment & Services	0,0385	-0,0067	-0,1251
212	TFG	General Retailers	-0,0042	0,0073	0,5723
213	TKG	Fixed Line Telecommunications	0,0047	0,0875	1,4492
214	TMT	Equity Investment Instruments	0	0,0038	1,6444*
215	TON	Food Producers	-0,0077	-0,0399	-2,0966**
216	TPC	General Industries	-0,0578	-0,0463	-0,8994
217	TRE	Industrial Transportation	0,0125	-0,0015	-0,0768
218	TRU	General Retailers	-0,0199	-0,0433	-1,8827*
219	TSH	Travel & Leisure	-0,0125	-0,0277	-1,6789*
220	TSX	Mining	0,0252	-0,0601	-0,7338
221	VIL	Mining	-0,0145	-0,0174	-0,2582
222	VKE	Real Estate Investment & Services	0	-0,0066	-0,6865
223	VLE	Industrial Transportation	0,0098	-0,0095	-0,4245
224	VMK	General Retailers	-0,0112	-0,0026	-0,3205
225	WBO	Construction & Materials	-0,0075	-0,0082	-0,4789
226	WEZ	Mining	0,0175	0,0635	0,7656
227	WHL	General Retailers	-0,0119	0,0718	1,6047
228	WNH	Support Services	-0,0187	-0,043	-0,9027
229	WSL	Mining	-0,0109	-0,1049	-2,3450**
230	YRK	Forestry&Paper	0	-0,0263	-1,0546
231	ZED	General Financial	0	-0,0041	-0,271
232	ZSA	Nonlife Insurance	0	-0,0128	-18,2532***

*** p<0.01, ** p<0.05, * p<0.1

Appendix D: Summary statistics for Cumulative Abnormal Returns

Table 19: QEI Summary statistics

QE1 CARs_Firms				QE1 CARs_Sectors			
Percentiles	Smallest			Percentiles	Smallest		
1%	-,2711145	-,357381		1%	-,7697699	-,7697699	
5%	-,1710128	-,357381		5%	-,5844917	-,7697699	
10%	-,1349925	-,357381	Obs 405,768	10%	-,5844917	-,7697699	Obs 405,768
25%	-,0766524	-,357381	Sum of Wgt. 405,768	25%	-,4485664	-,7697699	Sum of Wgt. 405,768
50%	-,0270076		Mean -0,02292	50%	-,1867734		Mean -0,11151
Largest			Std. Dev. 0,109904	Largest			Std. Dev. 0,463173
75%	,0220508	,8045873		75%	,0372157	1,060258	
90%	,0733888	,8045873	Variance 0,012079	90%	,2241646	1,060258	Variance 0,21453
95%	,1568309	,8045873	Skewness 1,899493	95%	1,060258	1,060258	Skewness 1,309277
99%	,2569087	,8045873	Kurtosis 16,42298	99%	1,060258	1,060258	Kurtosis 4,430798

Table 20: QE2 Summary Statistics

QE2 CARs_Firms				QE2 CARs_Sectors			
Percentiles	Smallest			Percentiles	Smallest		
1%	-,1367657	-,3564323		1%	-,1344203	-,1344203	
5%	-,0460928	-,3564323		5%	-,1292188	-,1344203	
10%	-,0278368	-,3564323	Obs 405,768	10%	-,1291394	-,1344203	Obs 405,768
25%	-,0123907	-,3564323	Sum of Wgt. 405,768	25%	-,0359177	-,1344203	Sum of Wgt. 405,768
50%	,0002737		Mean .0018942	50%	,0085389		Mean .0362279
Largest			Std. Dev. .0422569	Largest			Std. Dev. .1072033
75%	,0163031	,1636902		75%	,1061454	,2923863	
90%	,0409544	,1636902	Variance .0017856	90%	,1516476	,2923863	Variance .0114926
95%	,0560978	,1636902	Skewness -2,423955	95%	,2923863	,2923863	Skewness .4290435
99%	,1207645	,1636902	Kurtosis 26,85798	99%	,2923863	,2923863	Kurtosis 2,811806

Table 21: QE3 Summary Statistics

QE3 CARs_Firms			
Percentiles	Smallest		
1%	-.1526691	-.3014874	
5%	-.0857021	-.3014874	
10%	-.0450034	-.3014874	Obs 405,768
25%	-.0222672	-.3014874	Sum of Wgt. 405,768
50%	0		Mean -0.004868
Largest			Std. Dev. .0519989
75%	.0208584	.1627041	
90%	.0483601	.1627041	Variance .0027039
95%	.0764068	.1627041	Skewness -.556943
99%	.150939	.1627041	Kurtosis 8.896768

QE3 CARs_Sectors			
Percentiles	Smallest		
1%	-.3099078	-.3099078	
5%	-.3099078	-.3099078	
10%	-.1785607	-.3099078	Obs 405,768
25%	-.1008677	-.3099078	Sum of Wgt. 405,768
50%	-.0180553		Mean -0.033881
Largest			Std. Dev. .1695556
75%	.0986702	.326701	
90%	.2302869	.326701	Variance .0287491
95%	.326701	.326701	Skewness .1825863
99%	.326701	.326701	Kurtosis 2.526775

Appendix E: Results for the robust analysis

Table 22: QE1 CARs with extended event window

	Sector Code	Sector name	Sector Returns	CARs	t-stat
1	570	Oil Equipment & Services	0	-0,235	-2,832***
2	1350	Chemicals	0,003	-0,148	-3,764***
3	1730	Forestry&Paper	0,019	-0,301	-4,598***
4	1750	Industrial Metals&Mining	0,061	0,323	8,674***
5	1770	Mining	0,013	1,004	22,925***
6	2350	Construction & Materials	0,023	-0,624	-46,506***
7	2720	General Industries	-0,004	-0,552	-27,414***
8	2730	Electronic & Electrical Equipment	0,038	-0,283	-14,101***
9	2750	Industrial Engineering	-0,006	-0,447	-9,375***
10	2770	Industrial Transportation	-0,002	-0,22	-7,560***
11	2790	Support Services	0,045	-0,208	-5,061***
12	3350	Automobiles & Parts	0	-0,059	-1,423
13	3530	Beverages	0,017	0,177	4,685***
14	3570	Food Producers	0,013	0,022	2,389**
15	3720	Household Goods and Home Construction	0,009	-0,273	-9,822***
16	3740	Leisure Goods	0,06	-0,086	-1,969**
17	3760	Personal Goods	-0,02	0,055	1,904*
18	4530	Health care Equipment & Services	0	-0,191	-5,777***
19	4570	Pharmaceuticals & Biotechnology	0	-0,11	-5,178***
20	5330	Food & Drug Retailers	0,037	-0,453	-14,844***
21	5370	General Retailers	0,003	-0,727	-36,195***
22	5550	Media	-0,01	-0,113	-3,232***
23	5750	Travel & Leisure	0,024	-0,076	-3,492***
24	6530	Fixed Line Telecommunications	0,022	-0,006	-0,37
25	6570	Mobile Communications	0,019	-0,058	-0,933
26	8350	Banks	0,041	-0,114	-3,178***
27	8530	Nonlife Insurance	0,008	-0,011	-0,601
28	8570	Life Insurance	0,026	-0,451	-12,338***
29	8630	Real Estate Investment & Services	0,008	0,425	14,837***
30	8670	Real Estate Investment Trusts	0,024	0,339	20,037***
31	8770	General Financial	0,004	-0,115	-3,087***
32	8980	Equity Investment Instruments	-0,016	0,268	7,165***
33	9530	Software & Computer Services	0,01	-0,571	-13,849***
34	9570	Technology Hardware & Equipment	0,053	-0,222	-2,786***

*** p<0.01, ** p<0.05, * p<0.1

Table 23: QE2 CARs with extended event window

Sector Code	Sector name	Sector Returns	CARs	t-stat
1	570 Oil Equipment & Services	0,006329	-0,129	-0,99
2	1350 Chemicals	3,88E-05	-0,058	-1,442
3	1730 Forestry&Paper	0,008568	-0,074	-2,220**
4	1750 Industrial Metals&Mining	-0,00968	-0,067	-1,624
5	1770 Mining	0,000302	0,147	1,796*
6	2350 Construction & Materials	-0,00265	-0,166	-2,634***
7	2720 General Industries	-0,00309	-0,069	-2,156**
8	2730 Electronic & Electrical Equipment	0,002599	-0,202	-4,610***
9	2750 Industrial Engineering	0,005141	-0,02	-0,532
10	2770 Industrial Transportation	0,002261	0,315	5,540***
11	2790 Support Services	-0,01195	-0,058	-0,736
12	3350 Automobiles & Parts	-0,00498	-0,043	-2,087**
13	3530 Beverages	-0,0086	-0,083	-3,402***
14	3570 Food Producers	0,010092	0,161	5,715***
15	3720 Household Goods and Home Construction	-0,00055	-0,022	-1,393
16	3740 Leisure Goods	-0,00179	-0,023	-1,354
17	3760 Personal Goods	-0,01818	0,102	1,098
18	4530 Health care Equipment & Services	-0,00403	0,002	0,031
19	4570 Pharmaceuticals & Biotechnology	-0,00012	0,044	2,152**
20	5330 Food & Drug Retailers	0,012436	0,178	7,721***
21	5370 General Retailers	0,006982	0,166	4,373***
22	5550 Media	-0,00555	-0,028	-0,564
23	5750 Travel & Leisure	0,00119	0,592	4,315***
24	6530 Fixed Line Telecommunications	0,00741	0,014	0,656
25	6570 Mobile Communications	-0,0099	0,091	2,135**
26	8350 Banks	-0,00268	-0,073	-3,880***
27	8530 Nonlife Insurance	0	-0,013	-2,142**
28	8570 Life Insurance	-0,00271	-0,031	-0,937
29	8630 Real Estate Investment & Services	0,001079	-0,116	-5,599***
30	8670 Real Estate Investment Trusts	0,005983	0,039	2,227**
31	8770 General Financial	0,005634	0,11	1,900*
32	8980 Equity Investment Instruments	-0,02064	-0,175	-2,270**
33	9530 Software & Computer Services	-0,00394	-0,05	-1,015
34	9570 Technology Hardware & Equipment	0,005435	-0,008	-0,176

*** p<0.01, ** p<0.05, * p<0.1

Table 24: QE3: CARs with extended event window

Sector Code	Sector name	Sector Returns	CARs	t-stat
1	570 Oil Equipment & Services	0	-0,088	-1,423
2	1350 Chemicals	-0,011	-0,086	-1,924*
3	1730 Forestry&Paper	-0,011	-0,137	-6,795***
4	1750 Industrial Metals&Mining	-0,011	-0,31	-9,501***
5	1770 Mining	-0,003	0,037	0,379
6	2350 Construction & Materials	0,006	0,23	3,067***
7	2720 General Industries	-0,001	-0,046	-1,31
8	2730 Electronic & Electrical Equipment	-0,004	-0,296	-5,987***
9	2750 Industrial Engineering	-0,005	0,009	0,44
10	2770 Industrial Transportation	0,015	0,183	5,408***
11	2790 Support Services	-0,014	-0,098	-1,681*
12	3350 Automobiles & Parts	0,022	0,116	2,789***
13	3530 Beverages	-0,001	0,16	1,219
14	3570 Food Producers	0,001	0,099	3,707***
15	3720 Household Goods and Home Construction	0,001	0,024	4,392***
16	3740 Leisure Goods	-0,004	0,004	0,195
17	3760 Personal Goods	-0,014	-0,038	-2,161**
18	4530 Health care Equipment & Services	0,003	-0,022	-1,141
19	4570 Pharmaceuticals & Biotechnology	0,002	0,002	0,096
20	5330 Food & Drug Retailers	-0,005	0,097	3,619***
21	5370 General Retailers	0,009	0,327	7,197***
22	5550 Media	-0,003	-0,014	-0,631
23	5750 Travel & Leisure	-0,002	0,019	0,857
24	6530 Fixed Line Telecommunications	0,005	0,088	1,449
25	6570 Mobile Communications	0,005	0,137	4,431***
26	8350 Banks	-0,001	-0,099	-1,189
27	8530 Nonlife Insurance	0,004	0,018	1,205
28	8570 Life Insurance	-0,004	-0,05	-2,596***
29	8630 Real Estate Investment & Services	0,004	-0,179	-4,281***
30	8670 Real Estate Investment Trusts	0,004	-0,097	-2,742***
31	8770 General Financial	-0,004	-0,113	-5,003***
32	8980 Equity Investment Instruments	-0,005	-0,101	-4,736***
33	9530 Software & Computer Services	-0,007	0,149	2,102**
34	9570 Technology Hardware & Equipment	-0,001	-0,039	-2,512**

*** p<0.01, ** p<0.05, * p<0.1