A STUDY OF THE IMPACT OF TWO U.S. QUANTITATIVE EASING PROGRAMS ON MAJOR FINANCIAL MARKETS

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Abstract: *The purpose of this study is to explore the relationship between two United States Quantitative Easing programs (Quantitative Easing one and two) and the existence of positive abnormal returns among eight major financial markets which are the eight variables in this study: the Morgan Stanley Capital International (MSCI) World Index, the Standard and Poor (S&P) 500, the JP Morgan Emerging Markets Bond Index (EMBI) Spread, the Financial Times and the London Stock Exchange (FTSE) 100, Deutscher Aktien Index (DAX), Stock Exchange of Thailand (SET), 10 Year Treasury Yield, and Gold. This research aims to test the purpose of market efficiency, only focusing on the Semi-Strong form hypothesis. The daily closing price data from each financial market was collected from the Bloomberg database during the periods running from 17 June 2008 to 2 December 2008 and 13 April 2011 to 28 September 2011 respectively. The Unit Root Test by Augmented Dickey Fuller is applied. It is carried out by the EViews 5.1 program. This research follows the Correlational Research Methodology, which includes the Event Study Methodology and the use of Microsoft Excel. Statistically significant Total Standardized Abnormal Returns, Cumulative Total Standardized Abnormal Returns, Z-Statistic, and P-Value determination were used to present the test results. All eight variables became stationary data at first difference level. The Event Study Methodology interpreted the Total Standardized Abnormal Returns (TSARs) as not equal to zero, which means that both US Quantitative Easing programs had an effect on major financial markets. However, Quantitative Easing two had an excessive leakage. The Cumulative Total Standardized Abnormal Returns (CTSARs) is significant.*

Keywords: *Quantitative Easing Program, Financial Markets, Monetary Policy, Event Study Methodology, Stationary Test.*

1. Introduction

Quantitative Easing programs are programs intended to stimulate a country's economy as part of its monetary policy. They have become important monetary policy tools for many central banks such as, for example, the Bank of England or the Federal Reserve. The latter uses it to raise the money supply within the U.S. economy without changing the Fed Funds Rate in the market. U.S. Quantitative Easing programs have a greater impact on many financial markets than any other because the United States is a major driver of the world's economy. They are likely to affect interest rates and asset prices in many countries. Another name for the Quantitative Easing Program in the United States is "Large Scale Asset Purchase."

This article focuses on two recent U.S. Quantitative Easing programs and how they affected some major financial markets (in this study also referred to as 'samples'), namely, The Morgan Stanley Capital International (MSCI) World Index, the Standard and Poor (S&P) 500, the JP Morgan Emerging Markets Bond Index (EMBI) Spread, the Financial Times and the London Stock Exchange (FTSE) 100, Deutscher Aktien IndeX (DAX), Stock Exchange of Thailand (SET), and the 10 Year Treasury Yield, and Gold.

This research attempts to determine whether any abnormal returns were generated in financial markets after the U.S. Quantitative Easing programs were implemented. Abnormal returns can be calculated by measuring the gap between expected and normal returns. Returns before and after the U.S. Quantitative Easing programs were implemented will be compared using the Event Study Methodology (MacKinlay 1997; McWilliams & Siegel, 1997). This methodology focuses on the reaction of financial security prices to special events. Using the Event Study Methodology has been common practice for more than 40 years. This is especially true of stock market movement analysis.

This research looks at the effects from the two Quantitative Easing programs separately

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since there is a large gap between the periods during which Quantitative Easing one and two were implemented. This process may also entail looking at other significant events related to the samples considered. The researcher believes that, as significant events, the two U.S. Quantitative Easing programs were bound to have some effects on financial markets and on the stock market in particular, whose information flows tend to be very efficient, which means equity prices radpidly adjust to reflect new information coming to the market.

After reviewing the relevant literature and introducing the conceptual framework developed from previous empirical studies, this article focuses on the methodology used. It then discusses the results.

2. Theoretical Background

- *Quantitative Easing Programs*

U.S. Quantitative Easing programs aim to stimulate the economy. Easing programs are part of the monetary policy of the Federal Reserve (and also of the Central Banks of many countries) and are relatively new tools to address economic problems. The overall target (policy) rate remained unchanged in the two Easing programs. However, there is one limitation to the monetary policy applied; the nominal interest rate cannot be lower than zero. When the interest rate almost hits zero, inflation is relatively low. That's why the Federal Reserve needed to inject more money into the economic system. The two Easing programs also involved purchasing assets from the private sector, including banks and pension funds, by the Federal Reserve.

- *Quantitative Easing One*

On November 25, 2008, the Federal Reserve announced that it would buy the agency debt and mortgage-backed securities (MBS) in the market, declaring an amount of around 600 Billion US Dollars to achieve the purchase. An agency debt is a security, usually a bond, issued by a US government-sponsored agency, set up in order to allow certain groups of people to have access to low cost financing, such as for example, students and home buyers. Prominent issuers of agency securities include the Student Loan Marketing Association (Sallie Mae), the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac). Agency securities are usually exempt from state and local taxes, but are subjected to federal tax.

By 18 March 2009, the Federal Reserve held 1.75 trillion U.S. Dollars of bank debt, MBS, and Treasury notes, which reached a peak of 2.1 trillion U.S. Dollars in June 2010. Further purchases were halted when the economy started to improve. However, they resumed in August 2010 when the Fed decided the economy was not growing robustly enough. After the June halt, holdings started falling naturally as debt matured. They were projected to fall to 1.7 trillion U.S. Dollars by 2012. The Fed's revised goal shifted to keep holdings at the 2.054 trillion U.S. dollar level. When the extension of the Quantitative Easing program was announced, the Fed purchased treasury securities for around 300 Billion US dollars. In addition, it also bought 850 Billion U.S. dollars of agency debt and agency mortgage-backed securities.

- *Quantitative Easing Two*

The second U.S. Quantitative Easing program, called 'Operation Twist', was implemented on September 21, 2011. On that day, as part of the implementation of Operation Twist, the Federal Open Market Committee broadcast that there was an implementation of Operation Twist. This strategy from the Federal Reserve was conducted by using a bond purchase program. The strategy was separated into two main parts. The first one consisted in the selling by the Fed of short term bonds or bonds that had maturity lower than three years. The second was to buy longer-term bonds, those with a maturity of between six to thirty years. The total amount purchased was around 400 Billion U.S dollar. By implementing this strategy, the average maturity of the Federal Reserve portfolio was lengthened. Operation Twist sought Quantitative Easing without increasing the balance sheet of the Federal Reserve which did not print money into the system. Unlike Quantitative Easing one, Operation Twist aimed to minimize inflation that occurs when the Federal Reserve implements a Quantitative Easing Program.

- *Monetary Policies*

Monetary policies are implemented by the Central Banks of each country. The monetary policy affects the overall economy because it changes the reserves in the banking system. In addition, it also affects credit availability and money supply within the economy.

There are basically two main monetary policies: one is expansionary, the other contractionary. The purpose and implementation of these two policies are opposite. The contractionary monetary policy tries to slow down the economy when it moves too fast. The expansionary monetary policy, on the other hand, focuses on stimulating the economy when it is in a recession period.

In the United States, monetary policies are implemented by the Federal Reserve, the equivalent of the Central Banks in other countries. However, the Federal Reserve, unlike its Central Bank counterparts, does not consist of only one bank; instead, it combines 12 regional banks with the main Federal Reserve Bank as its main office. The Board of Governors consists of seven members nominated by the President and confirmed by the Senate. A full term is fourteen years. One term begins every two years, on February 1 of even-numbered years. A member who serves a full term may not be reappointed. A member who completes an unexpired portion of a term may be reappointed.

- *Financial Markets*

The financial system combines many markets, regulation, laws, institutions, and techniques via the financial instruments traded, such as stocks and bonds. Financial markets include two markets: money markets and capital markets.

Money markets are where financial securities are traded in the short term (one year or less). The purpose of a money market is to provide liquidity. Securities traded in money markets include: treasury bills; certificates of deposit; banker acceptances; commercial papers; federal funds; and euro-currency markets.

Capital markets deal with over one-year financial securities. Rewards from the capital markets are higher than in money markets, due to the length of the investments and thus the higher risks in capital markets as compared to money markets. Securities traded in money markets include: mortgage loans; municipal bonds; Eurobonds and Euronotes; consumer loans; corporate stocks; and corporate notes and bonds.

The main duty of the financial system is to match deficit units such as borrowers with surplus units such as lenders.

- *Empirical Studies*

Previous studies about Quantitative Easing announcements will now be examined as part of the review of empirical literature on monetary policies and on how they affect financial markets, in particular the stock and bond markets. Few research papers, however, deal with the specific issue of Quantitative Easing. One of the reasons is that this is a new monetary policy tool that is not broadly used by countries (mostly the U.S. and the United Kingdom).

The first empirical research paper considered in this study was issued by Morgan Stanley in June, 2012. Entitled, "Global Cross-Asset Strategy QE: Questionable Excitement," it aims to provide a review of the effects of the monetary policy of the United States on cross asset markets such as the S&P 500, and government bonds. The study points to a rising of yields subsequent to the implementation of Quantitative Easing one, also commonly referred to as 'large scale asset purchases'.

Another study on Easing programs by Lee (1992) focuses on the causal relations and dynamic interactions of inflation, asset returns, and real activities in the United States in the after-war period. It determined that stock returns showed very small variations in relation to real events. Also, the returns of the stocks show the causality of these events. These research findings are very important in that they lay the ground for subsequent studies on the topic. Many later studies focused on financial markets, especially on the effects of monetary policies on financial markets. Three in particular deserve special attention. They will be considered next:

Thorbecke (1997) researched how equity prices are responding to monetary policy shocks. The evidence indicates that they have a significant effect on *ex-post* and *ex-ante* returns of stocks. Positive monetary policy shocks increase stock returns. In addition, it was determined that macroeconomic indicators also can reflect the price of stock movements.

Rigobon and Sack (2003) examined the relationship between financial markets and monetary policy and found that stock market movements can largely affect the macro economy, the latter being also a critical factor used to determine monetary policy. Moreover, they found that there is a relationship between short term interest rates and stock market movements. There is also a direct relationship between these two factors.

Gupta (2006) found that when the threshold level of the financial sector is already reached, the contractionary monetary policy will provide growth for the mid-level financial sector to develop.

Another landmark study in this field is that of Bernanke and Gertler (2000). Their research summarizes how monetary policies react to variations in asset prices, especially the stock markets. It also looks at non-fundamental movements among asset prices in the macro-economy within a dynamic framework. It is often critical for a monetary policy to react to changes in asset prices.

Piazzesi and Swanson (2004) looked at monetary policy shocks and expectations. They used the future fed funds rate as an unbiased indicator of fed fund rates. Some error's forecast proportions were also used to predict ex-ante stock prices.

Finally, in their study on stock markets and monetary policy shocks, Bernanke and Kuttner (2005) used the Event Study Methodology to analyze the relationship between stock market index and so-called monetary 'surprises'. They found that a 'surprise' fed funds rate cut of about 25 basis points can increase the overall stock market by 1 percent. They also argued that the level of surprise is more relevant than the surprise timing. Typically, the value per share is calculated by the present value of discounted cash flows. They determined that when the fed funds rate increases surprisingly, stock prices are likely to decrease, pushing up the risk free rate, reducing expected future dividends, and raising the equity premium.

There are, however, few papers on the effect of monetary policy surprises in domestic areas in Asian stock markets using an Event Study approach as most of them focus on the United State and Europe.

One of the few existing studies is by Wongswan (2009) who looked at the Indonesian, Malaysian, and Korean stock markets. Although Thailand was affected by the U.S. monetary policy surprises, it was not included in the study. Wongswan found the policy to have an effect on the Indonesian, Malaysian, and Korean stock markets and monetary policy surprises.

Another one is by Kim and Nguyen (2009) who focused on major Asian stock markets such as Singapore and Hong Kong and on how the European and U.S. monetary policy shocks affected them. They found them to have largely negative effects on these markets. Their study also points to higher volatility around the time of the news announcement.

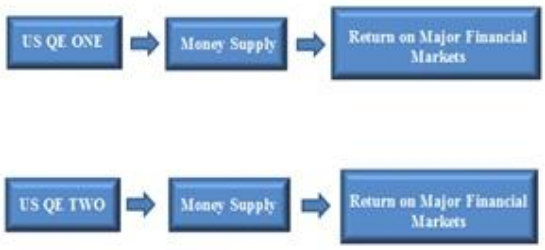
It should be noted that another reason for the relatively few studies on Quantitative Easing and its effects on the stock market is that most of the research tackling the Quantitative Easing issue focuses on the bond market. As to the commodity markets, the researcher could not find any empirical study.

3. Conceptual Framework and Research Hypotheses

The monetary policy transmission mechanisms implemented by the Federal Reserve start with the monetary policy effect on the money supply within the economy and the effects the interest rates have on the market and on consumption since people's spending also largely depends on interest rates. If market rates are low, the opportunity cost for spending and saving decreases. People tend to spend more and save less. And the flow of money within the economy will stimulate the growth of the Gross Domestic Product (GDP). These mechanisms were utilized to analyze the impact of the U.S. Quantitative Easing programs on major financial markets.

Analyzing the impact of the Quantitative Easing tools implemented by the Federal Reserve on major financial markets thus requires the development of two conceptual frameworks as shown in Figure 1.

Figure 1: Conceptual Frameworks



Source: Created by the author of this study

These two conceptual frameworks are used for the two research questions are the core of this study: (i) What constitutes a relationship between the U.S. Quantitative Easing program one and major financial markets? (ii) What constitutes a relationship between the U.S. Quantitative Easing program two and major financial markets? These two Quantitative

Easing programs affect the money supply within the economy. The relationship between these two Quantitative Easing programs and financial markets can be measured by the asset returns from each market.

To analyze their impacts on the markets, this paper applies the Event Study Methodology in both conceptual frameworks (MacKinlay, 1997; McWilliams & Siegel, 1997). As explained in the introduction, this methodology focuses on the reaction of financial security prices to special events.

The two Quantitative Easing programs are studied separately. Although the first and the second research questions have the same objective, one minor difference is the time when these programs were implemented.

The researcher reduced the risk of errors by not including other events in the samples. The time horizon focuses on the period which the researcher believes to purely reflect the effects from the two Quantitative Easing programs. The starting point is the time when the Federal Reserve implements its monetary policy, in this case, the Quantitative Easing tools. Quantitative Easing is one of the tools under the open market operation. Quantitative Easing involves two main effects: asset price increase and money supply increase. When the money supply increases, the interest rate in the financial markets goes down. This in turn affects asset prices in many countries, including in major financial markets.

To address each research question, two research hypotheses were developed in line with the conceptual framework.

The first null hypothesis reads as follows:

$H_0 : TSARs_1 = 0$

There is no significant difference between the Total Standardized Abnormal Returns (TSARs) and zero.

In other words, Quantitative Easing program one has no effect on major financial markets.

The second null hypothesis reads as follows:

$H_0 : CTSARs_1 = 0$

There is no significant difference between the Cumulative Total Standardized Abnormal Returns and zero (CTSARs).

No excessive leakage occurred from Quantitative Easing program one on major financial markets. It should be noted that the excessive leakage focuses only on information related to the significant event which, in this case, is the U.S. Quantitative Easing program.

The third null hypothesis is as follows:

$H_0 : TSARs_2 = 0$

There is no significant difference between the Total Standardized Abnormal Return and zero (TSARs).

Quantitative Easing program two has no effect on major financial markets.

The fourth null hypothesis can be stated as follows:

$H_0 : CTSARs_2 = 0$

There is no significant difference between the Cumulative Total Standardized Abnormal Return and zero (CTSARs).

There was no excessive leakage from the Quantitative Easing program two on major financial markets.

4. Research Methodology

Information is central to financial institutions. Predictions and analyses are based on financial data. If the data is wrong, it will generate misleading results. For these reasons, the source of each data collected for this paper is especially important.

The closing price of each financial asset in each market is collected from the Bloomberg database, a highly reliable source for financial data. Data about monetary policy tools comes from the Federal Reserve Reports. Also, some economic data comes from the International Monetary Fund (IMF) World Economic Outlook Database.

In addition to this primary data, this study uses secondary data (research papers) obtained from Google Scholar and from some internationally renowned universities as well as from local ones.

The data used in this study covers the periods running from 17 June 2008 to 2 December 2008 and 13 April 2011 to 28 September 2011. Although the research period covers specific dates, the data extends to longer periods in order to really cover the effects from the two events considered.

There exist many processes for the econometrical treatment of data. This research paper implements EViews 5.1 for running all financial data calculations for stationary test before putting the data in excel files. EViews 5.1 is part of the econometrical treatment process (Paweł Ciompa, 1910). It is a well-established software program which can convert non-stationary data into stationary

data. Non-stationary data refers to data that has a trend and which therefore does not require a data prediction. This research thus applies EViews 5.1 to convert non-stationary to stationary data. When time series data are non stationary, the results from the regression can be spurious and it should not be used because it is not reliable. Typically, spurious regressions occur when the results have significant relationships among variables. However, the relationships are considered as contemporaneous and there is no causal relation.

One of the tests conducted under the EViews 5.1 process is the Unit Root Test, which was developed by John Denis Sargan, Alok Bhargava, and Phillips Perron in 1986. It is used to determine whether a time series variable is non-stationary and is based on an autoregressive model.

Even though the Unit Root Test actually involves a series of tests, not just one, this study uses only the Augmented Dickey Fuller (ADF) Test which is the most well-known for large samples. Under the ADF test, whenever the output indicates an accepted null hypothesis, the data is non stationary. On the other hand, if the output indicates a rejected null hypothesis, it is stationary data. If the data is non stationary at level, this paper applies the first difference to convert data into stationary. In this study, all the variables (the S&P 500, MSCI index, Stock Exchange of Thailand, 10 Year Treasury Yield, JP Morgan EMBI Spread, Gold Commodity, FTSE 100, and DAX) are tested stationary through the ADF test.

This research paper sharpens the correlation analysis by using another econometrical treatment process as the next step: the Even Study Methodology. This methodology measures the effects of monetary easing in terms of the changes in asset returns and volatility.

The Event Study Methodology involves eight steps which will be examined next one by one: (i) Event Date Identification; (ii) The Event Window Definition; (iii) The Estimation Period Definition; (iv) Sample Selection; (v) Normal Return Calculation; (vi) The SARs Calculation; (vii) CTSARs Calculation; and (viii) The TSARs and CTSARs Statistical Significance Determination (Performing Financial Studies A Methodological Cookbook, Michael J. Seiler, year 2004).

Before proceeding with the description of the eight steps, one more comment should be made. The results from the ADF test indicate that all data become stationary at first difference levels. All the stationary data from EViews 5.1 is then exported to Microsoft Excel and divided into two main periods; Quantitative Easing one and two.

(i) Event Date Identification

The dates of the two U.S. Quantitative Easing programs are shown on the website of the Federal Reserve as well as on many financial websites. These internet sources already provided the exact date of the significant event. However, these sources do not show the exact starting and ending points. Thus, it is impossible to use this intraday data for this research analysis. Therefore, the researcher used the daily closing price instead. Specifically, for the U.S. Quantitative Easing program one, the exact date is 25 November, 2008. And Quantitative Easing two occurred on 21 September, 2011.

(ii) Event Window Definition

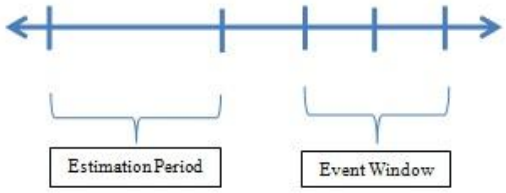
Given that previous research shows that the date of the event that the researcher identifies has a high degree of preciseness, a short event window period should be covered because if a long period were used, it might include another significant event. And as previous research shows, a large event window is not essential. This research includes several days prior to the event window in order to determine if there was some leakage and several day after in order to see whether the U.S. Quantitative Easing programs waited a few days before trading in the market. The event window that the researcher used is reduced to a 10-day event window. Therefore, this research uses only 5 days before and 5 days after the program announcements (-5 through +5). The researcher thinks that only five "trading" days before and after the event is enough as many financial markets typically react rapidly to 'news' of a significant event that drives investor expectations. This event window excludes weekend and takes into account how time zones affect the various countries considered in the samples. It is the most appropriate time frame from the researcher's point of view. However, it is important to note that only trading days are included in the samples. As mentioned, weekend and holiday are ignored.

(iii) Estimation Period Definition

For the estimation period, the researcher

deemed that 100 days for the estimation period would be enough. The aforementioned empirical studies show that the estimation period normally covers a time period before the significant event. As shown in Figure 2 below, the estimation period for this research paper will be based on the 115-day Estimation Period prior to both U. S. Quantitative Easing programs and on the 16-day period preceding the Event Window (the exact date of the event). There is a gap between an estimation period and the event window. It aims to eliminate the other effects, which might be included in the study period.

Figure 2: Event Study Methodology Time Frame



Source: Created by the author for this study

(iv) Sample Selection

This research aims to study eight major financial markets which the researcher views as good representatives of major financial markets. They include: the MSCI index; the S&P 500; the FTSE 100; the DAX; the Stock Exchange of Thailand; the 10 Year Treasury Yield; the JP Morgan EMBI Spread; and the Gold Commodity.

These financial markets include both traditional and alternative investments. All these markets have large trading volumes and the United States Quantitative Easing programs are likely to affect these samples. The researcher believes that the final outcome will be a good representation of "major" financial markets. However, as the researcher mentioned earlier, the researcher will use the S&P 500 as the benchmark for market returns.

From this stage onward, the researcher uses Microsoft Excel 2010 to implement the remaining steps of the Event Study Methodology, starting with the Normal Return Calculation step.

(v) Normal Return Calculation

This research implements the most frequent method, the Single Index Market Model, also called Risk Adjusted Return Method to calculate normal returns on each major market when there is no significant event such as the United States Quantitative Easing program. This calculation is part of the Event Study Methodology. It uses market returns as the benchmark when there is no significant event. However, the sample that the researcher selected already represents the market. Thus, the normal return for this research paper is based on other market returns except for the S&P 500 between the periods before the U.S. Quantitative Easing programs.

(vi) SARs Calculation

There are many ways of calculating abnormal returns. This research uses the Standardized Abnormal Returns (SARs) test which, as previous studies indicate, is frequently used (e.g. Patell, 1976; and Boehmer, Musumeci, & Poulsen, 1991). However, the abnormal return in this research paper is based on the period after there is a significant event in the market.

SARs calculations involve three main steps: (a) setting up the Event Study Microsoft Excel file; (b) performing intermediate calculations; as well as (c) the following Total Standardized Abnormal Returns Calculation:

$$SAR_{jt} = \frac{AR_{jt}}{\sqrt{s^2_{AR_{jt}}}}$$

$$s^2_{AR_{jt}} = \frac{\sum_{t=-115}^{-16}\left(AR_{jt(est.period)} - \overline{AR}_{j(est.period)}\right)^2}{D_j - 2} * \left(1 + \frac{1}{D_j} + \frac{\left(R_{mt(event.window)} - \overline{R}_{m(est.period)}\right)^2}{\sum_{t=-115}^{-16}\left(R_{mt(est.period)} - \overline{R}_{m(est.period)}\right)^2}\right)$$

In addition, all the days including in the event window period need to be calculated. After the SARs is calculated, the Z Statistic for SAR is computed by dividing TSARs by a square root of variance as above.

$$Z\text{-}statistic_t = \frac{TSAR_t}{\sqrt{\sum_{j=1}^{N}\frac{D_j - 2}{D_j - 4}}}$$

The denominator in this formula will not be changed for each day in the sample, because there is no subscript t (which represents time in the denominator). Calculations are based on each major financial market in the sample instead.

After calculating the denominator, the Z-Statistic for individual days is computed for the event window period. The CTSARs P-

Value is then calculated using Microsoft Excel (see below)

The Z-Statistic focuses on the denominator in section under the radical. These calculations will be denoted by Q_j.

$$Q_j = \sum_{j=1}^{N} \frac{D_j - 2}{D_j - 4}$$

The Q_j frequently denotes the term below a radical in previous equation. On the other hand, it can state that it is equal to the TSARs variance. As the subscription shows, the calculation is different for each major financial market included in the sample for 11 days of the event window period. The total calculation for the entire formula is then done.

The next step is to calculate the CTSARs, CTSARs Z-statistic, and CTSARs P-Value. The same process is repeated for Quantitative Easing two.

(vii) CTSARs Calculation

The CTSARs test statistic measures the significant level of the final results. The formula is as follows:

$$Cumulative\ TSAR_{T_1,\,T_2} = \sum_{t\,=\,T_1}^{T_2} TSAR_t$$

(viii) TSARs and CTSARs Statistical Significance Determination

This step combines steps seven (CTSARs) and eight. Three elements need to be determined: the CTSARs, CTSARs Z-statistic, and CTSARs p-value. The sum of all the TSARs for each day in all major markets then needs to be calculated in order to determine the CTSARs. At this juncture, it is then possible to determine the final outcome, i.e., whether Z-Statistic is significant or not for each day during the event window period.

The Z-Statistic on CTSARs is then implemented using Microsoft Excel. the process, similar to that used to calculate the TSARs, is based on the following formula:

$$Z_t = \left(\frac{1}{\sqrt{N}}\right)\left(\frac{\left(\sum_{T_1}^{T_2} SAR_{jt}\right)}{\sqrt{(T_2 - T_1 + 1)\left(\frac{D_j - 2}{D_j - 4}\right)}}\right)$$

5. Results and Discussion

- Stationary Test Results

Table 1 below summarizes all the results from the calculations as described above (for details of all the results at both At Level and At First Difference, see Appendix One).

Table 1 results show the calculations of the ADF statistic test, which is part of the Unit Root Test, and is run by EViews 5.1 at two different levels: At Level and At First Difference level stationary.

Table 1: Stationary Test Results

Variables	At Level	At First Difference	Variables
MSCI World (MXWO)	-1.595643 (1) [0.4846]	-29.76661 (1)** [0.0000]	MSCI World (MXWO)
S&P 500 (SPX)	-1.618150 (1) [0.4730]	-32.90249 (1)** [0.0000]	S&P 500 (SPX)
Stock Exchange of Thailand (SET)	-1.917211 (0) [0.3245]	-27.28663 (1)** [0.0000]	Stock Exchange of Thailand (SET)
10 Year Treasury Yield (USGG10YR)	-1.955925 (2) [0.3067]	-43.06289 (0)** [0.0001]	10 Year Treasury Yield (USGG10YR)
JP Morgan EMBI Spread (JPEIPLSP)	-1.593741 (6) [0.4856]	-38.18677 (0)** [0.0000]	JP Morgan EMBI Spread (JPEIPLSP)
Gold Commodity (GOLDS)	-0.903725 (0) [0.7875]	-41.58015 (0)** [0.0000]	Gold Commodity (GOLDS)
FTSE 100 (UKX)	-2.181706 (0) [0.2132]	-20.83775 (3)** [0.0000]	FTSE 100 (UKX)
DAX (DAX)	-1.892563 (0) [0.3361]	-41.05125 (0)** [0.0000]	DAX (DAX)

Note: ** means significant at alpha = 1 %

The first column lists the eight variables used in this research. The number on the first line in the second and third columns shows the test statistic result as per the McKinnon one sided p-values of statistics and the number in parentheses, also on the first line, the optimal lag(s) for the data. The number in brackets on the second line gives information about the p-value of test statistic.

As Table 1 indicates, -1.595643 is greater than the critical values at all levels (-3.434016, 2.863046, and 2.567619 at 1%, 5%, and 10% significant levels respectively). Thus, on the basis of the results, all the p-value results are greater than 0.05 for the whole sample. What this means is that either the sample has problems with the Unit Root or the data is non-stationary data. All the variables (The S&P 500, Stock Exchange of Thailand, 10 Year Treasury Yield, JP Morgan EMBI Spread, Gold Commodity, FTSE 100, and DAX) are shown as non-stationary data At Level.

Using EViews 5.1, the data was then transformed into stationary data since stationary data is usually required for all estimations. The research applies the Ln difference or first level. It was found that the MSCI world index's absolute calculation of the ADF test statistic is -29.766, which is less than the critical value at all levels (-2.566332, -1.941011, and -1.616573 for 1%, 5%, and 10% significant level respectively). Also, the final results indicate a rejection of the null hypothesis or Ho. This can be interpreted as showing that there is no problem with the Unit Root or, on the other hand, that the MSCI world index already became stationary data for the First Difference Level.

The final results for the other variables are also similar. The S&P 500, Stock Exchange of Thailand, 10 Year Treasury, Yield, JP Morgan EMBI Spread, Gold Commodity, FTSE 100, and DAX have all become stationary data at first difference level. The same method was applied for the data sets. The effects of each Quantitative Easing were divided into two main periods; pre- and post-Quantitative Easing and. Previous testing already showed that the data is non-stationary at level.

- *Event Study Methodology*

The results in Table 2 were obtained by applying the Event Study Methodology. They are divided into four main parts: TSARs (QE1), CTSARs (QE1), TSARs (QE2), and CTSARs (QE2). On the basis of these TSARs P-Value determinations, it is possible to determine whether or not the U.S. Quantitative Easing program one had an effect on major financial markets.

Table 2: TSARs, TSARs Z-Statistic, TSARs P-Value and: QE 1

Date	TSARs	TSARs Z-statistic	TSARs P-Value
-5	-1.4400	-0.5387	0.5901
-4	-2.6810	-1.0029	0.3159
-3	-2.1877	-0.8184	0.4131
-2	4.5730	1.7107	0.0871
-1	3.2442	1.2136	0.2249
0	-7.2542	-2.7137	**0.0067
1	-2.4677	-0.9232	0.3559
2	10.7073	4.0055	**0.0001
3	3.5388	1.3238	0.1856
4	-6.3316	-2.3686	***0.0179
5	0.1085	0.0406	0.9676

Note: ** means significant at alpha = 1 %
Note: *** means significant at alpha = 5 %

The TSARs P-Values show significant levels of 99%. They are significant at 99% on day 0 and +2 since the P-Value is below 0.01. The null hypothesis can therefore be rejected. The TSARs is not equal to zero, which means that Quantitative Easing program one had an effect on the major financial markets. The 95% confidence level, on day +4 also confirms that the null hypothesis should be rejected.

The results of the CTSARs, shown in Table 3 below, answer the question of whether or not any information leakage occurred.

Table 3: CTSARs, CTSARs Z-Statistic, and CTSARs P-Values

Date	**CTSARs**	**CTSARs Z-statistic**	**CTSARs P-Value**
5	-1.4400	-0.5387	0.5901
-4	-4.1210	-1.0901	0.2757
-3	-6.3087	-1.3625	0.1730
-2	-1.7356	-0.3246	0.7455
-1	1.5086	0.2524	0.8007
0	-5.7456	-0.8775	0.3802
1	-8.2134	-1.1613	0.2455
2	2.4939	0.3298	0.7415

3	6.0327	0.7523	0.4519
4	-0.2989	-0.0354	0.9718
5	-0.1904	-0.0215	0.9829

None of the P-Values are below 0.05. The results are not statistically significant. It is not abnormal that there are only 3 days out of 11 during which the event window period was significantly related to CTSARs. Based on the significant CTSARs on day 0 and +2, it can be concluded that Quantitative Easing program one had an effect on major financial markets. In addition, in light of the non-significant CTSARs, it can also be concluded that no excessive leakage occurred. This thus answers research question one.

The results considered next, using TSARs P-Value determination, will answer the question of whether the US Quantitative Easing program two has had an effect on major financial markets or not.

Table 4: TSARs, TSARs Z-Statistic, TSARs P-Value and: QE 2

Date	TSARs	TSARs Z-atistic	TSARs P-Value
-5	-0.9967	-0.3729	0.7092
4	4.2235	1.5799	0.1141
3	1.7763	0.6645	0.5064
2	-12.4106	-4.6427	**0.0000
1	54.8166	20.5062	**0.0000
0	-2.4188	-0.9048	0.3655
1	-19.6829	-7.3632	**0.0000
2	-6.8158	-2.5497	***0.0108
3	-15.7835	-5.9044	**0.0000
4	22.4420	8.3953	**0.0000
5	-8.5125	-3.1844	**0.0015

Note: ** means significant at alpha = 1 %
Note: *** means significant at alpha = 5 %

The TSARs P-Value shows a significant level of 99% on six days (-2, -1, +1, +3, +4, and +5) since the P-Value is below 0.01. The null hypothesis can thus be rejected. The TSARs is not equal to zero, which means that U.S. Quantitative Easing program two had an effect on major financial markets. The 95% confidence level on day +2 also indicates that the null hypothesis should be rejected. It is not unusual for 7 days out of 11 in the event window period to be significantly related to TSARs.

Table 5: CTSARs, CTSARs Z-Statistic, and CTSARs P-Value

Date	TSARs	TSARs Z-statistic	TSARs P-Value
-5	-0.9967	-0.3729	0.7092
-4	3.2267	0.8535	0.3934
3	5.0030	1.0806	0.2799
-2	-7.4076	-1.3855	0.1659
-1	47.4090	7.9314	**0.0000
0	44.9902	6.8709	**0.0000
1	25.3073	3.5782	**0.0003
2	18.4915	2.4457	***0.0145
3	2.7079	0.3377	0.7356
4	25.1499	2.9752	**0.0029
5	16.6375	1.8766	0.0606

Note: ** means significant at alpha = 1 %
Note: *** means significant at alpha = 5 %

The significant TSARs for days -2, -1, +1, +2, +3, +4, and +5, indicate that Quantitative Easing program two had an effect on major financial markets. It also answers research question two. No excessive leakage occurred.

5. Conclusion and Recommendations

As regards the gathering of evidence for the Semi-Strong form of market efficient hypothesis by implemented the Event Study Methodology. The methodology tries to gather the statistical evidence that security prices do not immediately reflect new information. Also, it helps to identify abnormal returns during the event period.

In general, significant positive Total Standardized Abnormal Returns (TSARs) during the event window period indicate that the major financial markets were not efficient enough in absorbing the good news that were released. In addition, significant positive Cumulative Total Standardized Abnormal Returns (CTSARs) during the event window period mean that value was still being created through price increases, pointing toward market inefficiency in terms of complete assimilation of the good news bearing

surprises. Positive Cumulative Total Standardized Abnormal Returns (CTSARs) occurred only in Quantitative Easing program two.

The overall findings show that Quantitative Easing programs one and two had an effect on major financial markets. They generated abnormal returns for many financial markets during the event window periods. They also indicate that most of the abnormal returns were generated one or two days before the event. However, in some markets, the abnormal returns were generated after the date of the event.

- *Recommendations*

The researcher recommends to invest in major financial markets before the implementation of a Quantitative Easing program. Furthermore, people should invest in the MSCI World and Stock Exchange of Thailand, which, on average, provided the highest returns. There were abnormal returns generated by Quantitative Easing programs one and two in major financial markets. Investing in these markets is likely to offer superior returns.

This study also shows which periods and which markets to invest in to maximize returns. International fund managers, individual investors, proprietary investors, institutional investors, and foreign investors can apply this research to generate excess returns.

- *Limitations*

This research paper focused on two U.S. Quantitative Easing programs. Therefore, it could only cover eight financial markets whose data cannot obviously represent all the markets in the world.

Also, the data that was used was based on daily data. The final price of each day may not be a good representative as there can be high fluctuations in price within a day. However, the data used is the closing price data provided in Bloomberg database and it is the most frequent one that can be obtained. Data on financial asset prices, which changes within each market index, might occur within a shorter period that the closing price, based on daily data, may not fully replicate. As a result, the overall conclusions and recommendations might be subject to variances in each particular financial market.

References

Amico, S. D., & King, T. B. Federal Reserve Board, Divisions of Research & Statistics and Monetary Affairs. (2012). Flow and stock effects of large-scale asset purchases: evidence on the importance of local supply. Washington, D.C..

Benford, J., Berry, S., Nikolov, K., Young, C.,& Robson,M.(2009). Quantitative easing. Quarterly Bulletin 2009 Q2. Bank's Mone- tary Analysis Division & Bank's Notes Division.

BIS Papers(2005), 22. Investigating the relationship between financial and real economy. Monetary and Economic Department, Bank for International Settlement.

Breedon, F., Chadha, J. S., & Waters, A. (2010). The financial market impact of UK quantitative easing.

CFA Institute. (2012). CFA level one economics. (7 ed., Vol. 2).

Dodd, R. (2007). Subprime: Tentacles of a crisis. Finance&Development.

Gonzalez-Astudillo, M. (2012). Essays on monetary-fiscal policy interactions and m- acroeconomic models of the term structure of interest rates.

Joint Center for Housing Studies of Harvard University. (n.d.).The state of the nation's housing 2008. Harvard University.

Joyce, M., Lasaosa, A., Stevens, I., & Tong, M. Bank of England, (2010). The financial market impact of quantitative easing. London: Publications Group.

Khotari, S. P., & Warner, J. B. (2006). Econometrics of event studies. Tuck School of Business, Dartmouth, Illinois.

Khotari, S., & Warner, J. B. (2006). Handbook of Corporate Finance: Empirical Corporate Finance (B. Espen Eckbo ed.). Dartmouth: Tuck School of Business.

Kimura, T., & Small, D. Federal Reserve Board, Divisions of Research & Statistics and Monetary Affairs. (2004). Quantitative monetary easing and risk in financial asset markets.

Kolari, J., & Pynnönen, S. (n.d.). Event-study methodology: Correction for cross-sectional correlation in standardized abnormal return tests.

Finance Department, Texas A&M University, Mays Business School, Texas.

Krishnamurthy, A., & Jorgensen, V. (2011). The effects of quantitative easing on interest rates. Kellogg School of Management.

Kuttner, K. N., & Mosser, P. Federal Reserve Bank, (n.d.). The monetary transmission mechanism in the United States: some answers and further questions. Newyork.

Michael J. Seiler. (2004). Performing Financial Studies A Methodological Cookbook.

Morgan Stanley Research. (2012). Cross Asset Strategy QE: Questionable Excitement.

NYU Stern. (2009). Acharya V. V. & Richardson M. (Eds.), Restoring Financial Stability: How to Repair a Failed System. Newyork: John Wiley & Sons.

Oda, N., & Ueda, K. Bank of Japan, Monetary Affairs Department. (2005). The effects of the bank of japan's zero interest rate commitment and quantitative monetary easing on the yield curve: a macro finance approach (05-E-6) Public Relations Department.

Pesaran, H. M. (1987). Econometrics. In J. Eatwell (Ed.), The New Palgrave: A Dictionary of Economics (Vol. 2, pp. 8-22).

Roche, C. O. (2010). Quantitative easing: "the greatest monetary non-event".

Samuelson, P. A., Koopmans, T. C., & Stone, J. R. N. (1954). Report of the evaluative committee for econometrica. Econometrica, 22(2), 141-146.

Saponara, M. A. (Director) (2003, April 9). Event study lecture. Economics616. Lecture conducted from Temple University, Philadelphia.

Serra, A. P. (2002). Event study tests a brief survey. UNIVERSIDADE DO PORTO, Porto, Portugal.

Ugai, H. Bank of Japan, Monetary Affairs Department. (2007). Effects of the quantitative easing policy: A survey of em-pirical analyses. Tokyo: Public Relations Department.

Weber, A. A. (2008, September). Financial markets and monetary policy. The evolving financial system and the transmission mechanism of monetary policy.

Websites

Accessed on August 25th, 2012
http://lib.dr.iastate.edu/etd/11930/
http://www.bc-cf.dreamhosters.com/docum-ent/What _CF_Looks_For.pdf
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1784270
http://lipas.uwasa./julkaisu/ewp.html
http://links.jstor.org/sici?sici=0022-0515%28199703%2935%3A1%3C13%3AESIEAF%3E2.0.CO%3B2-W
http://www.nber.org/papers/w8350
http://www.eurojournals.co-m/finance.html
http://www.jstor.org/discover/10.2307/2331297?uid=3738032&uid=2&uid=4&sid=21101226256323

http://en.wikipedia.org/wiki/FTSE_100_Index
http://en.wikipedia.org/wiki/JPMorgan_EMBI
http://en.wikipedia.org/wiki/MSCI_World
http://www2.webster.edu/~woolflm/statmethods.html
http://en.wikipedia.org/wiki/Francis_Galton
http://en.wikipedia.org/wiki/Event_study
http://en.wikipedia.org/wiki/Agency_debt
http://www.federalreserveonline.org

Appendix one

At Level

Null Hypothesis: MXWO has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=24)

		t-Statistic
Augmented Dickey-Fuller test statistic		-1.59564
Test critical values:	1% level	-3.43401
	5% level	-2.86304
	10% level	-2.56761

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: SPX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=24)

		t-Statisti
Augmented Dickey-Fuller test statistic		-1.61815
Test critical values:	1% level	-3.43401
	5% level	-2.86304
	10% level	-2.56761

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: SET has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statist
Augmented Dickey-Fuller test statistic		-1.9172
Test critical values:	1% level	-3.4340
	5% level	-2.8630
	10% level	-2.5676

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: USGG10YR has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on SIC, MAXLAG=24)

		t-Statistic
Augmented Dickey-Fuller test statistic		-1.955925
Test critical values:	1% level	-3.434018
	5% level	-2.863047
	10% level	-2.567620

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: JPEIPLSP has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Pr
Augmented Dickey-Fuller test statistic		-1.593741	0.4
Test critical values:	1% level	-3.434027	
	5% level	-2.863051	
	10% level	-2.567622	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GOLDS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Pr
Augmented Dickey-Fuller test statistic		-0.903725	0.7
Test critical values:	1% level	-3.434013	
	5% level	-2.863045	
	10% level	-2.567619	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: UKX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Pr
Augmented Dickey-Fuller test statistic		-2.181706	0.2
Test critical values:	1% level	-3.434013	
	5% level	-2.863045	
	10% level	-2.567619	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DAX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.892563	0.3361
Test critical values:	1% level	-3.434013	
	5% level	-2.863045	
	10% level	-2.567619	

*MacKinnon (1996) one-sided p-values.

At First Difference Level

Null Hypothesis: DMXWO has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-29.76661	0.0000
Test critical values:	1% level	-2.566332	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DSPX has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-32.90249	0.0000
Test critical values:	1% level	-2.566332	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DSET has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-27.28663	0.0000
Test critical values:	1% level	-2.566332	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DUSGG10YR has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-43.06289	0.0001
Test critical values:	1% level	-2.566331	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DJPEIPLSP has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-38.18677	0.0000
Test critical values:	1% level	-2.566331	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DGOLDS has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-41.58015	0.0000
Test critical values:	1% level	-2.566331	
	5% level	-1.941011	
	10% level	-1.616573	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DUKX has a unit root
Exogenous: None
Lag Length: 3 (Automatic based on SIC, MAXLAG=24)

		t-Statistic
Augmented Dickey-Fuller test statistic		-20.83775
Test critical values:	1% level	-2.566333
	5% level	-1.941011
	10% level	-1.616573

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DDAX has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=24)

		t-Statistic
Augmented Dickey-Fuller test statistic		-41.05125
Test critical values:	1% level	-2.566331
	5% level	-1.941011
	10% level	-1.616573

*MacKinnon (1996) one-sided p-values.