“An examination of the relationship between key macro-economic variables and the ISEQ index (1986-2017)”

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Abstract

This study examines the relationships between domestic interest rate, domestic inflation and the ISEQ index over the period of 1986 – 2017.
This study investigates the influence of domestic monetary policy and the existence of either the Fisher hypothesis or the proxy hypothesis in the context of the Irish economy.
This examination is carried out using a vector auto-regressive model with two period lagging.

Over the long run and for many of the short run models a negative causal relationship was observed between the domestic rate of inflation and returns of the ISEQ index.
This evidence is consistent with that of the proxy hypothesis which states that inflation and asset prices are negatively linked.

Long run results when examining domestic interest rates exhibited weak relationships with returns of the ISEQ index; with international interest rates such as LIBOR and the Federal funds rate exerting larger influence over asset prices.
This relationship was observed to change over several short run periods studied.
The observed results were in line with expectations framed by the literature review

Examination of several other factors introduced many other dimensions; notable of these is the consistent and significant positive causal relationship between the FTSE100 and the ISEQ index. This relationship was consistent not only in the long run model but also throughout all the short run period examinations.

This research attempts to fill a knowledge gap in current Irish literature.
Currently there exists little literature that examines the driving factors of returns of the ISEQ index. Of the literature in existence much of it is outdated given the events of the financial crisis of the past decade; other research is of limited scope and does not competently answer the questions posed by this research piece.

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List of Abbreviations Used

OLS – Ordinary Least Squares

VAR – Vector Auto-regressive

LIBOR – London interbank offered rate

DIBOR – Dublin interbank offered rate

GDP – Gross domestic product

CPI – Consumer Price index

FFR – Federal funds rate

FTSE 100 – Financial Times stock exchange 100

LSE – London stock exchange

ISEQ – Irish stock exchange index

ARCH - Autoregressive conditional heteroskedasticity

ECB – European Central Bank

C.E – Cointegrating equations

Y – Domestic output

C – Domestic consumption

I – Investment

I – Domestic interest rate

G – Government Spending

NX – Foreign trade

OECD – Organisation for economic co-operation and development

EGARCH - exponential generalized autoregressive conditional heteroskedastic

X(-1) – (Independent variable) lagged by one month

X(-2) – (Independent variable) lagged by two months

FX – Foreign exchange

Chapter 1: (i) Introduction

Chen et al (1986) note that the efficient market hypothesis and rational expectations asset pricing theory suggest that prices of assets should depend on their exposures to the state variables that describe and economy.
Following from this one could assume the factors that describe asset prices in one country will be different to that of another or the relationships thereof may greatly differ.
This can be seen clearly by conclusions drawn by academics in examination of several economies and the financial markets within.
The most famous examples of such being the Fisher hypothesis proposed by Fisher (1930) which states that a countries stock market is a perfect hedge against inflation.
This was later challenged by an opposite viewpoint in the form of the proxy hypothesis put forth by Fama et al (1997).

"A negative coefficient with causality running from interest rates to stock price is often expected, since a rise in interest rates reduces the present value of future dividend incomes which would depress stock prices" (Mok H.M.K, 1993)

While Mok's statement in generally considered to be a reasonable assumption it has been seen in many small open economies of similar size to Ireland that domestic interest rate has had little influence on asset prices.
This has been further observed by Bredin (2003) in which the ISEQ index was seen to be influenced to a much larger degree by external factors rather than that of domestically controlled.
As such this study, will attempt to gain an insight to the relationship that exists between both inflation, domestic interest rate and the returns of the ISEQ index.
After which other large constituents of movements of asset prices will also be examined.

(ii) Context and Rational

Like many other financial markets across the world the ISEQ index suffered a large devaluation following the worldwide financial crash of 2008 and beyond.
Knowledge of the interaction between the ISEQ index and the variables that effect movement of asset prices within may help explain both how the crisis happened and how the financial market has adapted in the period thereafter.
This study will approach this larger question from several periods of economic importance to Ireland.
A measure of these relationships will be taken both before and after the events in question and then compared to one another and also to a long run model.
The long run period in question will be 1986 – 2017 and events of economic importance will be examined within this period.

Currently there exists a gap in literature which examines the Irish stock exchange and the relationship between it and key macroeconomic variables.
The best literature in this area is that of Bredin et al (2003) and Bredin et al (2005).
While the findings of these papers are informative, the scope of study is particularly limited focusing solely on unexpected monetary policy shocks.
Also, there exists little literature which examines this topic in a similar economy to Ireland in the time following the 2008 financial crisis much of it having limited scope or relevance to the focus of this research piece.
This research will attempt to address the perceived knowledge gap by answering the research questions posed by this paper.

(iii) Research aims and objectives

The research aims of this paper can be broken into several subsections which shall be addressed individually.

The first aim of this paper will be to establish an understanding of any relationship that may exist over the long run between domestic interest rates and returns of the ISEQ index during the period of the study which will be 1986 – 2017.
If and when this relationship is observed; this will establish the role that monetary policy plays in the price of assets within the Irish economy over the long run.

The second aim of this paper will entail an examination of inflation to see if support can be given to either the Fisher hypothesis or the proxy hypothesis over the long run in the Irish economy.
To complete this aim; the relationship between inflation and returns of the ISEQ index will be examined.
Depending on the direction of any linear relationship observed; evidence supporting one of the two hypotheses shall be presented.

The third aspect of the research question will look to examine the concluding thoughts of Bredin (2005) in which he summarises that Ireland as a small open economy is particularly influenced by external economic factors such as the performance of foreign markets or foreign interest rates.
This paper will look to examine the relationship that exists between the Irish stock exchange and several foreign economic metrics.
Completion of this task will allow for an idea of the extent of any influence foreign economic policy has on Irish asset prices.

These relationships will then be examined over several different periods within the time frame of the study to examine how/if the observed relationships may change over time.
This examination of changes will conclude the fourth aspect of the research question.

Completion of these four aspects of the research will result in a robust examination of the ISEQ index and the relationships that are present between the returns thereof and macroeconomic variables.
This will add to the literature that is currently available on the subject and fill current gaps explored previously.

(iv) Conclusion

The remainder of this paper will be presented in the following format.
Chapter two will contain a literature review in which an in-depth examination of current literature in this area will be carried out.
Aspects such as findings and models used will be examined to correctly frame the remaining sections of this research.

Chapter three will follow from chapter two and will contain a methodology derived from examination of the literature explored in the previous chapter.
This chapter will set out the steps that will be taken in creating the empirical results of this research.
It will also explore several limitations of this study which will need to be addressed or acknowledged.

Chapter four shall set out the results that have been arrived at by following the methodology set forth in the chapter before it.
Within this chapter all models will be displayed in a chronological order; commentary and analysis of results will be presented accordingly

Chapter five will be the conclusion of this study; within this chapter concluding remarks on the findings observed will be made.
Also, future research directions or objectives will also be discussed.

Ultimately it is hoped that this research will answer the research questions posed in a direct and reliable manner thus filling the contemporary knowledge gap that is present in Irish literature at the time of writing.
It will also give an insight to the response of asset prices to economic stimulus.
This may shed insight to the inner workings of monetary policy and the effects thereof on asset prices.

Chapter 2: Literature Review

(i)Introduction to Literature

The apparent economic state of an economy can often be approximated by the level of efficiency and degree of development and complexity in said countries financial markets.
This implies that a country at a lesser stage of economic development will not have a financial market with the same level of complexity or efficiency than that of its more developed counterpart; As such markets that are highly developed and integrated into the economy of which they are based will display a reaction to the economic issues which are currently evident in the country of origin. (Ghosh, 1991)

Theories as to how monetary policy interacts with financial markets and the consequences thereof are said to be many and varied; Much of this discussion revolves around the interaction between the rate of inflation and movements of key interest rates on the returns of the exchanges being studied. (Hassan M, 2008)

In the context of inflation one of the most widely examined and referenced theories is that of the Fisher hypothesis proposed in the 1930 publication "The theory of interest rates" in which it is proposed that the stock market is a perfect hedge for inflation; As in a one percent increase in expected inflation will directly result in a one percent increase of the price of assets within a stock exchange. (Fisher I, 1930)
This hypothesis has been supported to one degree or another by several studies such as Omay et al (2015), Hassan (2008), Al-sharkas et al (2014) and Luintel and Paudyal. (2006)

This is not to say that this hypothesis has been universally accepted; with many authors publishing findings in direct opposition to the Fisher hypothesis.
Oxman (2012) dismissed the hedging effect after a study of several developed financial markets.
This has been further substantiated by the work of Wong et al (2003) who examined eight Asian countries and the G7 countries over the period 1958-1999 using ordinary least squares regression and lagging inflation rate by one year.
The findings of this research contradicted the fisher hypothesis when testing the coefficients at a five percent level of significance.

A contrasting theory has emerged to explain an apparent negative relationship between an increase of inflation and the price of assets.
This is the proxy hypothesis proposed by Fama and Schwert (1997) following a study of the interaction between inflation and asset prices in the USA, finding common stocks to exhibit a negative relationship with inflation.
While this theory has been researched in depth there has been little substantial evidence in support of it.
Although, while examples of such do exist which attempt to support this hypothesis; much of the support materials include models and conclusions in which large assumptions are made in support of the proxy hypothesis.
Such are the findings of Merikas et al (2006) in which the model used does not directly test the relationship between the variables in question in this hypothesis; but instead shows that the stock market is negatively correlated to the real economy and on the assumption that the real economy is positively related to inflation concludes by supporting the proxy hypothesis.
The authors in question note within this paper that there may be an issue of collinearity effecting the accuracy of the model used.
Both Cochran et al (1993) and Rapach (2002) reject this negative relationship in favour of a positive relationship between inflation and asset prices; with both papers building a model which directly examines these variables rather than making a conclusion based upon assumptions.

The second aspect of which this paper will examine will be the relationship between interest rates and the returns of the ISEQ index.

As with inflation rates there are many ideals or theories as to the effects of monetary policy on asset prices and the channels in which these effects take place.
Given the financial instability of the past decade in which we have seen the introduction of several non-traditional tools of monetary policy such as longer term re-financing loans given to struggling banks and quantitative easing which has been used to tackle the zero lower bound issue.
These non-traditional tools of monetary policy have opened several new channels of monetary policy.
This has changed many of the dynamics of monetary policy and the way in which interest rates interact with asset prices.

Of the models in this area the most influential of these is the IS model which attempts to explain the driving factors of output in an economy.
This model is as follows Y = C+I(i)+G+NX; here it is seen that interest rate is a driver of investment which in turn drives output. (Hicks, 1973)
This model can take effect in several ways; firstly, a rise in interest rates reduces the present value of future dividend incomes which would depress stock prices.
Alternatively, lower interest rates also represent a lower cost of borrowing meaning access to money is comparatively cheaper.
This can then stimulate investment and economic output which causes stock prices to increase.
These conclusions have been drawn by the findings of Mok (1993), Bjornland et al (2009), Pesaran et al (2000) and Gumbo et al (2015) who found a negative coefficient when examining the Zimbabwe stock exchange using ordinary least squares regression controlling for several variables including the price of oil, political instability and the price of gold.

As can be seen from the initial introduction to the literature in this area there is a vast amount of previous research conducted.
Interestingly, with small changes in either methodology, aims or time frame many differing results can be arrived at for similar economies.
Given the wide range of contrasting claims made by academics in this area and the apparent lack of contemporary Irish material following the economic crash in this area, this study will look to either add to the existing knowledge or fill an apparent knowledge gap by establishing a relationship between the variables in question and then examine how and if this relationship has changed during, before and after the 2008 financial crisis.

The remainder of this literature review shall be arranged as such.
The following section will examine in depth a range of inflationary rate literature in the context of the fisher theory and the proxy hypothesis as set out above.
Then there will be a section delving into the expanse of literature pertaining to interest rates and how these interact with asset prices.
Following this a section examining the evidence from an Irish perspective will be presented.
Several outliers will also be examined as part of this.
Finally, a conclusion will then be presented on the examined literature.

(ii) Inflation Rate Literature

Inflation can be defined as a sustained increase in the general price level of goods and services in an economy over a period of time.
Simply put an increase of inflation decreases the buying power of a given unit of currency.
Inflation can be measured in several different ways; CPI also known as the consumer price index which examines the change of price in a basket of goods and services being the most widely used measure of such.
CPI will be the measure of inflation used over the course of this study.

As previously stated in the introduction to this chapter the Fisher hypothesis which in its simplest form states that a stock market is a perfect hedge of inflation is considered a seminal piece of work in this area.
Many of the studies in this section examine this or the proxy hypothesis as proposed by Farma et al (1977) in which it is hypothesised that inflation has a negative causal relationship with asset prices.

Since the publication of "The theory of interest rates" by Fisher in 1930 the hypothesis proposing the hedging effect of stock markets from inflation this theory has been cited and examined countless times with multiple studies both supporting it and dismissing the hypothesis put forth.
Research that finds in favour of the Fisher Hypothesis includes that of Arjoon et al, (2012) in which the South African stock exchange was examined during the period of 1980 and 2010 using a vector auto-regressive model.
The findings of this paper noted that there was an increase of 16 percent in the price of long run real stock values following a one point increase within the model of inflation resulting from a permanent inflation shock.
The results seen here are in direct agreement with the hedging effect of this Fisher hypothesis over the long run.
This finding is further supported by the work of Boudoukh (1993) who found that over the course of two hundred years that both stock markets of the USA and the United Kingdom are positively linked to inflation.
Although this paper does not examine the extent of this relationship; whether it is the one for one relationship as hypothesised by Fisher is unexplored.

Similarly, Ely et al (1997) found in an examination of over fifteen western economies plus Japan and their respective stock exchanges using a cointegration model and quarterly data that ran from 1957 to 1992; which controlled for Industrial production levels, Real GDP, CPI and nominal narrow money measure; That in the long run stocks retain their value to inflation thus, directly supporting the Fisher hypothesis.
These findings have again been further supported by those of Rapach (2002), Al Oshaibat et al (2016) in the Amman stock exchange and Al-Sharkas et al (2014) whom upon examination of the stock exchanges of Jordan, Saudi Arabia, Kuwait and Morocco found strong long run evidence in support of the Fisher hypothesis between the years of 2000-2009 using an unrestricted vector autoregressive model.
The model used in this study used a correction term to control for unexpected inflation to ensure accuracy of findings over the long term.
Similarly, Chang (2013) also found strong evidence for support of the Fisher hypothesis in the Japanese stock market over the long run.
This finding by Chang directly supports the findings of Ely et al (1997) in the context of the Japanese economy.
Many of these papers referenced above use a combination of granger causality, cointegration test and some form of regression analysis be it ordinary least squares or vector auto-regressive.
Controls are built into these model for variables such as GDP, inflation, and other external factors such as exchange rate.

In the context of the UK, Irelands closest neighbour and largest trading partner it was found that there existed a long run hedging relationship between inflation and stock prices. (Luintel et al,2006)
This finding is in direct support with the previous finding of Boudoukh (1993) mentioned above.
As can be seen there exists a large amount of literature of which the above is a sample of in support of the Fisher hypothesis over the long run.
This is particularly evident in countries with large well developed financial markets such as that of the United Kingdom the United States of America, Japan etc.

It is also evident in countries in which a large part of the economy is controlled from within through mineral resources such as that of South Africa and Saudi Arabia for example.

Yet, while the consensus seems to be in favour of the Fisher hypothesis over the long run. Certain studies have been either able to completely reject the fisher hypothesis or cite lack of evidence for its acceptance in certain financial markets and economies.

Such are the findings of Hassan et al, (2015) whom upon examination of the OECD countries either found little evidence to support the fisher hypothesis or simply rejected it depending on the country in question.

Ireland in this study having threshold cointegration which provides an inconclusive result.

This finding is echoed by Karagianni et al (2011) who following a study of the US financial markets using non-linear methods of examination and a smaller sample period dismisses the fisher hypothesis which is in stark contrast to the earlier findings of Boudoukh (1993).

Most interesting of these findings that refute the Fisher hypothesis is that of Farma et al, (1977) and Farma (1981) in which what is now called the proxy hypothesis is presented.

This hypothesis puts forth that the stock market is negatively related to inflation.

Farma makes a few assumptions in this hypothesis.

First, high inflation rates anticipate low growth rates of real economic activity.

As economic activity slows so does expected demand for real cash balances which in turn leads to higher inflation expectations.

The second assumption made in this hypothesis is that high stock price growth rates expect high levels of economic activity growth.

As high levels of inflation anticipate low growth rates of real economic activity this hypothesis assumes that inflation and asset prices are negatively correlated.

While this seems to be in complete opposition to the consensus above that the Fisher hypothesis seems to hold for many economies over the long run there has been several pieces published exploring this hypothesis with varying conclusions.

One such piece of research in support of this hypothesis is that of Merikas et al, (2006) in which the German economy was examined over the course of four decades (1960-2000), using a vector auto regressive model with the variables included CPI, retail sales, GDP and employment growth it was found that inflation at least in Germany during the specified period was negatively related with both employment growth with a coefficient of -2.04 and investment growth with a coefficient of -4.43.

This paper concluded stating that inflation is negatively linked to economic activity thus by extension supporting the proxy hypothesis put forth by Farma.

Further to this these findings were echoed by both Kaul (1987) and Geske et al (1983).

Thus, adding support to the ideal that at least in some instances stock prices may be inversely related with inflation.

Whether the Fisher hypothesis holds in an economy; or an economy tends more towards the proxy hypothesis seems to vary from study to study. Examining the literature in this area there seems to be a larger sample of contemporary literature using more robust models such as that of granger causality, vector auto-regression, ordinary least squares regression when appropriate and the Johannsen co-integration test finding in favour of the fisher hypothesis over the long run or rejecting the proxy hypothesis.

On examination of the differences of this literature much of the findings in favour of the fisher hypothesis tends to examine a larger sample period than samples which conclude in favour of the proxy hypothesis.

It must also be said that the proxy hypothesis has been built upon two key assumptions as explained above.

Much of the literature that is in support of the proxy hypothesis examines the components of these assumptions but does not examine the assumption themselves such as Merikas et al. (2006)

As can be seen from the literature examined asset prices and inflation are inherently linked.

Whether the fisher hypothesis holds to one extent or another in an Irish context or the proxy hypothesis is a better explanation of an Irish relationship between rates of inflation and the returns of the ISEQ index is to be seen.
There is little contemporary study of this subject in an Irish context; with what has been carried out citing inconclusive results or a threshold positive cointegration.
This study will attempt to document this relationship and examine if the hedging effect of the fisher hypothesis exists in an Irish context to any extent over the period being examined.
The next section of this chapter will examine the literature pertaining to interest rates and the relationship between interest rates and asset prices.

(iii)Interest Rate Literature

Upon entering the European monetary union in 1999 Ireland and its central bank gave up all monetary policy autonomy in the form of control of interest rates.
Interest rates in theory interact with asset prices in a direct manner through what is known as the traditional route of monetary policy.
Through this route an increase in the cost of credit has a negative effect on the demand for loans.
A decrease in the number of loans issued negatively effects the amount of investment within an economy.
This effects asset prices two-fold; firstly, as investment decreases so does the future value of expected dividends and as such the present value of a share decreases.
Secondly as explained in the proxy hypothesis economic activity growth is a major driver of the increase of asset prices, as investment decreases due to the comparatively high cost of credit; economic activity growth decreases thus decreasing the expected value of said assets. (Fontana et al,2003) and Mishkin (1996)

In a contemporary sense, more non-traditional approaches of monetary policy have been implemented by the central banks in response to the zero lower bound.
One such of these is which directly interacts with both interest rates and asset prices is quantitative easing.
Quantitative easing is the long term wide scale purchase of assets by central banks to maintain liquidity in the financial markets and attempt to increase the rate of inflation.
A side effect of this is a rise in asset prices due to the large increase of demand for assets as the central banks purchase vast amounts of debt.
This then leads to a decrease in interest rates due to a larger monetary base.
Following a study of quantitative easing in Europe; an increase in asset prices and a decrease in interest rate was observed with the European financial markets. (Driffill, 2016)
This increase of asset prices following a period on quantitative easing has also been observed in Japan following repeated rounds of quantitative easing by the central bank of Japan. (Ueda, K 2012)
Investigation of the effects of quantitative easing and the channels through which it operates are in their infancy,
Examination of the more traditional channels of monetary policy and the possible effects of interest rates are far more developed.

The most influential of these models is that of the IS model in which $Y = C+I(i)+G+NX$.
In this model, it is seen that interest rate is a driver of investment which in turn drives output. (Hicks, 1973)
Further to this; output or GDP of an economy and interest rates have been further linked to movements and returns of stock prices as seen in a study of the Nigerian economy and financial markets following a study examining the period between 1985 to 2013 using the EGARCH technique. (Ayopo et al, 2016)

An examination of the Istanbul stock exchange during the timeframe of 2003-2010 using the cointegration method found a statistically significant negative relationship between interest rate and asset prices. (Ozcan, 2012)
These finding were further supported by Cengiz et al, (2014) and Jai et al, (2008) who found using the granger causality method that there existed a long run stable relationship between interest rate and asset prices over the long run in the Shanghai stock exchange.
All of these findings were further substantiated by the work of Gumbo et al, (2016) whom in the case of Zimbabwe between the years of 2009-2013 using a combination of granger causality testing, cointegration testing and ordinary least squares regression observed a significant inverse causal relationship between interest rate and asset price.
The model in question controls for the price of oil, GDP growth, monetary base growth and the rate of inflation.
The methodology used by these studies is similar to what will be implemented over the course of this study of the Irish economy and the ISEQ index.
It will be noticed that many of these economies are very different to the Ireland.
Also noted is that following the financial crisis in 2008 much of the research in this area in a western sense has been focused elsewhere, creating a contemporary knowledge gap in which this study will acknowledge and attempt to satisfy.

Interestingly, in an examination of the US financial market in the period of 1994-2015 it was found using regression analysis as has been proposed for the use of this study that for a short period during the height of the financial crisis that a fall in interest rates depressed asset prices for a short period. (Gu et al, 2016)
While this is interesting information that contrasts with the channels of monetary policy as discussed above; one must consider correlation vs causation in this situation.
While asset prices did fall in a period in which interest rates were lowered, before this crash asset prices were in an economic bubble.
To say that a decrease in interest rates was the cause in this fall off in asset prices rather than an overdue economic adjustment is an idea that warrants further investigation.

As can be seen from the literature presented that monetary policy and the channels in which it operates play a direct role in the establishment of asset prices in an economy.
Ireland in this context is an interesting case due to its recent turbulent fiscal history.
This study will examine the long run relationship between monetary policy and asset prices in Ireland.
Then the changes in this relationship will be examined in the period after becoming a member of the European monetary union in which central bank autonomy was surrendered to the ECB.
Lastly this paper will attempt to examine the knowledge gap in this area regarding the relationship between monetary policy and asset prices post 2008 financial crisis.

(iv) An Irish context and outliers

Ireland given its recent turbulent economic history makes for an interesting case study of the interaction of monetary policy and inflation rates with asset prices.
In the late 1980's Ireland emerged from a national debt crisis.
In 1999 Ireland became a full member of the European monetary Union, adopting the euro as its currency and surrendering central bank autonomy to the European central bank.
Finally, after an exceptionally eventful financial crisis following the 2008 collapse of Lehman brothers the Irish government was forced into a troika bailout deal to salvage both the Irish economy and the Irish financial services sector.
This study from an Irish angle adds an interesting dimension for these reasons; also, this study helps fill a contemporary post crisis gap in the literature in this area.

In a 2003 study of the ISEQ index and its interaction with both domestic and international monetary policy shocks; during the period of 1988 to 2002 it was observed that while domestic monetary policy did influence asset prices international monetary policy shocks caused much more monumental movements of asset prices. (Bredin et al, 2003)
This study examined the impact of these shocks using a staggered regression model.
The model in question examined events at that day only on an event only basis and as such relied on efficient market hypothesis to control for other variables in that other variables were already included in asset price.
Interestingly the regression model used in this paper called for either a positive co-efficient for domestic rates or a slightly negative co-efficient.
This contrasts the findings of multiple authors such as Cengiz et al, (2014), (Ozcan, 2012) and Gumbo et al, (2016)
International rates followed the general theory as above that interest rates exhibit a negative causal relationship with asset prices.
This shows that as a small open economy that heavily relies on foreign investment Ireland is particularly sensitive to international monetary shocks and crises.
This finding was also supported by Pirovano (2000) who found that in the case of small lesser developed economies of eastern Europe in which foreign investment plays a large part of all investment activities; that while domestic monetary policy impacted upon asset prices and a negative co-efficient was observed it was clear that international monetary policy had a larger impact on asset prices.

Follow up research by Bredin et al (2005) examined the impact of US monetary policy announcements and the impact of Irish stock market volatility.
This research built on the 2003 findings of the same author examined the extent of influence that American monetary policy has on Irish asset prices.
This study again using a similar regression model for the period of 1989 – 2003 and controlling for changes in the US stock exchange and a term labelled an unexplained element.
While a significant negative relationship was found between unexpected changes US interest rates and the ISEQ index it was not as large as originally anticipated. (Bredin et al, 2005)

In defiance with much of the literature in this area and similarly to the findings of Bredin et al, (2003); Tino (2011) found that in small open economies which are now part of the European monetary union that no significant correlation was found between interest rate fluctuations and asset prices after the introduction of the euro.
Before this there existed a significant negative causation.
When examining this, it is seen Ireland shares many similarities to this in which per Bredin et al, (2003) the ISEQ index shares a weaker than expected relationship with domestic monetary policy.
In the context of this study an interesting dynamic would be to examine the relationship between domestic monetary policy and asset prices pre-EMU admission.

Will Ireland exhibit the same negative causation that was evident in the findings of Tino (2011) and Diacanasu et al (2014)

Other small lesser developed economies have been observed to have a reaction like that of more developed economies to changes in monetary policy albeit at a slower pace or to a lesser extent as was seen by Ingleas et al (2012) in a comparison of the Caribbean financial markets and the US financial markets.

This finding was supported by Anzuini et al (2007) in an examination of new EU member states at that time.

Again, examining this from an Irish viewpoint for this study could it be a case that Ireland does react in a similar fashion.

Examination of the macroeconomic data of Ireland as part of this study may shed some light in this area.

There are several instances in which the relationship between inflation and asset prices has changed from being negative to positive during periods of recession as noted by Cifter A, (2015)

Again, causation vs correlation must be examined in this case as given the recessionary period asset prices would have fallen regardless of inflation.

Either way this may be an interesting dimension to explore over the course of this study.

Examining the literature that directly relates to Ireland unearths a few interesting outliers such as the findings of Bredin in which it is stated that domestic monetary policy does not play a significant role in asset prices and that this relationship does not always display a negative coefficient as one would expect.

It would seem as though the openness and small size of the Irish economy exposes it to international monetary shocks to a greater degree than that of a larger more robust economy such as that of the UK or the USA.

This adds an interesting dynamic to this research as conclusions may be drawn that are conflicting with more intuitive ideals that lower interest rates lead to an increase in asset prices.

Over the course of this study these dynamics and others will be examined in order to explain some of the driving variables of the ISEQ index and the extent as to which movements of inflation and interest rate have on that asset prices of the ISEQ index.

(v) Conclusion of Literature Review

On examination of the literature available in this area in the case of the interaction of inflation and the price of assets of stock exchanges two hypotheses are examined repeatedly.

Those are the Fisher hypothesis in which the stock market should act as a hedge against inflation and the Proxy hypothesis proposed by Fama.

The proxy hypothesis is the antithesis of the Fisher hypothesis stating that inflation is negatively related to asset prices.

As examined above there is much literature examining this with the consensus being that for large well developed financial markets the Fisher hypothesis holds to one degree or another over the long run.

Which of these hypotheses the ISEQ index is subject to if either will be examined over the course of this paper.

The interaction between monetary policy has in the past been a dry area with the consensus being that interest rates are negatively related to asset prices in large developed financial markets.

Given the current issue of the zero lower bound and use of non-traditional monetary policy such as that of quantitative easing we are seeing new channels of monetary policy and new effects of said policy.

In an Irish context, it has been seen that international monetary policy has a larger impact on asset prices than domestic policy.
How has this relationship evolved post crisis?
Over the course of this study an attempt will be made to observe these relationships in an Irish context.

Chapter 3: Methodology

(i)Introduction

The questions posed by this paper can be simply broken down into several key areas or ideals which will be empirically examined over the concluding sections of this research.
The first; and possibly the most intriguing of these in a contemporary sense will be an examination of the effects of changes in monetary policy on asset prices in the Irish economy with returns of the ISEQ index being used as a proxy.
Next both the Fisher hypothesis which states that a countries stock exchange is a perfect hedge against inflation and the proxy hypothesis which states that there is a negative causal relationship between inflation and asset prices rather than a positive one will be investigated in detail.
Finally, the ISEQ index will be then examined over several key periods in Irish economic history to ascertain if and how the relationships between variables observed change over the period in question.

Key to this chapter is the introduction of the statistical process that will satisfy the research questions posed at the outset of this examination.
Following analysis of the literature in this area several key variables have been identified; these include consumer price index, domestic interest rate, LIBOR, Federal funds rate, returns of the FTSE100 and the returns of the Dow Jones.
Within the previously mentioned literature several processes of examining these relationships were also identified such as Granger causality testing, Johansen cointegration testing, Vector auto-regression, ordinary least squares regression and EGARCH; using an amalgamation of methodology in examined literature a best practise process was selected and will be examined over the course of this chapter.

In an Irish context, there exists a large gap in contemporary literature with the most recent in this area being the research of Bredin et al (2003) and Bredin et al. (2005)
These studies examined consequences of domestic monetary policy shocks on the ISEQ index and in the later paper the effects of international monetary policy shocks after the findings of the first paper in which international monetary policy plays a large role in domestic asset prices.
This work did not examine inflation; thus, it did not extend to either the fisher or proxy hypothesis.
Other authors who have examined the ISEQ index in the context of inflation have only done so in a very limited capacity as part of a larger study as can be seen with Hassan et al. (2015)
This leaves a large contemporary literature gap in this area which this paper will attempt to fill.

(ii) Initial Approach to Research Question

Following an examination of similar literature in this area several approaches stood out in creation of an explanatory model and several problems were also presented which could negatively impact the findings of this paper.
The first issue posed was the type of statistical analysis which would be carried out to examine the relationships outlined in the research question.
Several methods to analyse time series data is explored in the literature.
This ranges from basic analysis of granger causality varying co-integration techniques, examination of simple impulse response graphs and regression analysis
regression analysis being the most usable of these; as an approximation of the influence of each variable can be observed from the coefficients and accompanying impulse response graphs which satisfy the objectives of this research in examining influence.

The type of regression analysis used to create a reliable model was then the next question posed. Several possibilities were presented in the literature ranging from simple ordinary least squares regression, vector auto-regressive and ARCH regression.

On examination of the most recent literature the vector auto-regressive model yielded the most consistent and repeatable results used across several studies such as those of Anzuini et al (2007), Arjoon et al, (2012) and Al-Sharkas et al (2014).

Many older studies used a stepwise ordinary least squares regression this was cast aside in these papers favouring the ability to easily lag variables and a more explanatory regression output of vector auto -regression.

Vector auto-regression differs to simple OLS regression as it in effect contains three equations for each variable within a single linear function;

VAR expresses each variable as a linear function of its own past values, the past values of all other variables being considered and a serially uncorrelated error term. (Stock J et al, 2001)

When using any class of regression analysis there are several limitations and considerations which must be examined when building a model to explain time series data such as this.

The most pressing of these is that of spurious correlation between the dependant variable and the independent variables; which if ignored would negatively impact the reliability of the model in question.

Secondly the effect of correlation of independent variables must be examined; as movement of an individual variable will influence other model variables; this will influence regression output. While this movement cannot be removed, it can be accounted for an acknowledged using correlation matrix (Table 1).

Examining the issue of spurious correlation leading to nonsense regression output several options were uncovered to traverse this obstacle.

One of which was to examine a correlation matrix of variables with their means removed; while this will remove a large amount of spurious correlation, it still presented the possibility of correlation as a coincidence.

To overcome the inherent limitation associated with spurious correlations between dependent and independent variables, a correlation matrix of the independent variables was presented (Table 1). This pointed to possible correlations between variable X and Y, therefore, in order to provide a more conclusive test, the Johansen cointegration technique was employed to overcome possible correlation of coincidence following Al-sharkas et al (2014), Cengiz et al, (2014) and Ozcan, (2012).

1) Long Run Model Correlation Matrix

	Return	*Inflation rate*	*Domestic rate*	*UK Rate*	*US Rate*	*Dow Jones*	*FTSE 100*
Return	1	0.077432	0.000218	-0.04065	0.02774	0.636927	0.048688
Inflation rate	0.077432	1	0.11759	0.18883	0.219279	0.103206	-0.0383
Domestic rate	0.000218	0.11759	1	0.80868	0.684335	0.020405	0.037458
UK Rate	-0.04065	0.18883	0.80868	1	0.889458	0.005684	0.017425
US Rate	0.02774	0.219279	0.684335	0.889458	1	0.032855	0.054687
Dow Jones	0.636927	0.103206	0.020405	0.005684	0.032855	1	0.061396
FTSE 100	0.048688	-0.0383	0.037458	0.017425	0.054687	0.061396	1

2) Long Run Model Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.261794	385.8127	111.7805	0.0000
At most 1 *	0.213504	273.8095	83.93712	0.0000
At most 2 *	0.172082	185.1875	60.06141	0.0000
At most 3 *	0.168519	115.5050	40.17493	0.0000
At most 4 *	0.082241	47.40728	24.27596	0.0000
At most 5 *	0.035720	15.73937	12.32090	0.0129
At most 6	0.006261	2.317570	4.129906	0.1510

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

The basic premise of Johansen cointegration implies that when a number of proposed variables share common trend(s) and demonstrate existence of long-run equilibrium relationship, they are said to be cointegrated (Naser H, 2015)
This model can be extended to conclude granger causality; in the instance when cointegrating variables are observed granger causality must run in at least one direction.

As can be observed in Table 2 the Johansen cointegration test output for the Long run model at a 95% level of confidence there are at most 6 cointegrating equations.
Following this we can be reasonably confident that the issue of spurious correlation has been overcome.

The methodology outlined above is in line with best practise of the literature examined in the previous chapter of this paper.
Strict adherence to the basic methodology proposed above should result in avoidance of spurious correlation when creating a reliable regression model.

(iii) Variable Selection and Data sample

Initial variable selection for the model in question was guided by the research aims which look to establish the relationship between domestic interest rates, the rate of domestic inflation and the returns of the ISEQ index.
The timeframe was set as 1986 to 2017 due to availability of macroeconomic data; with several short run models created within this period to examine several periods of economic importance in greater detail.
A long run model of this nature accounts for multiple key periods of economic peak and downturn in the ISEQ index; necessary for a complete examination of long term relationships

The first question posed by the research attempts to examine how changes in monetary policy interact with returns of the ISEQ index.
To answer this question a domestic interest rate known is DIBOR or Dublin interbank offered rate was procured from the central bank of Ireland.
This interest rate is now set in accordance to ECB rates since 1999 as per (Honohan, P 2016) and the data corresponds to rates offered between banks for three month loans updated monthly between the period of March 1986 and April 2017.
The output of this model is to be the returns of the ISEQ index which was calculated from the log returns of the ISEQ index monthly closing prices of the same period.

The ISEQ index returns are calculated by getting the log of this month's closing price divided by the closing price of the previous month.
This data was sourced entirely from the Irish Stock Exchange.
The second of the main research aims posed by this paper looks to examine the interaction between the rate of inflation and returns of the ISEQ index.
Again, this question required for a measure of inflation to be added to the model being built to account for this.
Consumer price index was selected for this as monthly data was readily available from the central statistics office of Ireland.
CPI is calculated by examining the price movements of a set basket of goods and services in Ireland, thus achieving a robust representation of inflation in Ireland.
After the initial inputs were accounted for, a number of control variables were added to the model.
Following the findings of Bredin et al (2003) and (2005) in which the returns of the Dow Jones and the federal funds rates were used as controls as part of a similar analysis these variables were added to the model used.
Dow Jones monthly closing data which is a US equivalent of the ISEQ index of sorts was available directly from Dow Jones and the three monthly Federal funds rate updated monthly which is a US equivalent of DIBOR was available directly from the federal reserve.
Following the findings of Gumbo et al, (2016) in which the regression model used controlled for a large GDP co-efficient.
GDP data was sourced on a yearly basis from the central statistics office of Ireland with growth rates being derived from that.
Quarterly data was also available from 1997 but this was too small a sample.
Monthly data was unavailable.
Following on from the Findings of the 2005 Bredin et al paper and the findings of Pirovano (2000) who agreed that small open economies are largely influenced by external factors rather than internal the monthly returns of the FTSE 100 which is a UK equivalent of the ISEQ index was also selected as a control.
This data was acquired from the financial times.
Following the literature mentioned above the three-month Libor rate updated monthly again, a UK equivalent of DIBOR was also selected as another external interest rate.
Libor data was available from the ICE benchmark administrator.
This will conclude the variable selection and data sample section of this chapter.
The proceeding section shall examine the specific VAR model process undertaken over this study.

(iv) Model Creation

Several steps were taken in creation of the specific VAR models used over the course of this study.
As explained, correlation matrix was examined with cointegration test carried out between independent and dependant variables separately.
Non cointegrated variables were removed from the specific models and then cointegration was examined as a model.
Upon creation of the VAR model the lagging metric is particularly open to interpretation.
There is no specific best course of action described in any of the examined literature.
Following the model as described in Bredin et al (2005) a one month lagging parameter was selected initially for variables.
Upon repeated trial and error a second lagging parameter of two months was also used to compliment the individual VAR models.

This lagging parameter consistently resulted in a repeatable high adjusted r-squared metric improving the descriptive nature of the models created.

VAR Model - Substituted Coefficients:
==========
RETURN = 0.0103360029775*RETURN(-1) + 0.0633098970388*RETURN(-2) - 0.0888364925019*DOMESTIC_RATE(-1) + 0.305331871928*DOMESTIC_RATE(-2) + 0.0724750410412*DOW_JONES(-1) - 0.102029762786*DOW_JONES(-2) + 0.896006065322*FTSE_100(-1) + 0.21699414793*FTSE_100(-2) - 1.09531561214*INFLATION_RATE(-1) - 0.274353737662*INFLATION_RATE(-2) + 0.763428121939*UK_RATE(-1) - 1.28935576403*UK_RATE(-2) + 0.562576082086*US_RATE(-1) - 0.14278608259*US_RATE(-2) + 0.0068779247639

Above: VAR model output example
After which point several impulse response models were created to visualise the effects of the independent variables on the dependant variable in this case the returns of the ISEQ index.
Commentary and analysis of output can now occur at this point.

(v) Limitations of methodology

In any study, there exists several limitations to the data and methodology; this study is no different to any other in that regard.
Within the data set chosen there exists a few limitations relating to availability of data which must be disclosed and examined.
One of the research aims of this paper is to examine the changes between the relationships between macroeconomic variables returns of the ISEQ index.
To do this in a meaningful way monthly data is needed to examine when any change happens.
A lack of monthly GDP data presents a large gap in the monthly model which will be created; to account for this limitation a model will be created which uses yearly data.
While this model will examine the relationship between GDP growth and returns of the ISEQ index meaningful examination of changes over time will be limited.

Much of the literature examined such as that of Gumbo et al, (2016) control for exchange rate.
Given the introduction of the euro to Ireland in 2000 a continuous exchange rate does not exist for the period of the study.
Prior to 2000 the Irish punt was the official currency in Ireland; post 2000 the Euro was the official currency of Ireland.
While data is available for the entire period in question, the only way to properly account for exchange rate is to build a pre-2000 model and a post 2000 model.

The vector auto regression model which will be used to create a linear relationship between variables like all models suffers from several limitations and issues that must be disclosed or addressed.
The first of which as discussed above is spurious correlation between variables.
Strict adherence to the methodology set out above will limit exposure to this.
The Var model itself is also subject to a few statistical limitations which must be disclosed;
Standard methods of statistical inference such as computing standard errors for impulse response may give misleading results if some of the variables are highly persistent.
Also, without modification standard Var models can miss non-linearity's, conditional heteroskedasticity and drifts or breaks in parameters. (Stock J et al, 2001)

Given a set of limitations as outlined above; context will be placed on any findings of this paper.
Sufficient steps have been taken to avoid major issues or spurious correlation within the regression models that will be presented in the concluding parts of the following chapter.
Once the outlined methodology is adhered to accuracy of results can be assured

(vi) Conclusion of Methodology

The research question that this paper poses looks to examine the relationship the exists between interest rates and the rate of inflation on the returns of the ISEQ index
This study will shed light on the implications of monetary policy on the price of assets in the Irish economy; with the ISEQ index being used as a proxy for said asset prices.

The outlined methodology of Johansen cointegration to reduce the possibility of spurious correlation should in theory result in a reliable regression output.
The vector auto-regressive model chosen as the regression model in this study has been tried and tested numerous times within the literature and results in a reliable output once the limitations of the model are acknowledged.

The concluding sections of this paper will be arranged as follows;
The following chapter will present the empirical findings of the model built in accordance with the outlined methodology.
Analysis and commentary of the empirical findings will be made of the different time periods and model specifications under study.
Comparisons and contrasts will be drawn between the different findings.
After which point the final chapter will look to draw conclusions from this study and examine further limitations and/or areas of expansion for further study

Chapter 4: Empirical Results and Analysis

(i)Introduction

This chapter will present, analyse and discuss the empirical results in chronological order within the context of the research question posed at the beginning of this research.
This chapter will consist of an in-depth analysis and comparison of the different models built to acquire an understanding of the driving macroeconomic factors of the ISEQ index.

Each of the models presented will be examined in detail.
The relationships between each of the variables will be examined and critiqued.
Examination of the domestic interest rate coefficients will describe the relationship between monetary policy and returns of the ISEQ index.
Examination of the coefficients of the inflation variables within the presented models will allow commentary on both inflation related hypothesis presented; the Fisher hypothesis (Fisher I, 1930) and the proxy hypothesis (Farma et al, 1977) and which of these if either applies to the Irish economy.
The remaining variables in the vector auto-regressive models presented will illustrate the degree to which the ISEQ index is effected by foreign macroeconomic factors as alluded by Bredin et al, (2015).
Examination of these relationships and the changes thereof over time will allow for contrasting of the Irish economy over several time periods.

This chapter shall be arranged as follows;
First the long run model (1986-2017) will be presented and examined within the context outlined above to satisfy the aims of the research question.
After which the periods both before (1986-1999) and after the introduction of the euro in Ireland (2000-2017) shall be examined and critiqued within the same framework as previously outlined.
Before and after will be contrasted with both one another and then the long run model.
Presentation and examination of the period before the crash of Lehman bros. (2000-2008) and the period directly after the crash (2008-2017) will follow.
Again, the same frame work that was applied to the previous models shall be applied here.
Finally, the last period to be examined as part of this study will examine the period directly before the troika bailout package was announced (Apr 2000-Nov 2010) and the period directly after (Dec 2010 – Apr 2014)

By the conclusion of this chapter the research question shall be addressed in its entirety.
The relationship between domestic monetary policy and returns of the ISEQ index shall be thoroughly investigated.
Both the Proxy hypothesis and the Fisher hypothesis will be addressed with one or both dismissed in the case of Ireland.
The extent of influence of the chosen external macroeconomic factors will also be thoroughly explored.
The perceived gap in the current literature in this area will then have been addressed with a robust study of the chosen area.

(ii) Long Run Model

Vector Autoregression Estimates
Date: 07/09/17 Time: 15:15
Sample (adjusted): 1986M05 2017M04
Included observations: 372 after adjustments
Standard errors in ( ) & t-statistics in [ ]

DOMESTIC_RATE(-1)	-0.088836 (0.12000) [-0.74032]	RETURN(-1)	0.010336 (0.05363) [0.19272]
DOMESTIC_RATE(-2)	0.305332 (0.11781) [2.59173]	RETURN(-2)	0.063310 (0.04729) [1.33873]
DOW_JONES(-1)	0.072475 (0.08509) [0.85177]	UK_RATE(-1)	0.763428 (0.66715) [1.14431]
DOW_JONES(-2)	-0.102030 (0.06592) [-1.54780]	UK_RATE(-2)	-1.289356 (0.67172) [-1.91948]
FTSE_100(-1)	0.896006 (0.04864) [18.4210]	US_RATE(-1)	0.562576 (0.28172) [1.99693]
FTSE_100(-2)	0.216994 (0.08767) [2.47514]	US_RATE(-2)	-0.142786 (0.29120) [-0.49033]
INFLATION_RATE(-1)	-1.095316 (0.51512) [-2.12631]	C	0.006878 (0.00375) [1.83361]
INFLATION_RATE(-2)	-0.274354 (0.51513) [-0.53259]		

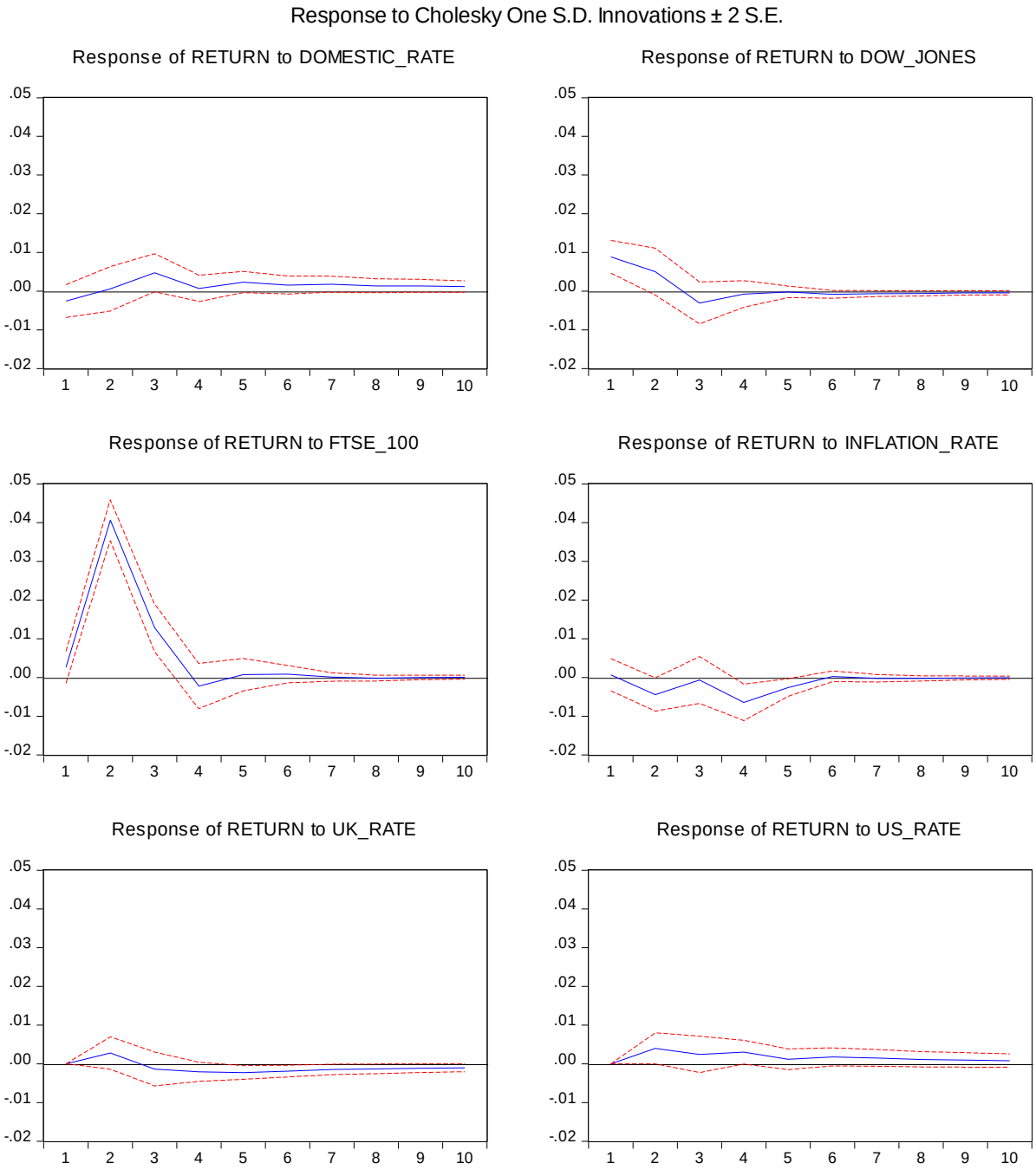
R-squared	0.549120	Log likelihood	667.1499
Adj. R-squared	0.531439	Akaike AIC	-3.506182
Sum sq. resids	0.603017	Schwarz SC	-3.348162
S.E. equation	0.041099	Mean dependent	0.005240
F-statistic	31.05609	S.D. dependent	0.060041

Var model return output

RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC_RATE(-1) + C(1,4)*DOMESTIC_RATE(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE_100(-1) + C(1,8)*FTSE_100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*UK_RATE(-1) + C(1,12)*UK_RATE(-2) + C(1,13)*US_RATE(-1) + C(1,14)*US_RATE(-2) + C(1,15)

VAR Model - Substituted Coefficients:
==========
RETURN = 0.0103360029775*RETURN(-1) + 0.0633098970388*RETURN(-2) - 0.0888364925019*DOMESTIC_RATE(-1) + 0.305331871928*DOMESTIC_RATE(-2) + 0.0724750410412*DOW_JONES(-1) - 0.102029762786*DOW_JONES(-2) + 0.896006065322*FTSE_100(-1) + 0.21699414793*FTSE_100(-2) - 1.09531561214*INFLATION_RATE(-1) - 0.274353737662*INFLATION_RATE(-2) + 0.763428121939*UK_RATE(-1) - 1.28935576403*UK_RATE(-2) + 0.562576082086*US_RATE(-1) - 0.14278608259*US_RATE(-2) + 0.0068779247639

Long Run Impulse Response Graph



This model consists of the Returns of the ISEQ index between 1986 and 2017 as the dependant variable.
Independent variables for this model consist of inflation rate, domestic interest rate, Libor, Returns of the DowJones and returns of the FTSE100.
The lagging parameters of the model include a one month and a two-month lag which consistently produced the most reliable output throughout this study.
The VAR model produced an adjusted r-squared parameter of 0.53.

Inflation rate lagged by one month presents a coefficient of -1.0953 and lagged by two months presents a coefficient of -0.27435.
These results reject the Fisher hypothesis that state the stock exchange is a perfect hedge against inflation.
The Irish stock exchange exhibits a strong negative causal relationship between the rate of inflation and returns of asset prices.
The evidence produced supports the existence of the proxy hypothesis in the Irish economy over the long run.

Domestic interest rates exhibit a coefficient of -0.08836 lagged by one month and 0.305332 lagged by two months.
One would expect a large negative causal relationship as described by Mok (1993).
Instead this seems to be far more consistent of the findings of Bredin et al (2005) and Tino (2011) that in a small open economy domestic monetary policy exhibits a weak causal relationship with asset prices with external monetary policy and economic performance having a greater influence.
This seems to be evident in the long run in the Irish economy with the FTSE100(-1) exhibiting a coefficient 0.986 and the FTSE100(-2) with a coefficient of 0.305332.
Further to this Libor(-2) exhibits a coefficient of -1.289.
This highlights the importance of UK economic activity and monetary policy on the Irish economy over the long run.
US interest rates and economic performance exhibit larger influence than that of Irish counterparts, With US_RATE(-1) exhibiting a coefficient of 0.76 and US_RATE(-2) exhibiting a coefficient of-0.142.
The large UK influence on Irish asset prices is clear in this depiction.

Given the large level of US and UK investment in Ireland results such as this were to be expected.
These findings regarding the influence of external factors in the Irish economy is in line with the literature in this area.
These findings exhibit an economy that is particularly sensitive to international economic movement.
This can be seen with the importance that the UK economic metrics play in the long run in the model presented.
Upon examination of this model one can easily see how a downturn in the international economy can negatively affect Irish asset prices as was seen in the 2008 international financial crisis.

(iii) Pre-euro Introduction (May 1986 – December 1999)

Vector Autoregression Estimates
Date: 07/13/17 Time: 21:41
Sample (adjusted): 1986M05 1999M12
Included observations: 164 after adjustments
Standard errors in ( ) & t-statistics in [ ]

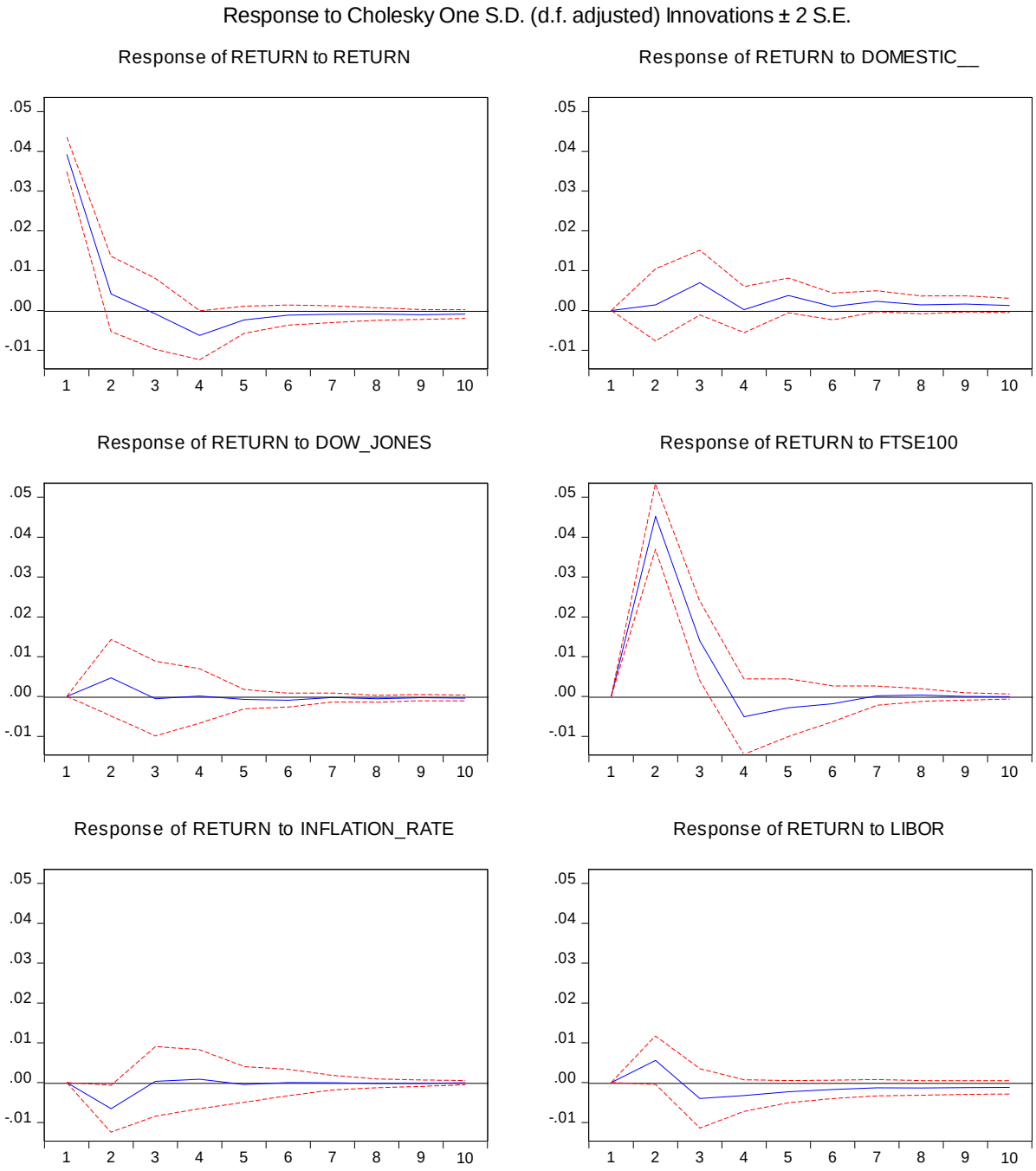
RETURN(-1)	-0.052480 (0.08014) [-0.65485]	FTSE100(-2)	0.324159 (0.11362) [2.85295]
RETURN(-2)	0.054866 (0.06686) [0.82061]	INFLATION_RATE(-1)	-2.080084 (0.86461) [-2.40580]
DOMESTIC__(-1)	-0.095502 (0.11614) [-0.82232]	INFLATION_RATE(-2)	-0.351415 (0.88849) [-0.39552]
DOMESTIC__(-2)	0.304204 (0.11491) [2.64744]	LIBOR(-1)	1.274448 (0.68835) [1.85146]
DOW_JONES(-1)	0.050897 (0.11199) [0.45447]	LIBOR(-2)	-1.566512 (0.70485) [-2.22246]
DOW_JONES(-2)	-0.085099 (0.09196) [-0.92540]	C	0.013915 (0.00996) [1.39661]
FTSE100(-1)	0.886005 (0.06351) [13.9498]		

R-squared	0.624060	Log likelihood	305.2451
Adj. R-squared	0.594184	Akaike AIC	-3.563965
Sum sq. resids	0.232117	Schwarz SC	-3.318244
S.E. equation	0.039207	Mean dependent	0.009978
F-statistic	20.88834	S.D. dependent	0.061546

VAR Model:
==========
RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC__(-1) + C(1,4)*DOMESTIC__(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE100(-1) + C(1,8)*FTSE100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*LIBOR(-1) + C(1,12)*LIBOR(-2) + C(1,13)

VAR Model - Substituted Coefficients:
==========
RETURN = - 0.0524803422173*RETURN(-1) + 0.0548663702281*RETURN(-2) - 0.0955023378415*DOMESTIC__(-1) + 0.304203924305*DOMESTIC__(-2) + 0.05089739532*DOW_JONES(-1) - 0.0850992978516*DOW_JONES(-2) + 0.886004822495*FTSE100(-1) + 0.324158503022*FTSE100(-2) - 2.08008363685*INFLATION_RATE(-1) - 0.351414987686*INFLATION_RATE(-2) + 1.27444756541*LIBOR(-1) - 1.56651249617*LIBOR(-2) + 0.0139145449063

Pre-Euro Introduction Impulse Response Graph



The Pre- Euro introduction model includes data from 1986-1999.
The variables for this model include Domestic rate, DowJones returns, FTSE100 returns. Inflation rate and LIBOR.
During this period the Federal Funds rate was a non-cointegrating variable and was omitted from the model for this reason.
Omitted for the same reason is the Punt/USD fx rate and Punt/£ sterling fx rate.
This model exhibits an adjusted r-squared of 0.59.

Compared to the Long run model this displays a weaker influence between US economic performance and ISEQ index returns.
Possibly due to the infancy of financial globalisation at this period.
FTSE100 retains a similar influence as seen in the long run model with FTSE100(-1) exhibiting a coefficient of 0.886 and FTSE100(-2) exhibiting a coefficient of 0.32415
The evidence to support the proxy hypothesis is again evident in this model with an Inflation(-1) coefficient of -2.08 and an Inflation(-2) coefficient of -0.351
This model displays a larger negative causal relationship than what was observed in the "Long run model" described previously in this chapter.
Given that the proxy hypothesis is evident in this model due to the negative causal relationship between inflation and ISEQ index returns; this would give reason for rejection of the fisher hypothesis for this period.
This rejection and apparent negative relationship again presents evidence of the existence of the Proxy hypothesis in the Irish economy during this period.

LIBOR(-1) has a coefficient of 1.27 and LIBOR(-2) -1.56.
This again displays the effect of foreign monetary policy on a small open economy such as Ireland as expressed by Tino (2011)
The strong UK economic influence further extends to the impact the performance of the FTSE100 has on the ISEQ index.
Similarly to the Long run model significant positive coefficients can be observed with FTSE100(-1) exhibiting a coefficient of 0.886 and FTSE100(-2) exhibiting a coefficient of 0.324.
This relationship is further illustrated on the accompanying impulse response graphs.

Domestic interest rate(-1) exhibits a coefficient of -0.0955 and domestic interest rate (-2) exhibits a coefficient of 0.304.
Comparing this again to the data for the LIBOR input again like the long run model reinforces the importance of international market forces and the role they play in the Irish economy; the UK specifically in this instance.

(iv) Post Euro Introduction

Vector Autoregression Estimates
Date: 07/13/17 Time: 21:31
Sample (adjusted): 2000M03 2017M04
Included observations: 206 after adjustments
Standard errors in ( ) & t-statistics in [ ]

RETURN(-1)	0.019071 (0.07401) [0.25768]	INFLATION_RATE(-1)	-0.203476 (0.74096) [-0.27461]
RETURN(-2)	0.021076 (0.07046) [0.29910]	INFLATION_RATE(-2)	-0.352037 (0.73703) [-0.47764]
DOMESTIC__(-1)	-6.324938 (3.16274) [-1.99983]	LIBOR(-1)	1.635352 (2.13629) [0.76551]
DOMESTIC__(-2)	5.268573 (3.01402) [1.74802]	LIBOR(-2)	-1.832750 (2.18610) [-0.83836]
DOW_JONES(-1)	0.113061 (0.13489) [0.83819]	USD__(-1)	-0.656988 (1.23815) [-0.53062]
DOW_JONES(-2)	-0.095903 (0.09722) [-0.98641]	USD__(-2)	1.640195 (1.28282) [1.27859]
FTSE100(-1)	0.899236 (0.08019) [11.2143]	C	0.010078 (0.00549) [1.83458]
FTSE100(-2)	0.121816 (0.14581) [0.83546]		

R-squared	0.518042	Log likelihood	366.7648
Adj. R-squared	0.482715	Akaike AIC	-3.415192
Sum sq. resids	0.342726	Schwarz SC	-3.172871
S.E. equation	0.042360	Mean dependent	0.001424
F-statistic	14.66427	S.D. dependent	0.058897

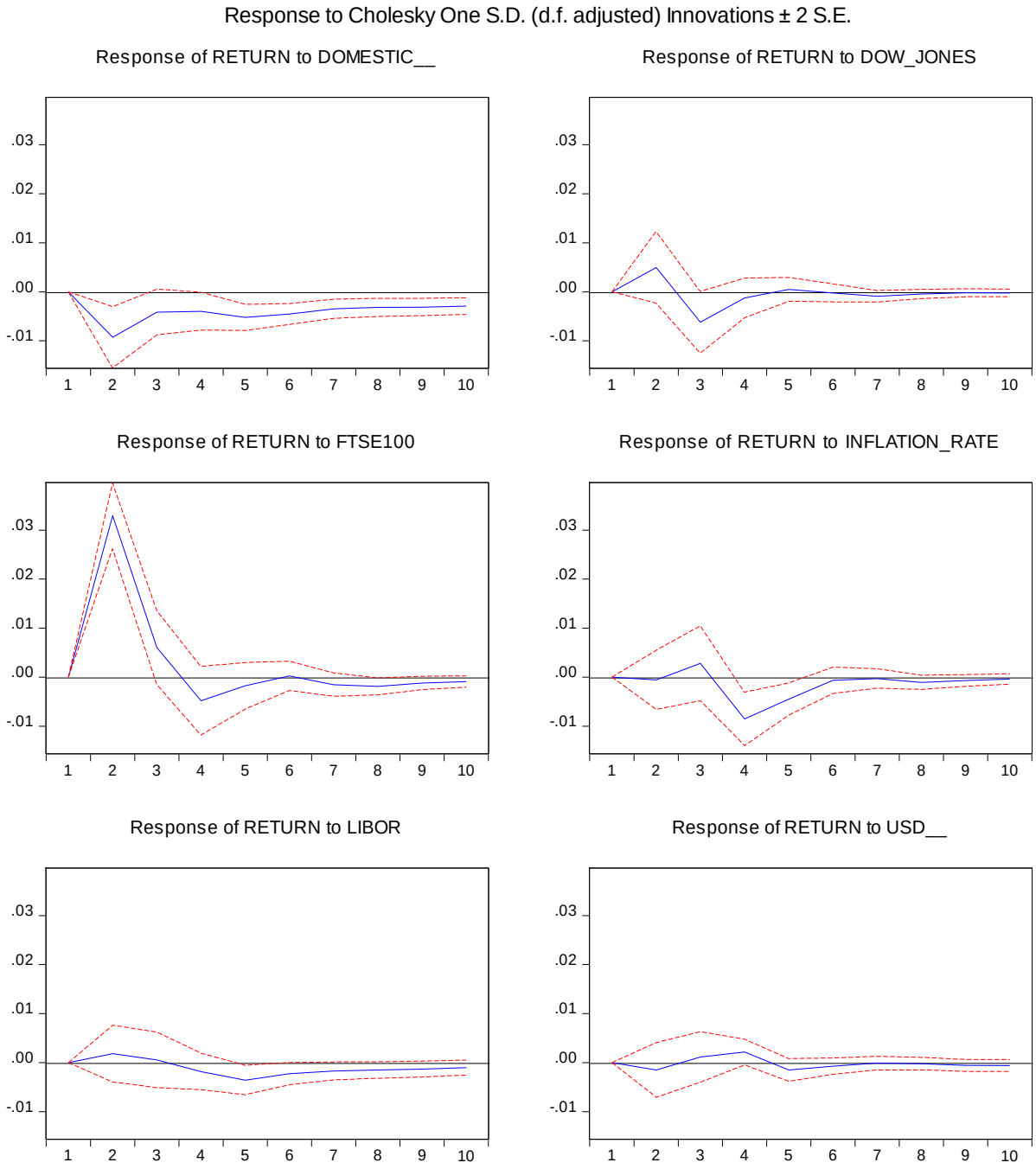
VAR Model:
==========

RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC__(-1) + C(1,4)*DOMESTIC__(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE100(-1) + C(1,8)*FTSE100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*LIBOR(-1) + C(1,12)*LIBOR(-2) + C(1,13)*USD__(-1) + C(1,14)*USD__(-2) + C(1,15)

VAR Model - Substituted Coefficients:
==========

RETURN = 0.0190713818387*RETURN(-1) + 0.0210758826417*RETURN(-2) - 6.3249379159*DOMESTIC__(-1) + 5.26857258545*DOMESTIC__(-2) + 0.113061005746*DOW_JONES(-1) - 0.0959032042241*DOW_JONES(-2) + 0.899236181605*FTSE100(-1) + 0.121816092017*FTSE100(-2) - 0.20347556782*INFLATION_RATE(-1) - 0.352036813449*INFLATION_RATE(-2) + 1.63535152476*LIBOR(-1) - 1.83274953849*LIBOR(-2) - 0.656988144026*USD__(-1) + 1.64019549419*USD__(-2) + 0.010077571561

Post-Euro Introduction Impulse Response Graph



In the post-Euro introduction model, all variables used in the long run model are cointegrating.
Again, neither of the fx rates were cointegrating during this period and were thus omitted.
Adjusted r-squared for this model is 0.4827
This model differs from both the long run and pre-euro introduction model as this model places more emphasis on domestic monetary policy rather than international.
This is the first instance in which this has happened thus far and exhibits a shift of importance from international money markets to that of domestic.
In this model Domestic(-1) exhibits a coefficient of -6.32 which would support the theories of Mok (1993) that there exists a negative causal relationship between interest rates and asset prices.
Again, LIBOR and US monetary policy also play a large part in this model.

The proxy hypothesis is again present in this model but to a lesser degree with Inflation(-1) having a coefficient of -0.203 and inflation(-2) displaying a coefficient of -0.352.
The shift of importance towards domestic interest rate and lessening of the effects of the proxy hypothesis could be attributed to the strength of the domestic economy at this stage as the Celtic tiger and building boom was at its height during this period.
During this period, short term loans were used to finance large amounts of investment (Bernhagen P et al, 2011) International monetary policy also increased in influence during this period but not to the extent as was seen with domestic policy.
LIBOR(-1) exhibiting a coefficient of -1.8353 and LIBOR(-2) displaying a coefficient of -1.832750.
FTSE100 continues to display a consistent positive influence as was seen in the previous models with FTSE100(-1) displaying a coefficient of 0.899 and FTSE100(-2) displaying a coefficient of 0.1218.
This positive relationship is similarly illustrated in the accompanying impulse response graph.
Again, while US monetary displayed an influence it did not grow to the extent that either domestic or UK monetary policy grew in influence during this period.

During this period we can conclude that there is again evidence that would support the existence of the proxy hypothesis.
Existence of this evidence rejects the Fisher hypothesis in the Irish economy during this period.
It can be seen this is the first instance in which the domestic interest rate plays a large part in setting asset prices.
Previous models presented until now domestic monetary policy had minor influence, with UK rates holding a larger influence.
This shift of influence could be hypothesised to be a result of one of several factors.
One of which being during the post Euro introduction period domestic interest rates were now set by the ECB rather than the Irish central bank, thus adding an international influence to domestic monetary policy.
One could also hypothesise that the strength of the housing market and the levels of investment thereof during this period would have exponentially increased the importance of domestic policy during this period within the Irish economy.

(v) Pre-Lehman Bros. Collapse

Vector Autoregression Estimates
Date: 07/13/17 Time: 20:39
Sample (adjusted): 2000M03 2008M08
Included observations: 102 after adjustments
Standard errors in ( ) & t-statistics in [ ]

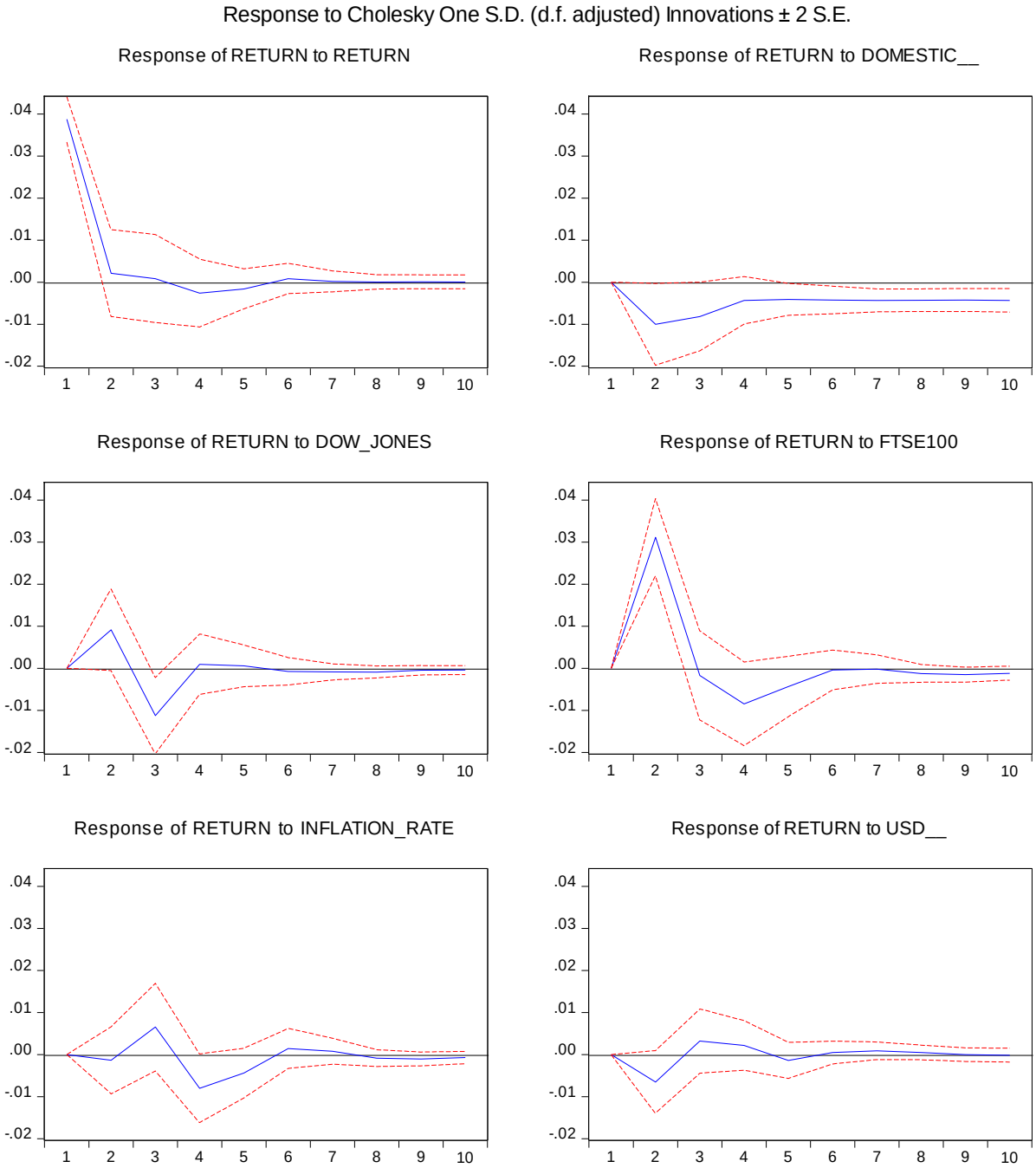
RETURN(-1)	0.020073 (0.10769) [0.18640]	FTSE100(-2)	0.008703 (0.19445) [0.04476]
RETURN(-2)	0.070396 (0.10817) [0.65079]	INFLATION_RATE(-1)	-0.279582 (0.98700) [-0.28326]
DOMESTIC__(-1)	-5.796107 (3.83339) [-1.51201]	INFLATION_RATE(-2)	-0.392405 (1.01687) [-0.38590]
DOMESTIC__(-2)	3.940409 (3.69952) [1.06511]	USD__(-1)	-2.389519 (1.36274) [-1.75346]
DOW_JONES(-1)	0.095187 (0.18113) [0.52551]	USD__(-2)	3.258905 (1.43081) [2.27767]
DOW_JONES(-2)	-0.246635 (0.13392) [-1.84166]	C	0.033787 (0.01629) [2.07401]
FTSE100(-1)	0.874339 (0.11219) [7.79369]		

R-squared	0.571292	Log likelihood	193.8144
Adj. R-squared	0.513489	Akaike AIC	-3.545380
Sum sq. resids	0.133562	Schwarz SC	-3.210824
S.E. equation	0.038739	Mean dependent	-0.001270
F-statistic	9.883379	S.D. dependent	0.055539

VAR Model:
==========
RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC__(-1) + C(1,4)*DOMESTIC__(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE100(-1) + C(1,8)*FTSE100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*USD__(-1) + C(1,12)*USD__(-2) + C(1,13)

VAR Model - Substituted Coefficients:
==========
RETURN = 0.0200726353885*RETURN(-1) + 0.070395538148*RETURN(-2) - 5.79610727637*DOMESTIC__(-1) + 3.9404086345*DOMESTIC__(-2) + 0.0951874665456*DOW_JONES(-1) - 0.246634666333*DOW_JONES(-2) + 0.874338990482*FTSE100(-1) + 0.00870333845611*FTSE100(-2) - 0.279582212853*INFLATION_RATE(-1) - 0.392405182852*INFLATION_RATE(-2) - 2.38951925268*USD__(-1) + 3.25890520992*USD__(-2) + 0.0337866474848

Pre-Lehman Bros. Collapse Impulse Response Graph



The model which examines the returns of the ISEQ index pre-Lehman bros. crash runs from March 2000 – August 2008
The variables of this model include domestic interest rate, returns of the DowJones, returns of the FTSE100, domestic inflation rate and Federal funds rate.
Libor and the previously mentioned fx rates were omitted from this model as non-cointegrating variables.
This model has an adjusted r-squared of 0.5134.

Similarly to the post-euro introduction model which included the Celtic tiger area this model exhibits a large domestic(-1) coefficient of -5.796 and domestic(-2) of 3.94.
The related impulse response graphs support a negative causal relationship between domestic interest rates and returns of the ISEQ index for this period.
Similarly to the post euro introduction model and in contrast to the long run models presented; domestic interest rate holds a far larger influence in this instance that of international interest rates. This would be as expected given the large level of domestic investment in the overheated housing market which was taking place at the time (Honohan, P 2016).

Again the proxy hypothesis is evident but with diminishing effect with an inflation rate(-1) coefficient of -0.27 and inflation rate(-2) coefficient of -0.392.
As with all other models with evidence of the proxy hypothesis present; the fisher hypothesis can be rejected for the period examined.
Given the diminishing effect of the proxy hypothesis as domestic policy becomes a larger driver of asset prices this would seem as though to be falling in line with an assessment made in the literature review that internally driven economies tend towards the fisher hypothesis as was seen in countries with rich natural resources.
Ireland could be considered internally driven by the housing market at this point.
Given the fact it was moving slowly away from the proxy hypothesis at this point when compared to the results of both the pre-euro model and the long run model when examined in the context of inflation.

Similarly, to the long run model the US interest rate and FTSE100 maintain relatively large coefficients.
FTSE100(-1) exhibits a coefficient of 0.874 and FTSE100(-2) exhibits a coefficient of 0.0087; maintaining the strong positive relationship observable in all models to this point.
US interest rates display large coefficients during this period with US rate(-1) displaying a coefficient of -2.3895 and US rate(-2) displaying a coefficient of 3.2589.
While US interest rates had a major influence on ISEQ index returns at this point the DOWJONES(-1) displayed minor influence with a coefficient of 0.0951 and DOWJONES(-2) displaying a coefficient of -0.2466.
The large US interest rate coefficients would move to have a major impact on the Irish markets following the crash of Lehman bros. after this period and the subsequent credit difficulties faced internationally thereafter.

(vi) Post Lehman Bros. Collapse

Vector Autoregression Estimates
Date: 07/13/17 Time: 20:02
Sample (adjusted): 2008M11 2017M04
Included observations: 102 after adjustments
Standard errors in ( ) & t-statistics in [ ]

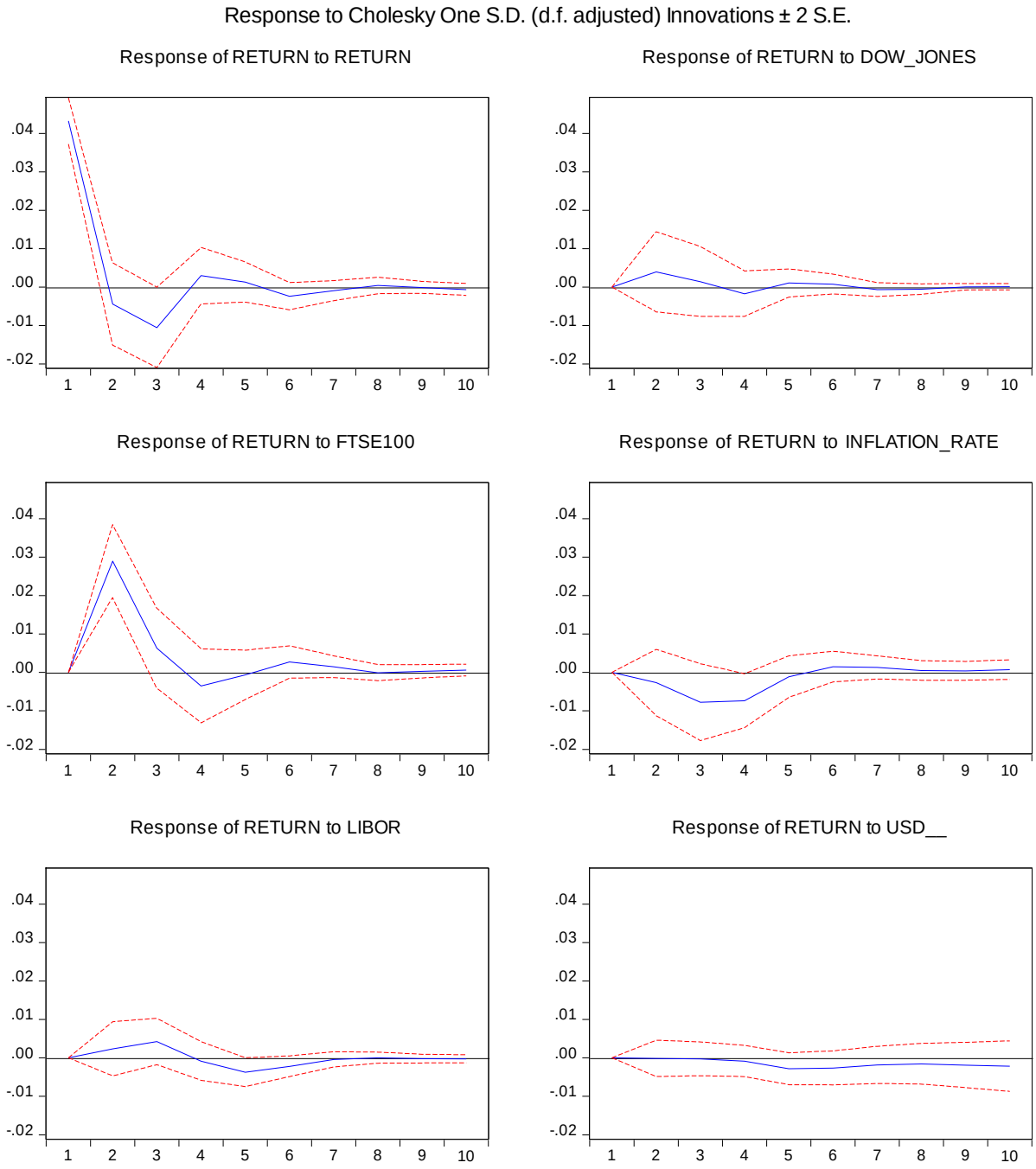
RETURN(-1)	-0.068667 (0.10752) [-0.63864]	INFLATION_RATE(-2)	-1.846791 (1.04895) [-1.76060]
RETURN(-2)	-0.201803 (0.10275) [-1.96402]	LIBOR(-1)	4.026847 (5.20036) [0.77434]
DOW_JONES(-1)	0.085112 (0.20690) [0.41136]	LIBOR(-2)	-4.422412 (3.79573) [-1.16510]
DOW_JONES(-2)	0.148790 (0.14294) [1.04094]	USD__(-1)	-0.271251 (5.09227) [-0.05327]
FTSE100(-1)	0.823664 (0.12096) [6.80961]	USD__(-2)	-5.843724 (4.27217) [-1.36786]
FTSE100(-2)	0.257274 (0.21452) [1.19928]	C	0.018306 (0.01330) [1.37591]
INFLATION_RATE(-1)	-0.730690 (1.10759) [-0.65971]		

R-squared	0.467286	Log likelihood	182.5881
Adj. R-squared	0.395459	Akaike AIC	-3.325257
Sum sq. resids	0.166450	Schwarz SC	-2.990701
S.E. equation	0.043246	Mean dependent	0.008014
F-statistic	6.505748	S.D. dependent	0.055620

VAR Model:
==========
RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOW_JONES(-1) + C(1,4)*DOW_JONES(-2) + C(1,5)*FTSE100(-1) + C(1,6)*FTSE100(-2) + C(1,7)*INFLATION_RATE(-1) + C(1,8)*INFLATION_RATE(-2) + C(1,9)*LIBOR(-1) + C(1,10)*LIBOR(-2) + C(1,11)*USD__(-1) + C(1,12)*USD__(-2) + C(1,13)

VAR Model - Substituted Coefficients:
==========
RETURN = - 0.0686673257841*RETURN(-1) - 0.201803123194*RETURN(-2) + 0.0851121045095*DOW_JONES(-1) + 0.148789829097*DOW_JONES(-2) + 0.823663841*FTSE100(-1) + 0.257273789113*FTSE100(-2) - 0.730689890337*INFLATION_RATE(-1) - 1.84679062599*INFLATION_RATE(-2) + 4.0268465543*LIBOR(-1) - 4.42241221553*LIBOR(-2) - 0.271251396861*USD__(-1) - 5.84372371643*USD__(-2) + 0.018306413065

Post Lehman Bros. Collapse Impulse Response Graph



The model created to account for the period after the crash of Lehman bros. is composed of the period between November 2008 to April 2017.
The independent variables that were included in this model are the returns of the Dow Jones, returns of the FTSE100, domestic inflation rate, LIBOR and the US federal funds rate.
Domestic interest rate and fx rates were non cointegrating variables in this model and inclusion of such would have resulted in spurious regression.
This model presents with an adjusted r-squared of 0.39 which makes this one of the weaker models presented in this study in regards of explanatory power.

In contrast to all the previous VAR models presented to explain the relationship between domestic interest rate, inflation and returns of the ISEQ index; this is the first model to state that during the period of examination domestic interest rate or monetary policy had no significant relationship to the returns of the ISEQ index.
This could possibly be explained by the international credit crisis that was taking place at this point.
This is evident in the model presented with the re-emergence of the importance of international interest rates with LIBOR(-1) exhibiting a coefficient of 4.0268 and LIBOR(-2) exhibiting a coefficient of -4.422.
US federal funds rate(-1) during this period was -0.27 and the same rate lagged by two months displays a coefficient of -5.843.
The renewed importance of US interest rates during this period could be hypothesised to have been a direct result of the crash of Lehman bros.

The Fisher hypothesis is again dismissed in favour of the proxy hypothesis for this model.
This can be examined on both the impulse response graph and via examination of the coefficients
With inflation(-1) exhibiting a coefficient of -0.730 and inflation(-2) exhibiting a coefficient of -1.846.
As domestic interest rate is no longer a driver of this economy the influence of the proxy hypothesis has grown when compared to the “Pre-Lehman bros. crash” model
This is the converse of the period of the Celtic tiger from when the economy was for the most part internally driven by the housing market.

FTSE100 holds a consistent influence throughout the study as it does in this model.
Observable in the VAR model is a FTSE100(-1) coefficient of 0.823 and a FTSE100(-2) coefficient of 0.257.
Overall while this model is considered the weakest in the context of statistical explanatory power; The non-cointegrating nature of the domestic interest rate during this period raises interesting questions regarding the effectiveness of domestic policy in dealing with financial crashes if the nature 2008.

(vii) Pre-Troika Bailout

Vector Autoregression Estimates
Date: 07/13/17 Time: 20:28
Sample (adjusted): 2000M03 2010M11
Included observations: 129 after adjustments
Standard errors in ( ) & t-statistics in [ ]

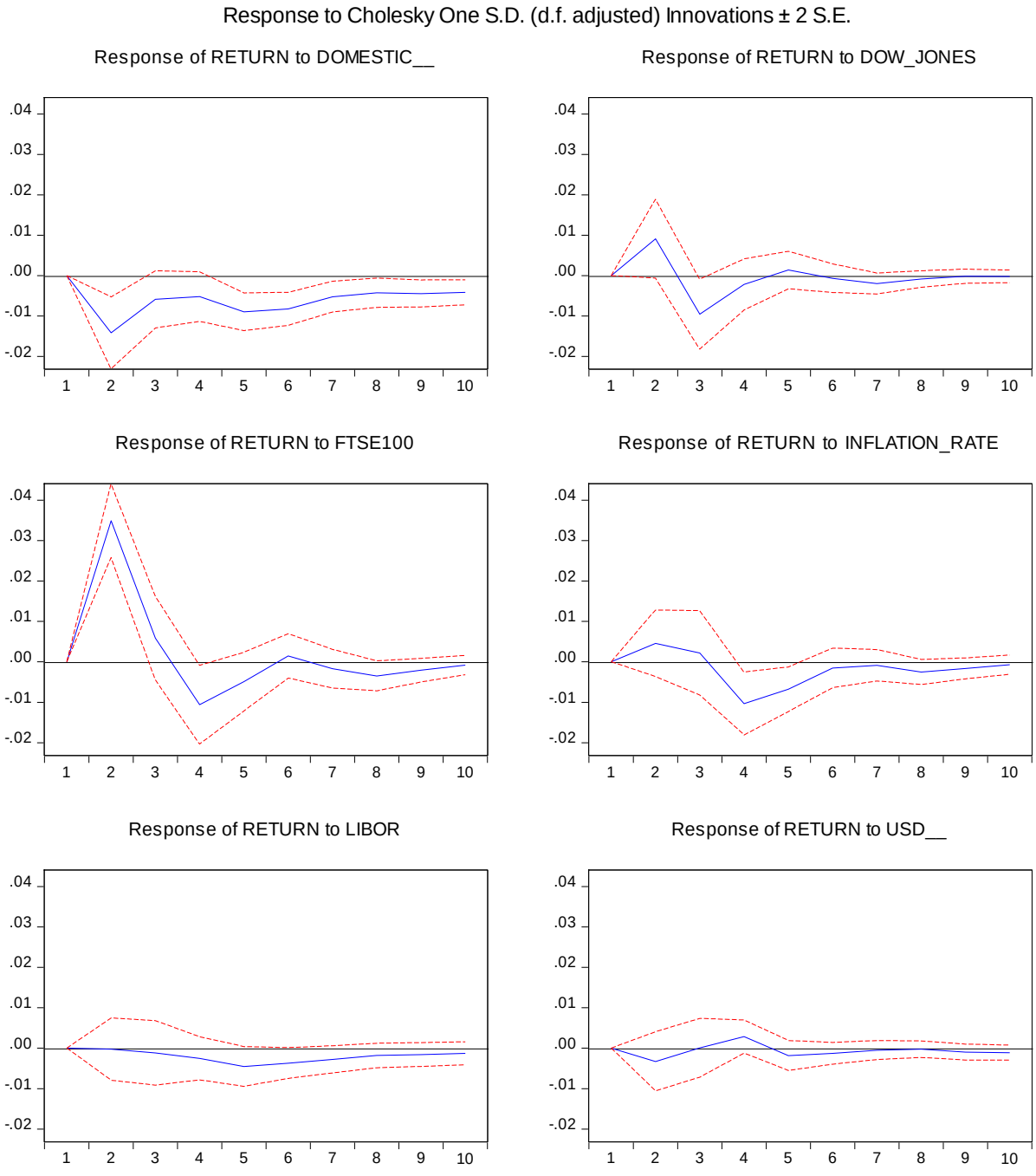
RETURN(-1)	0.017779	INFLATION_RATE(-1)	1.106595
	(0.09356)		(1.01526)
	[0.19002]		[1.08997]
RETURN(-2)	0.056284	INFLATION_RATE(-2)	-0.557506
	(0.08752)		(0.98398)
	[0.64310]		[-0.56658]
DOMESTIC__(-1)	-8.783946	LIBOR(-1)	0.356208
	(3.85148)		(2.42800)
	[-2.28067]		[0.14671]
DOMESTIC__(-2)	6.801236	LIBOR(-2)	-0.018912
	(3.58678)		(2.48723)
	[1.89620]		[-0.00760]
DOW_JONES(-1)	0.306687	USD__(-1)	-1.205761
	(0.17858)		(1.34906)
	[1.71736]		[-0.89378]
DOW_JONES(-2)	-0.157660	USD__(-2)	2.282369
	(0.12423)		(1.42765)
	[-1.26907]		[1.59869]
FTSE100(-1)	0.914340	C	0.007831
	(0.10399)		(0.01317)
	[8.79217]		[0.59459]
FTSE100(-2)	-0.077831		
	(0.19968)		
	[-0.38978]		

R-squared	0.593679	Log likelihood	225.5184
Adj. R-squared	0.543780	Akaike AIC	-3.263852
Sum sq. resids	0.228899	Schwarz SC	-2.931315
S.E. equation	0.044809	Mean dependent	-0.005112
F-statistic	11.89758	S.D. dependent	0.066341

VAR Model:
==========
RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC__(-1) + C(1,4)*DOMESTIC__(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE100(-1) + C(1,8)*FTSE100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*LIBOR(-1) + C(1,12)*LIBOR(-2) + C(1,13)*USD__(-1) + C(1,14)*USD__(-2) + C(1,15)

VAR Model - Substituted Coefficients:
==========
RETURN = 0.0177785829853*RETURN(-1) + 0.0562841757939*RETURN(-2) - 8.78394583543*DOMESTIC__(-1) + 6.80123646481*DOMESTIC__(-2) + 0.306687368579*DOW_JONES(-1) - 0.15766033762*DOW_JONES(-2) + 0.914339908662*FTSE100(-1) - 0.0778312278382*FTSE100(-2) + 1.10659543109*INFLATION_RATE(-1) - 0.557506035245*INFLATION_RATE(-2) + 0.356208271653*LIBOR(-1) - 0.0189115974772*LIBOR(-2) - 1.20576056163*USD__(-1) + 2.2823694085*USD__(-2) + 0.00783082150252

Pre-Troika Bailout Impulse Response Graph



In the model built to account for the period before the Troika bail out of the Irish government is built using data from the period of March 2000 – November 2011.
All variables used in the long run model are used in this model.
Again, fx rates were non-cointegrating variables and were omitted to maintain integrity of the VAR model.
This model presented an adjusted r-squared of 0.5437.

This is the only model in which there is evidence to support the possibility of the Fisher hypothesis being present in the Irish economy during this period.
This can be seen on the relevant impulse response graph for inflation.
It is also evident in the coefficients inflation(-1) displays a coefficient of 1.10695.
Yet the Fisher hypothesis cannot be fully accepted in this model as inflation(-2) displays a coefficient of -0.55.
Even though a definite conclusion cannot be drawn for this period; it presents an interesting outlier for what was a turbulent time in Irish economics.

On examination of the impulse response graph for domestic interest rates a strong negative causation is seen.
This contrasts with what was seen on the long run model; in which notably weaker relationships were observed.
On examination of the VAR model domestic interest rate(-1) returns a coefficient of -8.783 and domestic interest rate(-2) returns a coefficient of 6.801.
This strong influence of domestic rate encompasses several contrasting periods in the Irish economy. This model includes the Celtic tiger era, the crash of Lehman bros. and the period just before the Troika bailout of the Irish government in which the Irish government was effectively unable to borrow.
As this model includes the post Lehman bros crash period large federal funds coefficients are observable with USDRATE(-1) exhibiting a coefficient of -1.205 and USDRATE(-2) exhibiting a coefficient of 2.283
The impulse response graph displayed a negative causation for this variable during this period.

Returns of international markets display strong influence on the returns of the ISEQ index with the FTSE100 displaying a large positive causation on both the impulse response graphs and observable in the VAR coefficients presented with FTSE100(-1) displaying a coefficient of 0.9143 and FTSE100(-2) displaying a coefficient of -0.0778; this is in line with the observations made in the long run model.
LIBOR displayed a weaker influence in this period than that of the long run model with observable coefficients of LIBOR(-1) of 0.356 and LIBOR(-2) of 0.0189

(viii) Post Troika Bailout

Vector Autoregression Estimates
Date: 07/13/17 Time: 20:56
Sample (adjusted): 2011M02 2017M04
Included observations: 75 after adjustments
Standard errors in ( ) & t-statistics in [ ]

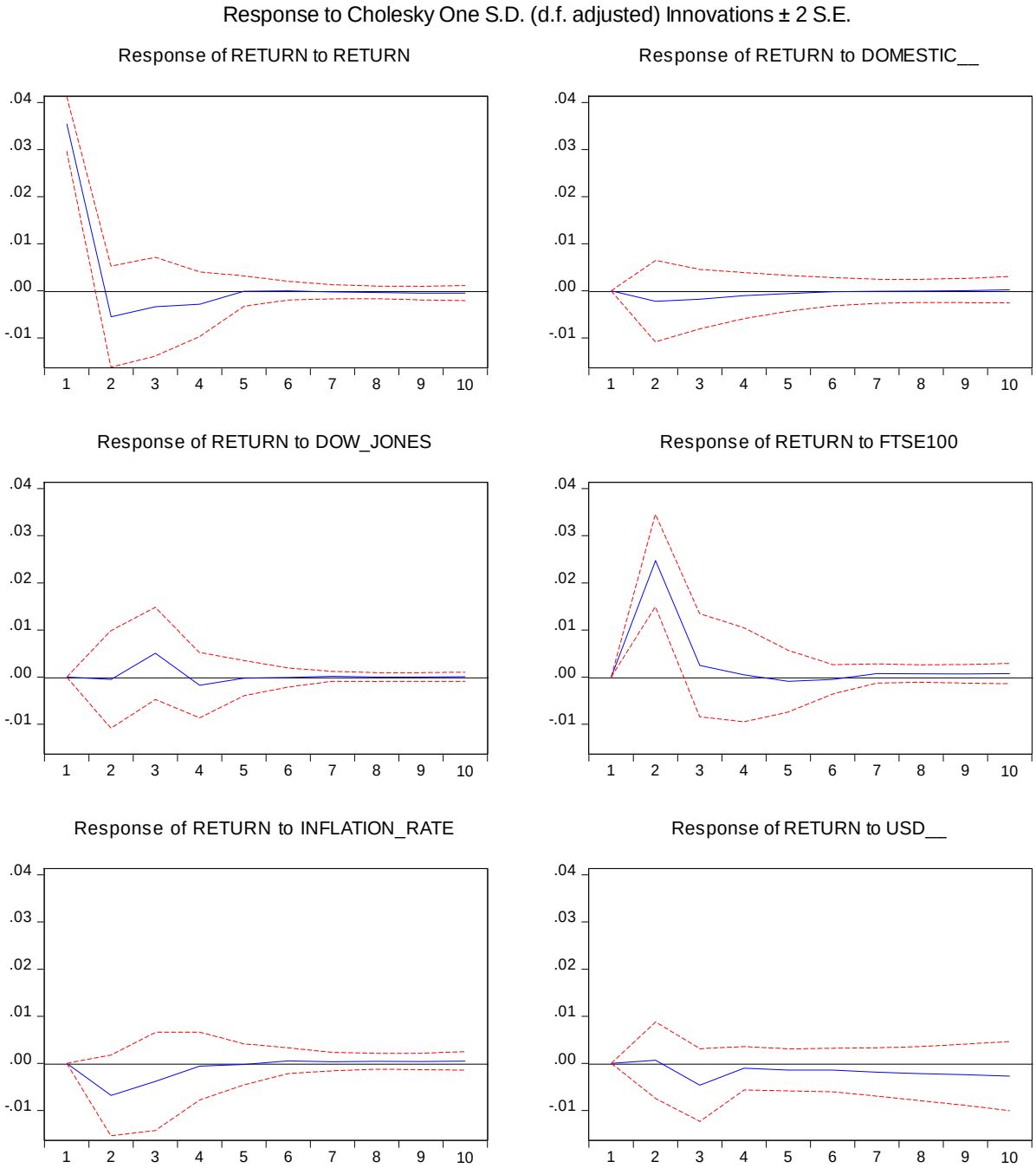
RETURN(-1)	-0.124361 (0.13154) [-0.94545]	FTSE100(-2)	0.299588 (0.21566) [1.38914]
RETURN(-2)	-0.168821 (0.12726) [-1.32654]	INFLATION_RATE(-1)	-1.768753 (1.12829) [-1.56763]
DOMESTIC__(-1)	-1.837991 (6.92876) [-0.26527]	INFLATION_RATE(-2)	-1.241064 (1.14761) [-1.08144]
DOMESTIC__(-2)	1.974594 (6.92274) [0.28523]	USD__(-1)	1.511338 (9.40295) [0.16073]
DOW_JONES(-1)	0.034196 (0.20992) [0.16290]	USD__(-2)	-7.825291 (11.5350) [-0.67840]
DOW_JONES(-2)	0.302750 (0.16579) [1.82610]	C	0.019129 (0.00948) [2.01858]
FTSE100(-1)	0.747147 (0.14254) [5.24167]		

R-squared	0.384890	Log likelihood	151.1117
Adj. R-squared	0.265837	Akaike AIC	-3.682977
Sum sq. resids	0.078079	Schwarz SC	-3.281279
S.E. equation	0.035487	Mean dependent	0.011700
F-statistic	3.232921	S.D. dependent	0.041417

VAR Model:
==========
RETURN = C(1,1)*RETURN(-1) + C(1,2)*RETURN(-2) + C(1,3)*DOMESTIC__(-1) + C(1,4)*DOMESTIC__(-2) + C(1,5)*DOW_JONES(-1) + C(1,6)*DOW_JONES(-2) + C(1,7)*FTSE100(-1) + C(1,8)*FTSE100(-2) + C(1,9)*INFLATION_RATE(-1) + C(1,10)*INFLATION_RATE(-2) + C(1,11)*USD__(-1) + C(1,12)*USD__(-2) + C(1,13)

VAR Model - Substituted Coefficients:
==========
RETURN = - 0.124360617341*RETURN(-1) - 0.168820773796*RETURN(-2) - 1.83799085255*DOMESTIC__(-1) + 1.97459355169*DOMESTIC__(-2) + 0.034195677839*DOW_JONES(-1) + 0.302749750837*DOW_JONES(-2) + 0.747146928716*FTSE100(-1) + 0.299587627674*FTSE100(-2) - 1.7687533927*INFLATION_RATE(-1) - 1.24106386209*INFLATION_RATE(-2) + 1.51133793135*USD__(-1) - 7.8252908144*USD__(-2) + 0.0191285499998

Post Troika Bailout Impulse Response Graph



The period after the Troika bailout stretches from February 2011 to April 2017.
The independent variables in this model include the domestic interest rate, returns of the DowJones, returns of the FTSE100, the domestic rate of inflation and the US federal funds rate.
Both LIBOR and fx rates were omitted due to them being non-cointegrating variables in this model.

This model presents an adjusted r-squared of 0.26 making this the weakest of the models presented.
Like the long run model and unlike what was seen with the model built to explain the period directly before the troika bailout, this model exhibits evidence in favour of the proxy hypothesis.
This can be seen on examination of both the impulse response graph relating to it and in the coefficients present in the VAR model.
Inflation(-1) exhibits a coefficient of -1.7687 and inflation(-2) exhibits a coefficient of -1.24106 both of which strongly support existence of the proxy hypothesis.
This contrasts with the model that describes the period before the troika bailout in which evidence to support both the Fisher hypothesis was observed.
All other models including that of the long run model support the view that the proxy hypothesis is evident in the Irish economy and that there exists a negative causal relationship between the rate of domestic inflation and returns of the ISEQ index.

In examination of domestic interest rates this model displays large coefficients with domestic interest(-1) exhibiting a coefficient of -1.837 and domestic interest rate(-2) exhibiting a coefficient of 1.9745.
FTSE100 continues to exhibits a positive causal relationship with returns of the ISEQ index as can be seen in the relevant impulse response graph in the previous page.
This can also be seen in the coefficients present in the VAR model for this variable with FTSE100(-1) exhibiting a coefficient of 0.747 and FTSE100(-2) exhibiting a coefficient of 0.299.
The FTSE100 relationship is in line with what was observed in the other models presented in this study.
Returns of the DowJones also displays a positive causal relationship with returns of the ISEQ index as seen in the relevant impulse response graph.
The coefficients for this variable support this fully with DowJones(-1) having a coefficient of 0.03419 and DowJones(-2) displaying a coefficient of 0.302.
Upon examination of the influence of the federal funds rate on the price of Irish assets one observes coefficients of USD(-1) being equal to 1.51 and USD(-2) being equal to -7.825.

(ix) Conclusion of Empirical Results, Analysis and Commentary

Given the results presented over the course of this chapter several conclusions can be drawn regarding the research questions posed at the outset of this paper.
Most significant of this is the reoccurring existence of the proxy hypothesis throughout many models presented.
Concluding this chapter; it can be said that there is a large body of compelling evidence presented that dismisses the Fisher hypothesis in the case of Ireland and the ISEQ index and supports the existence of the proxy hypothesis as proposed by Farma et al (1977).
This can be seen both over the long run and in all the short run models; the notable exception being the model used to explain the period leading to the troika bailout.

When examining the relationship between domestic interest and returns of the ISEQ index over the long run it is clear that the concluding comments of Bredin et al (2003) and (2005) hold true that in the long run domestic monetary policy does not hold the same level of influence that international monetary policy does.
These findings support that of Tino (2011) and Pirovano (2000) in the context of domestic interest rates playing a secondary role to international rates in small open economies with large levels of foreign investment.
The outlier to this long run view is the periods that include the Celtic tiger; given the large levels of domestic investment in the overheated housing industry as alluded to by (Honohan, P 2016) and (Bernhagen P et al, 2011) one would assume that domestic interest rates would move into a primary role during this period.
During this period; domestic interest rates displayed a negative causal relationship with the returns of the ISEQ index.

Examination of the other factors mentioned in the methodology generally provided consistent output throughout the course of this study.
Examination of the FTSE100 and its relationship to the ISEQ index uncovered a consistent positive causal relationship between it and the returns of the ISEQ index.
Similar results were obtained from examination of the returns of the DowJones; albeit this result did not return as large an influence as was seen in Bredin et al (2005).

Further study in this area could benefit from a metric of government/sovereign confidence especially in the period surrounding the troika bailout.
Bond yield could possibly be used as an adequate measure of this; given a bond with a higher yield could carry a higher risk of default.
A measure such as this could increase the explanatory power of the post troika VAR model presented in the concluding sections of this chapter.

As mentioned in the methodology the findings of Gumbo et al, (2016) called for a large GDP coefficient in the regression results presented.
The availability of monthly GDP data was initially considered a limitation of this study.
Upon further examination of the GDP variable threshold cointegration was observed; upon examination of a regression model GDP explained little of the movement of ISEQ index returns over the long run and was as such omitted from findings.
FX or foreign exchange rates were present in all models where appropriate but found to be non-cointegrating at all periods examined.

Given the results presented and the analysis thereof a conclusion can be drawn that the study has achieved the research aims set forth at the outset.
An estimation of the relationship between domestic interest rate and returns of the ISEQ index has been made; framed within the context of previous literature.
Upon examination of the relationship between the rate of inflation and returns of the ISEQ index it can be stated that there exists evidence of a negative causal relationship or proxy hypothesis over the long run.

An estimation of the influence of foreign macroeconomic variables has on stock prices in the Irish economy has also been made.
Given this the aims of this research have been achieved within this chapter.

Chapter 5: Conclusion

The overall aim of this study was to examine and document the observable relationship between domestic interest rate, domestic inflation and the movements of prices of the ISEQ index.
The overarching motivation of this study was to provide a framework which will allow for an approximation of the response of asset prices to changes in monetary policy over the long run.

The Relationship Between Inflation and the ISEQ index

This study presented two contrasting theories as to the relationship between inflation and returns of the ISEQ index.
The Fisher hypothesis proposes that equities present a perfect hedge against inflation.
This is contrasted by the Fisher hypothesis which states that equities present a negative causal relationship with equities.

Over the long run a significant body of evidence was observed to support the proxy hypothesis in the VAR models used to describe the relationship between the ISEQ index returns.
This evidence continued to be observed in many of the short run models.
It must be noted that a deterioration of the strength of the proxy hypothesis coefficients was observed during periods which domestic interest rates held a large influence in the presented models.
This was observed exclusively during periods which included the "Celtic tiger" era.
One must consider causation versus correlation in examination of this conclusion.
While an observation can be made regarding this a definitive statement cannot be made; this is an area that may warrant further study in the future.

The Relationship Between Interest Rates and the ISEQ Index

"*A negative coefficient with causality running from interest rates to stock price is often expected, since a rise in interest rates reduces the present value of future dividend incomes which would depress stock prices*" (Mok H.M.K, 1993)

Following the thought process of Mok one would expect domestic interest rates to hold a large negative causal relationship with the returns of the ISEQ index.
Upon examination of the presented; over the long run one can observe that domestic_rate(-1) exhibits a weak negative coefficient and domestic_rate(-2) exhibits a stronger positive coefficient.

While these results seem unexpected examination of other constituents of the presented models conveyed the image that Irish stock prices are far more influenced by international monetary policy rather than domestic.
The exception to this being the period of the Celtic tiger when a large negative causal relationship can be observed on examination of the pre-troika bailout impulse response graphs.

Overall it can be seen other than this brief period Ireland as a small open economy is greatly influenced by international economic activity as concluded by Bredin (2003) and (2005).

Limitations and Recommendations for Further Research

As acknowledged in the previous methodology chapter; the VAR technique used in this research can be prone to several limitations.
These can include spurious regression output if independent variables are not thoroughly vetted before implementation.
Standard methods of statistical inference such as computing standard errors for impulse response may give misleading results if some of the variables are highly persistent.

Also, without modification standard Var models can miss non-linearity's, conditional heteroskedasticity and drifts or breaks in parameters

Acknowledgement of disclosed limitations and the robust independent variable selection process in place should minimise impact of said limitations.

Future studies could benefit from a metric of government or sovereign confidence especially in the period surrounding the international financial crisis.

The use of bond yield was presented as a possibility in the concluding section of the empirical results and analysis chapter.

Examination of the correlation vs causation question posed regarding the influence of domestic interest rates and the proxy hypothesis will make for an interesting tangent if future research was to be undertaken.

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Appendix

1)

DIBOR descriptive statistics	
Mean	5.35415
Standard Error	0.23465
Median	4.56
Mode	2.14
Standard Deviation	4.69299
Sample Variance	22.02416
Kurtosis	6.855187
Skewness	1.590659
Range	40.33
Minimum	-0.33
Maximum	40
Sum	2141.66
Count	400

2)

ISEQ returns	
Mean	0.007517
Standard Error	0.002992
Median	0.01529
Mode	#N/A
Standard Deviation	0.060658
Sample Variance	0.003679
Kurtosis	3.314783
Skewness	-0.95955
Range	0.516946
Minimum	-0.32055
Maximum	0.196395
Sum	3.089452
Count	411

3)

Inflation Rate	
Mean	0.002223
Standard Error	0.000256
Median	0
Mode	0
Standard Deviation	0.005202
Sample Variance	2.71E-05
Kurtosis	4.836389
Skewness	1.275059
Range	0.045201
Minimum	-0.01677
Maximum	0.028436
Sum	0.916
Count	412

4)

FTSE100	
Mean	0.004958
Standard Error	0.00224
Median	0.009216
Mode	#N/A
Standard Deviation	0.044744
Sample Variance	0.002002
Kurtosis	5.364843
Skewness	-1.13883
Range	0.436471
Minimum	-0.3017
Maximum	0.134771
Sum	1.97805
Count	399

5)

Dow Jones	
Mean	0.0067
Standard Error	0.002261
Median	0.009713
Mode	#N/A
Standard Deviation	0.043723
Sample Variance	0.001912
Kurtosis	4.580132
Skewness	-1.13594
Range	0.393653
Minimum	-0.26417
Maximum	0.12948
Sum	2.505742
Count	374

6)

LIBOR	
Mean	5.604933
Standard Error	0.207473
Median	5.53
Mode	0.59
Standard Deviation	4.017696
Sample Variance	16.14188
Kurtosis	-0.26009
Skewness	0.560062
Range	15.05
Minimum	0.33
Maximum	15.38
Sum	2101.85
Count	375

7)

Federal Funds Rate	
Mean	4.229223
Standard Error	0.160401
Median	4.665
Mode	0.07
Standard Deviation	3.255779
Sample Variance	10.6001
Kurtosis	-0.83634
Skewness	0.260438
Range	14.31
Minimum	0.04
Maximum	14.35
Sum	1742.44
Count	412

8) Long Run Model Correlation Matrix

	Return	*Inflation rate*	*Domestic rate*	*UK Rate*	*US Rate*	*Dow Jones*	*FTSE 100*
Return	1	0.077432	0.000218	-0.04065	0.02774	0.636927	0.048688
Inflation rate	0.077432	1	0.11759	0.18883	0.219279	0.103206	-0.0383
Domestic rate	0.000218	0.11759	1	0.80868	0.684335	0.020405	0.037458
UK Rate	-0.04065	0.18883	0.80868	1	0.889458	0.005684	0.017425
US Rate	0.02774	0.219279	0.684335	0.889458	1	0.032855	0.054687
Dow Jones	0.636927	0.103206	0.020405	0.005684	0.032855	1	0.061396
FTSE 100	0.048688	-0.0383	0.037458	0.017425	0.054687	0.061396	1

9) Long Run Model Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.261794	385.8127	111.7805	0.0000
At most 1 *	0.213504	273.8095	83.93712	0.0000
At most 2 *	0.172082	185.1875	60.06141	0.0000
At most 3 *	0.168519	115.5050	40.17493	0.0000
At most 4 *	0.082241	47.40728	24.27596	0.0000
At most 5 *	0.035720	15.73937	12.32090	0.0129
At most 6	0.006261	2.317570	4.129906	0.1510

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

10) Pre-Euro Introduction Correlation Matrix

	Return	*Inflation rate*	*Domestic %*	*Libor*	*Dow Jones*	*FTSE100*
Return	1	0.153676	-0.00032	-0.12059	0.627065	0.047854
Inflation rate	0.153676	1	0.02333	0.11314	0.183512	-0.03179
Domestic %	-0.00032	0.02333	1	0.479694	-0.02255	0.04279
Libor	-0.12059	0.11314	0.479694	1	-0.05046	-0.00901
Dow Jones	0.627065	0.183512	-0.02255	-0.05046	1	0.066416
FTSE100	0.047854	-0.03179	0.04279	-0.00901	0.066416	1

Date: 07/13/17 Time: 21:40
Sample (adjusted): 1986M06 1999M12
Included observations: 163 after adjustments
Trend assumption: No deterministic trend
Series: DOMESTIC__ DOW_JONES FTSE100 INFLATION_RATE LIBOR RETURN
Lags interval (in first differences): 1 to 2

11) Pre-Euro Introduction Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.476227	276.4335	83.93712	0.0000
At most 1 *	0.351039	171.0220	60.06141	0.0000
At most 2 *	0.221899	100.5436	40.17493	0.0000
At most 3 *	0.193642	59.64700	24.27596	0.0000
At most 4 *	0.137256	24.56483	12.32090	0.0003
At most 5	0.003063	0.500035	4.129906	0.5425

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

12) Post-Euro Introduction Correlation Matrix

	Return	*Inflation rate*	*Domestic %*	*Libor*	*USD %*	*Dow Jones*	*FTSE100*
Return	1	0.0189	-0.25366	-0.17538	-0.03446	0.642015	0.038476
Inflation rate	0.0189	1	0.282344	0.325607	0.357058	0.037011	-0.05453
Domestic %	-0.25366	0.282344	1	0.92861	0.783069	-0.2005	-0.20922
Libor	-0.17538	0.325607	0.92861	1	0.852203	-0.16672	-0.13831
USD %	-0.03446	0.357058	0.783069	0.852203	1	-0.06819	-0.05595
Dow Jones	0.642015	0.037011	-0.2005	-0.16672	-0.06819	1	0.040465
FTSE100	0.038476	-0.05453	-0.20922	-0.13831	-0.05595	0.040465	1

Date: 07/13/17 Time: 21:29
Sample (adjusted): 2000M04 2017M04
Included observations: 205 after adjustments
Trend assumption: No deterministic trend
Series: DOMESTIC__ DOW_JONES FTSE100 INFLATION_RATE LIBOR RETURN USD__
Lags interval (in first differences): 1 to 2

13) Post-Euro Introduction Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.472248	379.9103	111.7805	0.0000
At most 1 *	0.328402	248.8888	83.93712	0.0000
At most 2 *	0.299912	167.2793	60.06141	0.0000
At most 3 *	0.185317	94.18660	40.17493	0.0000
At most 4 *	0.146975	52.17056	24.27596	0.0000
At most 5 *	0.080597	19.58256	12.32090	0.0026
At most 6	0.011428	2.356277	4.129906	0.1473

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

14) Pre-Lehman bros. Collapse Correlation Matrix

	Return	*Inflation rate*	*Domestic %*	*USD %*	*Dow Jones*	*FTSE100*
Return	1	0.016779	-0.27515	0.052979	0.659805	0.022017
Inflation rate	0.016779	1	0.183867	0.181457	-0.04637	-0.08445
Domestic %	-0.27515	0.183867	1	0.553727	-0.13744	-0.27917
USD %	0.052979	0.181457	0.553727	1	-0.01398	0.038377
Dow Jones	0.659805	-0.04637	-0.13744	-0.01398	1	-0.01457
FTSE100	0.022017	-0.08445	-0.27917	0.038377	-0.01457	1

Date: 07/13/17 Time: 20:41
Sample (adjusted): 2000M04 2010M11
Included observations: 128 after adjustments
Trend assumption: No deterministic trend
Series: RETURN DOMESTIC__ DOW_JONES FTSE100 INFLATION_RATE LIBOR USD__
Lags interval (in first differences): 1 to 2

15) Pre-Lehman bros. Collapse Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.512324	277.4730	111.7805	0.0000
At most 1 *	0.381782	185.5557	83.93712	0.0000
At most 2 *	0.353152	123.9988	60.06141	0.0000
At most 3 *	0.230299	68.23641	40.17493	0.0000
At most 4 *	0.149387	34.73199	24.27596	0.0017
At most 5 *	0.093624	14.02178	12.32090	0.0257
At most 6	0.011181	1.439253	4.129906	0.2697

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

16) Post-Lehman bros. Collapse Correlation Matrix

	Return	*Inflation rate*	*Libor*	*USD %*	*Dow Jones*	*FTSE100*
Return	1	0.054358	-0.53331	-0.38394	0.626179	0.047475
Inflation rate	0.054358	1	-0.20522	0.045247	0.167379	0.029153
Libor	-0.53331	-0.20522	1	0.518506	-0.42669	-0.24197
USD %	-0.38394	0.045247	0.518506	1	-0.15403	-0.18263
Dow Jones	0.626179	0.167379	-0.42669	-0.15403	1	0.085574
FTSE100	0.047475	0.029153	-0.24197	-0.18263	0.085574	1

Date: 07/13/17 Time: 20:02
Sample (adjusted): 2008M12 2017M04
Included observations: 101 after adjustments
Trend assumption: No deterministic trend
Series: RETURN DOW_JONES FTSE100 INFLATION_RATE LIBOR USD__
Lags interval (in first differences): 1 to 2

17) Post Lehman bros. Collapse Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.575978	215.4600	83.93712	0.0000
At most 1 *	0.424684	128.8052	60.06141	0.0000
At most 2 *	0.270971	72.96877	40.17493	0.0000
At most 3 *	0.204177	41.04857	24.27596	0.0002
At most 4 *	0.133679	17.98233	12.32090	0.0051
At most 5	0.033953	3.488867	4.129906	0.0733

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

18) Pre-Troika Bailout Correlation Matrix

	Return	*Inflation rate*	*Domestic %*	*Libor*	*USD %*	*Dow Jones*	*FTSE100*
Return	1	0.046372	-0.26044	-0.11379	0.074138	0.663268	0.083225
Inflation rate	0.046372	1	0.284274	0.383844	0.390774	0.016949	-0.04229
Domestic %	-0.26044	0.284274	1	0.847935	0.669245	-0.22242	-0.30303
Libor	-0.11379	0.383844	0.847935	1	0.772944	-0.15823	-0.18772
USD %	0.074138	0.390774	0.669245	0.772944	1	-0.01138	-0.04566
Dow Jones	0.663268	0.016949	-0.22242	-0.15823	-0.01138	1	0.083381
FTSE100	0.083225	-0.04229	-0.30303	-0.18772	-0.04566	0.083381	1

Date: 07/13/17 Time: 20:26
Sample (adjusted): 2000M04 2010M11
Included observations: 128 after adjustments
Trend assumption: No deterministic trend
Series: DOMESTIC__ DOW_JONES FTSE100 INFLATION_RATE LIBOR RETURN USD__
Lags interval (in first differences): 1 to 2

19) Pre-Troika Bailout Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.512324	277.4730	111.7805	0.0000
At most 1 *	0.381782	185.5557	83.93712	0.0000
At most 2 *	0.353152	123.9988	60.06141	0.0000
At most 3 *	0.230299	68.23641	40.17493	0.0000
At most 4 *	0.149387	34.73199	24.27596	0.0017
At most 5 *	0.093624	14.02178	12.32090	0.0257
At most 6	0.011181	1.439253	4.129906	0.2697

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

20) Post Troika Bailout Correlation Matrix

	Return	*Inflation rate*	*Domestic %*	*USD %*	*Dow Jones*	*FTSE100*
Return	1	0.028948	-0.02423	-0.06713	0.537904	-0.15619
Inflation rate	0.028948	1	0.155232	0.094415	0.1658	-0.06588
Domestic %	-0.02423	0.155232	1	-0.4447	-0.02452	-0.12015
USD %	-0.06713	0.094415	-0.4447	1	0.047578	0.108886
Dow Jones	0.537904	0.1658	-0.02452	0.047578	1	-0.12515
FTSE100	-0.15619	-0.06588	-0.12015	0.108886	-0.12515	1

Date: 07/13/17 Time: 20:55
Sample (adjusted): 2011M03 2017M04
Included observations: 74 after adjustments
Trend assumption: No deterministic trend
Series: DOMESTIC__ DOW_JONES FTSE100 INFLATION_RATE RETURN USD__
Lags interval (in first differences): 1 to 2

21) Post troika Bailout Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.516455	153.4827	83.93712	0.0000
At most 1 *	0.427858	99.71342	60.06141	0.0000
At most 2 *	0.278932	58.39421	40.17493	0.0003
At most 3 *	0.202965	34.19460	24.27596	0.0021
At most 4 *	0.159739	17.40724	12.32090	0.0065
At most 5 *	0.059356	4.528083	4.129906	0.0396

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values