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The Effects of Oil Price Shocks on the Stock Market Returns in Developed Economies

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by

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"I affirm that I have carried out my academic endeavors with full academic honesty." [Signed, *Ian Zangrilo*]

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Abstract:

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This paper examines the effects of oil price shocks on stock returns in OECD countries, specifically Canada, France, Germany, Japan, United Kingdom, United States, and Norway. The empirical method used is the vector autoregression (VAR) model where a generalized impulse response function is applied to the results of the VAR to determine how stock prices respond to a shock in oil prices. The VAR model uses quarterly data for the period 1994 to 2016 for the following variables: interest rates, real GDP, real stock returns, real UK Brent crude oil, and APSP crude oil index. To take into account structural changes and different geo-political and economic events within the data, the whole sample is divided into multiple sub-groups. The results suggest no relationship between oil price shocks and stock returns in developed countries when taking into account the full sample period. When the sample is segregated the results illustrate a negative relationship of oil price shocks to stock returns in the second sub-group (2003, Q1 – 2008, Q3) for France and a positive relationship in Canada in the third sub-group representing the time period of 2008, Q4 to 2012, Q2. The results suggest the necessity to segregate the data in order to take into account structural changes across time and present little evidence for fluctuations of oil prices influencing stock returns.

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Chapter One

I. Introduction

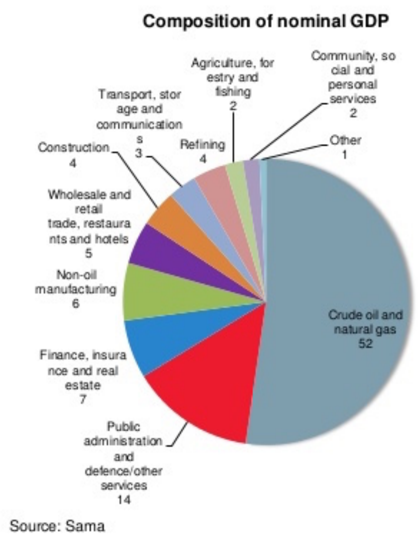
Oil represents one of the main inputs of production for industrialized nations, as the majority of the world's production requires the use of oil, especially in manufacturing and transportation. Since oil is a major factor of production, it is assumed that a significant change in oil prices will have an effect on input prices, therefore influencing profitability of firms and its share price. Because of the proposed effect on the global economy, several studies have been done to quantify the relationship, if any, between stock markets and oil price shocks. This paper looks at eight countries in the OECD to determine the effects of oil price shocks on stock returns. Additionally, it looks at whether the effects differ depending on whether the country is an oil producer or consumer. Due to the importance of studying this relationship, OPEC and other large oil producing countries have been looked at closely to gage its level of production because of its large effect on the determination of oil prices.

The oil price declines in 2016 have caused much controversy on how oil producers should react. OPEC had a meeting on November 30th 2016 to discuss its plan on whether to increase, decrease, or keep its production constant. OPEC stated that they plan to cut production in order to obtain a sustained increase in oil prices yet whether non-OPEC countries will follow is unknown. As of December 2016, Russia has arranged with OPEC to cut production yet other countries like Mexico and Norway publically stated that they would not join in reducing the production of oil. Even with OPEC projections to cut production to increase the price, in the recent Oil & Money conference there was a consensus that the increase in oil prices would be offset because of the recent decrease in costs in America's shale fields (Smith & Blas 2016).

The recent OPEC agreement to cut production by as much as 700,000 barrels a day has also affected the futures market. This agreement has caused many hedge funds to change their views on the upcoming oil market and bet bullish that the price of crude oil will rise in the future; crude oil futures has been its highest since July 2014. This bullish sentiment has not only affected options but has also trickled down into individual stocks related to oil (Banerji 2016).

Countries who are deeply reliant on the production and exportation of oil could see large effects on its economy as oil price fluctuate. If the majority of a country's revenue and GDP is determined by the price of oil, then an oil shock (i.e. decrease in oil prices) could be a huge problem for oil producers. However, for countries that are highly diversified (i.e. the United States), oil price shocks may not pose such a huge threat. For instance, Saudi Arabia represents an oil-based economy. According to Forbes, petroleum accounts for 90% of exports earnings and 45% of GDP as seen in *Exhibit 1***.** Thus, oil-producing counties whose revenue relies deeply on oil exports may need to diversify their assets.

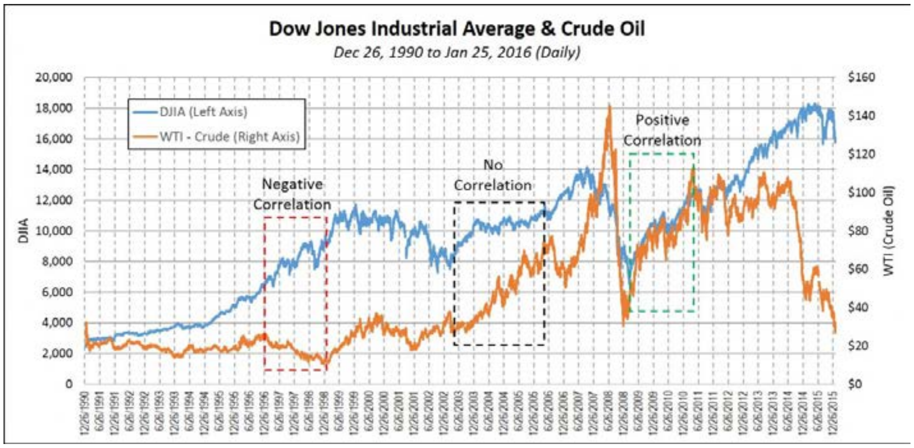
Exhibit 1: Composition of Saudi Arabia GDP



**Source: James – MEED

Historically, oil prices have been influenced deeply by political actions and consumer demand. By looking at the history of oil prices one can start to comprehend how oil price shocks were caused and illustrate the cause of the shocks in a simple supply and demand model. *Exhibit* 2 plots a graph of the Dow Jones versus WTI crude oil over a period of time, it suggests a possible association between the stock market and oil prices. During times of low oil prices, the stock market in the United States tends to do well, yet as time progresses the relationship changes to a positive correlation where stock prices follow the prices of oil.

Exhibit 2:



**Source: Patton

Exhibit 3 represents the WTI crude oil prices per barrel adjusted for inflation using the headline CPI on a logarithmic scale. During 1994, Q1 to 2016, Q1 there were eight oil price shocks (1974, 1979-1980, 1985, 1990-1991, 197-1998, 2001, 2003, 2014) caused by changes in the supply and demand of oil. A shock can be described as an unexpected event that produces a significant change in a short period. To summarize these shocks, it can be seen that as time progressed the source of oil price shocks shift. From the periods of 1974-1991, supply side factors are the reasons for a shock in oil prices. After 1991, shifts in the demand of oil are more

influential. It can be seen that around 1986 the pattern of oil prices seems to change. Pre-1986, oil prices were very steady except for a sudden increase or decrease whereas post-1986, oil prices seem to be more volatile and gradual.

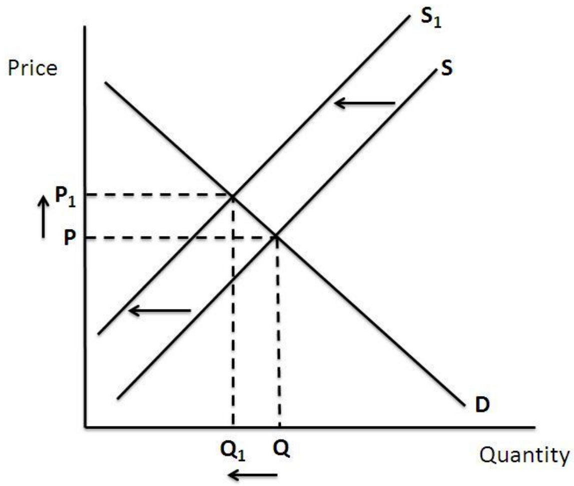
A supply and demand model can help us understand these changes in oil prices. During certain periods (1974, 1979-1980, 1985, 1990-1991, 2003), supply side factors were the main drivers, while during other periods (1997-1998, 2001), demand side factors were more prominent in causing shocks in oil prices. There are also certain periods (2014) where both supply and demand side factors cause a shock in oil prices. Political pressures, wars, and recessions are actions that can cause a shift in the supply or demand of oil. Changes in political pressures can cause shifts in the supply and demand of oil that consequently change the international price. For example, the model states that when there is a positive supply shock in the market, the supply curve shifts to the right causing the price of oil to decrease and the output to increase.

Exhibit 3: Historical Crude Oil Prices

http://www.macrotrends.net/1369/crude-oil-price-history-chart

The first shock to the oil market occurred in 1974. In 1973, Arab oil producers imposed an embargo on oil exports. As a result of the imposed embargo by the highest oil producing countries, the supply of oil decreased immensely causing a negative supply shock. The oil crisis caused by the Arab oil producers leveraging their power over the global price of oil hit the western financial systems greatly, specifically the United States. In 1974, it was very difficult for the United States to respond to the embargo since the US industry at that time lacked the capacity to produce (Corbett). The decrease in the supply of oil caused the supply curve to shift left, resulting in a shortage. As a result, the price of oil increased from $19.52 to $52.68 per barrel, as seen in *Exhibit 4*.

Exhibit 4: Decrease in Supply of Oil

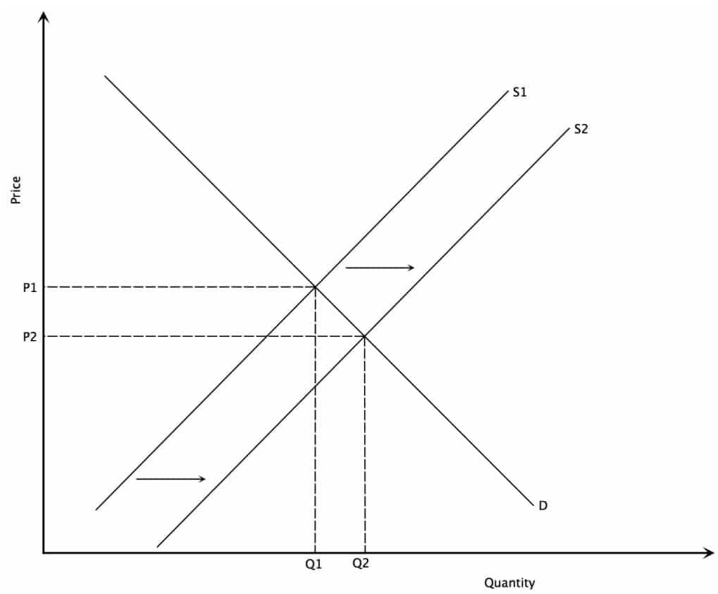


1979-1980 represented the second major oil crisis. The second major oil crisis was very similar to the shock in 1974 due to its relation with the Middle East. In 1978, there was a revolution in Iran causing a supply disruption in the production of oil. The decrease in production of oil by a major oil producer provoked fear of an immense increase in oil prices similar to the 1974 oil crisis. Due to the fear, many countries decided to store oil and increase reserves, causing a negative supply shock (increase in oil prices). As seen in the model illustrated

for the 1974 shock, a decrease in supply will cause the supply curve to shift left and prices to increase (Graefe).

In 1985, oil prices plummeted when Saudi Arabia decided to increase its market share in the production of oil, no longer abiding by OPEC output restrictions. In response to Saudi Arabia's increase in market share, other OPEC members decided to increase production to stop reductions in their revenue. As seen in *Exhibit 5*, this increase in oil supply caused oil prices to decrease. Saudi Arabia was able to sustain the massive drop in the price of crude oil because of its large amount of oil reserves, one of the largest in OPEC. As seen in 1974, political pressures and actions play a large role in price changes within the oil market especially when large oil producers decide to alter production.

Exhibit 5: Increase in Supply

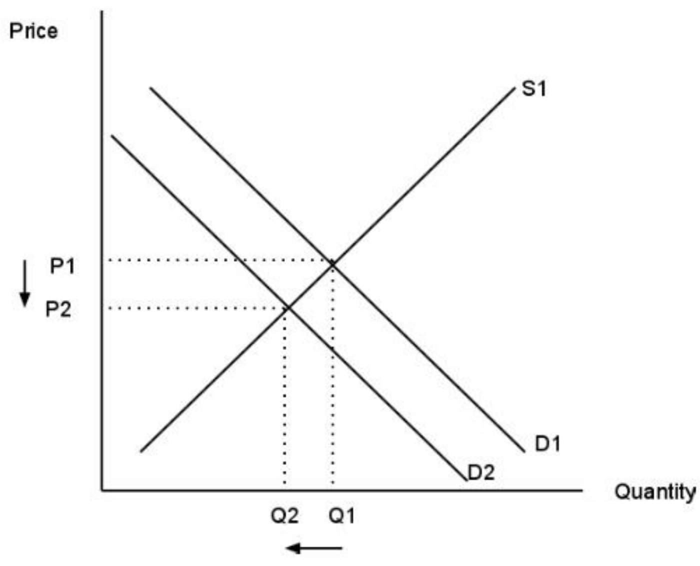


In 1990 there was a short-term shock in the oil market where the price of crude oil increased immensely. The sharp increase in oil was caused by a war between Iraq and Kuwait (the Gulf War), countries that represented the two biggest oil producers at the time. As a result of

the war, the UN decided to impose an embargo on both Iraq and Kuwait's oil exports thus knocking out the two biggest oil producers. The result was very similar to the situation in 1974 where there was a negative supply shock (oil price increase) caused by a war between oil-producing nations yet the Gulf War lasted for a shorter duration.

Again in 1997 and early 1998, there was overproduction of oil due to the belief that world consumption would stay at the same level as years before. In the mid 1990's, the economy was in economic expansion and experienced an increased world demand for energy. As a result, oil production was increasing in order to keep up with the consumption and demand. However, in 1997 there was a financial crisis in Asia and a decrease in activity in Japan and Europe resulting in a reduction of demand and consumption of oil (Mabro). Due to the negative demand shock, the demand curve shifted left thereby decreasing both the price (from $36.85 to $16.84 per barrel) and output of oil in the oil markets as seen in *Exhibit 6*.

Exhibit 6: Decrease in the Demand of Oil



Although the demand of oil fell significantly, the production of oil still increased at a constant rate due to the false belief that consumption would stay steady. This resulted in a huge

decline in the price of crude oil in 1997 (IMF, 2000). Once the price reached a certain level where countries could no longer sustain gains in revenue, OPEC decided to decrease the production of oil in 1999. As a result, the supply curve shifted to the left and the price of crude oil rose.

The price of oil decreased in 2001 due to the US economy going into a decline while OPEC and non-OPEC countries increased oil production. Due to the decrease in demand and increase in supply, the price of oil plummeted. OPEC tried to stop this price reduction by decreasing production. In 2003, the price of oil increased due to the invasion of Iraq by the United States. The invasion caused a decrease in the supply of oil in the Gulf state thus shifting the supply curve to the left and increasing the price of oil while decreasing the output of oil. As a result of increased tension in the Middle East, an increase in demand from China and Asian countries due to economic expansion, and the depreciation of US currency, oil prices increased until 2008, Q3 when there was a financial crisis (BBC, 2008).

The drop of oil prices in 2014 was caused by both supply and demand side factors. Many countries that were experiencing economic expansion – including China, Russia, and India – started to experience a decrease in growth resulting in a decrease in the demand for oil. The decrease in the demand for oil caused the demand curve to shift to the left and the price to fall. Additionally, due to the high prices of oil, the US and Canada started to produce more oil – through fracking, for example – thereby immensely decreasing the volume of its imported oil. Since prices were dropping, Saudi Arabia had two options: to keep the level of market share and stay steady with the current level of production or cut production as a way to send prices upward. Saudi Arabia decided that market share represented a better path in the long-term and kept the production of oil stable, causing oil prices to plummet (Lawler, 2014). The market has been

oversupplied and prices have plummeted as a result, creating uncertainty in the market, which should be represented in the stock markets.

Chapter Two

II. Economic Theory on how oil Price Shocks can Affect Stock Markets

Oil price shocks and volatility should have effects on national income and therefore be represented in the stock markets. This paper will use the aggregate supply and demand model to show the link between oil prices and the oil market. This section will then use economic theory as a way to show how changes in the oil market affect stock returns through a change in a firm's profits.

Following Blanchard, the aggregate supply curve represents the relationship between total outputs on the price level for a given period of time. The aggregate supply curve is formed through the use of wages and prices. The aggregate supply curve can be represented by the following equation, which is derived from the wage and price equation:

$$P = P^e(1+\mu)F\left(1-\frac{Y}{L}, z\right)$$

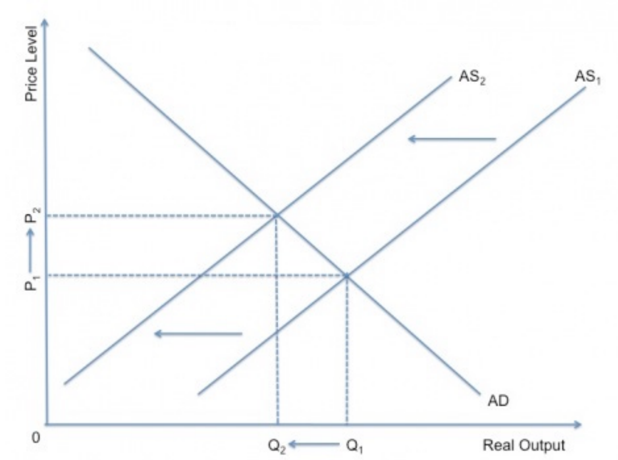
The price level is derived by the unemployment rate and expected price level. $\frac{Y}{L}$ represents the unemployment effects on wages as a result, the higher the output in a given labor force, the lower the unemployment rate. Oil prices will be explained by the variable "z", therefore a large shift in oil prices will cause "z" to change thus increasing the price level. To summarize, the aggregate supply curve captures the effect of output on price level in the following manner: an increase in output will lead to a decrease in the unemployment rate causing

wages to increase and the price level to increase overall. Since an increase in output leads to an increase in price level, the supply curve is upward sloping.

Changes in expected price, expected inflation, price shocks, and output gap are the four factors that can shift aggregate supply. Therefore, when a major oil producer decides to increase its production of oil, the market will become saturated resulting a drop in the “z” variable. Since there is an initial decrease in “z” then the aggregate supply curve will shift right causing the actual price level to fall.

When there is a change in expected inflation, both firms and workers will want to be compensated for the effects. For example, if expected inflation rises then workers and firms would want wages and prices to increase as a way to compensate for the losses. Therefore, an increase in expected inflation shifts the aggregate supply curve to the left since every output level is associated with higher price levels (profits). Price shocks occur when firms raise prices to offset the demand for higher wages. Additionally, high demand for an increase in wages causes output to exceed the production capacity of the economy, leading to a persistent positive output gap. This gap will cause inflation to rise due to the increase in demand. Thus, with the increase in inflation the aggregate supply curve shifts left. Each of these cases shows a negative supply shock caused by an increase in prices, which result in a decrease in nation income, as seen in *Exhibit 7*.

Exhibit 7: Negative supply shock



The aggregate demand curve represents the amounts of goods produced that consumers are willing to purchase at various price levels; it shows how the price level affects output. The aggregate demand curve is represented by the following equation:

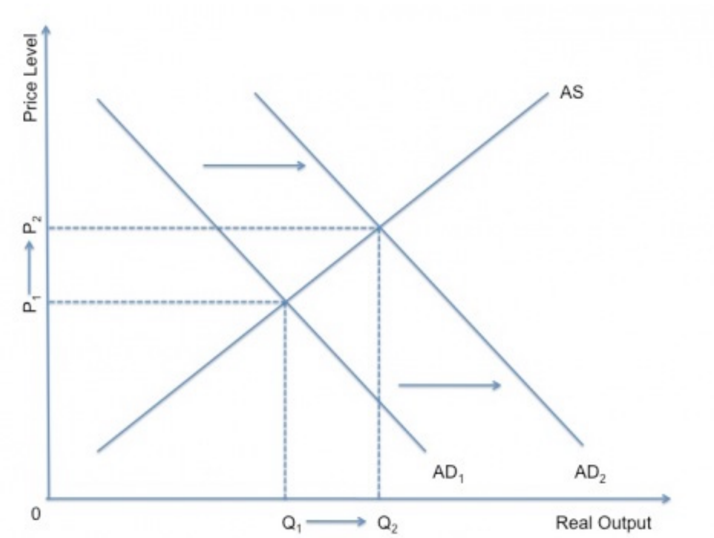
$$Y= C+I+G+NX$$

The above equation shows that change in autonomous consumption, investment, government spending, or net exports can shift national income and therefore aggregate demand. The wealth effect and net exports effect can be used to explain shifts in the slope of the aggregate demand curve. The wealth effect states that as the price of one's assets rise, they are more likely to spend thus increasing consumption and investment. The net export effect states that as prices fall domestically, foreign made goods become relatively more expensive whereas domestic goods become relatively cheaper. As a result, the demand for imports falls while the demand for exports rises, shifting net exports thus moving along the aggregate demand curve.

An increase in the price level will lead to a decrease in the ratio of nominal money supply to price level (real money stock), causing interest rates to increase and demand to interest sensitive components to decrease thus decreasing output. As a result, any alterations to monetary

or fiscal policy will shift the aggregate demand curve. For example, if the nominal money supply increases then output will increase at a given price level causing the aggregate demand curve to shift right, as seen in *Exhibit 8*. The aggregate demand curve is downward sloping because during times of high inflation central banks increase interest rates thus lowering equilibrium level of aggregate output.

Exhibit 8: Increase in Aggregate Demand



The aggregate supply and demand model will be used to show the relationship between the price of oil and the oil market. The relationship can be seen in the following manner. The global demand for oil depends on global income. Therefore, an increase in national income will lead to an increase in the demand of oil causing the price of oil to increase. Since the price of oil increases, production becomes more expensive and as a result, the initial increase in "z" will cause the price level to increase thus shifting the aggregate supply curve to the left. Eventually, the initial decrease in output will return to potential output leaving only a rise in prices in the long run.

The aggregate supply and demand model helps explain how oil price shocks would affect output in the oil market. In order to show the link between oil prices and stock returns, two cases will be shown. Both cases will show how a change in oil prices affects the stock market through its effect on the profitability of firms, depending on whether a country is an oil importer or exporter. Using theory of stock price determination, an increase in profitability of a firm will increase a company's dividends per share payout. Since dividends per share are used as a way to determine stock price valuation – through the dividend discount model - then an increase in dividends payout will result in higher stock prices (Investopedia, 2003).

Each case will represent a reason to why a change in oil price will affect the stock market in addition to showing the different effects between oil-consuming countries and oil-producing countries. The first and second case will follow the trend of historical oil price changes. The trend tends to show that pre-1986 the majority of shocks are supply shocks whereas post-1986 the majority of shocks are demand shocks. Therefore, the first case will represent a supply shock and the second case a demand shock. Each case will follow the same underlying theme that expected profitability affects stock prices.

The first case illustrates a decrease in the production of oil. For oil-consuming countries, as prices increase cost of production rises. Since input prices increase, the quantity of products that the producers are willing to sell at certain prices decrease. An increase in "z" will cause the price level to increase thus shifting the ASC to the left. As seen in *Exhibit 7*, as the ASC shifts left real output decreases. Since the amount of product firms are able to sell declines, firms augment the price of its product as a way to offset the upsurge in input prices. An increase in product prices will lead to diminishing demand and consumption and as a result, GDP decreases. The decrease in national income (GDP) is associated with a decrease in consumption and

investment thus reducing corporate earnings. In consequence of the decrease in corporate earnings, firms' stock prices decrease.

For oil-producing countries, as oil prices rise, firms' cash flows increase assuming the output of oil increases. As cash flows increase for oil producing firms there should be augmented investment in the oil sector. Since oil represents the main source of revenue, an increase in investment in the oil sector should amplify belief of economic growth and therefore shift the aggregate demand curve. Increase in oil prices creates a multiplier effect on the economy. Simply, an increase in income will lead to increases in both consumption and investment thus boosting profits; there is a positive correlation between oil prices and stock prices.

The second case demonstrates a decrease in the global demand for oil. As global demand weakens, oil prices decrease. This decrease in oil prices could result in a decrease in the value of oil exports in addition to a reduction in investment in the oil industry thus shifting the aggregate demand curve left. The decrease in national income will be seen in oil-producing countries. The decrease in cash flows for oil-producing firms could result in a reduction of the firm's capacity for debt. The lower the oil price and the longer they stay at a low level, the lower the cash flows for drillers. This increases the difficulty in paying back loans and augmenting default risk. The reduction in a country's capacity to debt could lead to debt defaults and reduced credit. In return, this could hurt the banking and investment sector. For oil-consuming countries, the reduction in oil prices will have the opposite effect presented in case one.

In the past, during times of immense decreases in the price of oil, companies that were unable to withstand the fall in prices have defaulted and declared bankruptcy. The shock in 1986 that pulled down the price of oil caused around twenty-seven percent of exploration and production companies to declare bankruptcy and default in the United States. In the past year,

forty-two American drillers have declared bankruptcy (Long, 2016). Since oil companies borrow a lot of money to increase production and investment during times when oil prices are high, the risk of default increases during oil shocks. The increase in defaults should create uncertainty in the market of an economic slowdown and be represented in the stock market.

Overall, these cases show that oil price shocks could have asymmetric effects on stock returns - through effects on firm's profitability - depending on whether the country is mainly an oil consumer or producer. In contrast to the cases above, the efficient market hypothesis states that oil prices should not affect stock returns. The hypothesis states that the results of oil shocks will immediately and efficiently be represented and incorporated in the valuation of stock prices thus having thus having minimal to no effects.

Chapter Three

III. In Depth Analysis on Related Literature Looking at Oil Prices on Stock Prices

While there is a vast amount of literature that focuses on the effects of changes in oil prices on the stock market, there are very few that look at the disparity between oil-consuming economies versus oil-producing economies. Additionally, previous literature has presented mixed results on how oil price shocks have affected developed countries throughout time. The differences in empirical results can stem from the origin of the shocks, whether asymmetric effects are present, and the state of stock market. The papers being reviewed can be separated into two categories: those that focus on different specifications of oil price increases and decreases and those that focus on oil price volatility. The common theme when combining results from previous literature is that an increase in the price of oil (positive oil price shock) or increase in volatility of oil prices both have asymmetric effects on stock returns depending on the type of the economy. An increase in the price of oil has a negative effect on stock returns in oil consuming economies and a positive effect of stock returns in oil producing economies. The extent of these effects depends on the state of the stock market (bullish or bearish) and/or the origin of the shock (supply or demand).

Cunado and Gracia (2014), Jammaz (2015), Nusair (2016), Ramos & Veiga (2013), Baumeister and Kilian (2016) all focus on how increases in oil prices affect stock returns. Each author comes to the same common conclusion stated above yet in his or her own specific way.

Cunado and Gracia (2014) and Jammaz (2015) both focus only on oil consuming economies and found that their stock markets respond negatively to oil price increases. Cunado

and Gracia (2014) define oil price shocks as demand and supply shocks. In contrast, Jammaz (2015) defines oil price shock as a net oil price increase (NOPI)[1].

The two authors differ in the countries examined and ways in which they extend literature. Cunado and Gracia (2014) looked at the association between stock market returns and oil price shocks, specifically in twelve European countries using a vector autoregressive (VAR) and vector error correction (VECM) models.[2] With the aim of distinguishing between demand and supply shocks, the authors included both world oil production and world oil price. The authors identified whether there is a supply or demand shock by looking at the sign of the correlation between world oil production variation and oil price changes. Thus “when oil prices and world oil production vary in the same direction, [they] will identify this as an oil demand shock, and when the sign of the correlation between oil price and world oil production is negative, [they] will identify this as an oil supply shock.” (366) The authors first found that for several European countries – around 11- oil price increases have a significant negative effect on stock market returns. This result makes sense since most of these countries represent oil-importing economies and therefore will be impacted by cost implications. Additionally, the authors found that oil supply shocks exert more negative effects on European stock returns than oil demand shocks. The authors found that oil supply shocks have a significant negative effect on 9 countries in comparison to 4. The authors came to this conclusion by determining that supply shocks have more of a significant effect in the impulse response function in addition to affecting a greater majority of countries in the sample. The authors support this argument and results through an aggregate demand and supply model, stating that as oil prices increase due to a

[2] 12 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Portugal and the UK

supply shock – for example, the first Gulf war – would result in an increase in the cost of energy inputs in oil-importing economies thus decreasing economic activity. Cunado and Gracia (2014) comment on a part of the common theme – that oil price shocks has asymmetric effects - adding the idea that supply shocks between the periods 1973-2011 exert more of an effect on stock returns than demand shocks in oil consuming economies.

In contrast to Cunado and Gracia (2014), Baumeister and Kilian (2016) support the hypothesis that oil demand price shocks are more important in regards to the reaction in the stock market than oil supply price shocks. The authors illustrate that lower fuel cost as a result of the decrease in prices of oil do not lead to augmented stimulus of firms who deeply rely on oil in the firms production. They support this argument by displaying the stock returns of companies that are oil-intensive in the firm's production. Between the periods of June 2014 and March 2016, firms in the US economy that are reliant on oil as a major input only outperformed the rest of the economy marginally. On the contrary, stock returns are well above average when looking at sectors that are responsive to shifts in consumer demand, which makes sense since "consumer spending … accounted for 69% of U.S. GDP in 2014" (Baumeister and Kilian, 8). The mixed results between these two articles could stem from the fact that Baumeister and Kilian (2016) are strictly looking at the movement of stocks during the shocks rather than running regressions to see the association between the two.

Jammaz (2015) focused on five developed countries within the G7 (Canada, Germany, Japan, United Kingdom and United States). The author looks at how an increase in oil prices affects stock return yet mainly focuses on how regime-shifting effects comes into play. The author wants to identify whether the effects of oil price shocks change depending on whether of the stock market is in a bullish or bearish phase during that particular shock. To take into account

these regime-shifting effects a two-regime MS-EGARCH model is used for the period of 1989 to 2007 due to its ability to capture asymmetry and regime shifts. The author concludes that an increase in oil prices has more of a significant negative effect on stock returns during bull phases where stocks are booming. This conclusion is justified by the idea that during times of economic recession, industrial production and other economic sectors reduce their reliance on crude oil, according to Jammaz. By looking at Cunado and Gracia (2014), Jammaz (2015), and Baumeister and Kilian (2016) it can be seen that there are asymmetric effects on the stock market in oil consuming countries whether looking at bullish versus bearish phases or supply versus demand shocks.

Nusair (2016) focused on only oil exporting economies. The research differs from previous literature by looking at "the short-run and long run effects of oil price shocks on the real GDP" in the Gulf Cooperation Council (GCC) countries through the use of a cointegrating nonlinear autoregressive distributed lag (NARDL) model (Nusair 2016, 257).[3] The author did not define oil price shock. The author found a nonlinear relationship between oil price shocks and real GDP in all countries. The findings suggest that positive oil price changes result in a more substantial impact on real GDP in comparison to negative oil price shocks. Additionally, negative oil price shocks are statistically insignificant on GDP in the long run. Thus, as oil prices increase in oil-exporting countries, real GDP will increase. The author's findings are very similar to the common theme – that oil price shocks have asymmetric effects - even though it focuses on GDP rather than stock returns. A reason for why it can be inferred that an increase in GDP could affect stock returns is that investors usually use GDP as a guide to the overall health of the economy.

[3] GCC countries include: Bahrain, Kingdom of Saudi Arabia, Kuwait, Qatar, Sultanate of Oman, and the United Arab Emirates (UAE)

Ramos & Veiga (2013) looked at both oil consuming and producing economies in regards to the effects of oil price increases on the stock market. The authors looked at 18 countries during the period of 1988 to 2009 and used a Generalized Autoregressive Conditional Heteroskedasticity Model (GARCH). The oil-consuming countries included: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Japan, the Netherlands, Portugal, Spain, Sweden, and Switzerland. Whereas the oil-producing countries included: Canada, Colombia, Mexico, Norway, and Russia. The authors found that an increase in the price of oil results in a negative impact on stock returns in oil-importing economies, which aligns with the findings from Cunado and Gracia (2014) and Jammaz (2015). Additionally, the authors found that an increase in the price of oil results in a positive impact on stock returns for oil-exporting economies, which aligns with Nusair (2016) results.

In contrast to the common theme above that oil shocks have an effect on stock returns, Chang and Le (2015) found that oil price shocks have no association or causality in stock returns as a whole, but when broken down into 5-year periods there are significant impacts. The authors looked at three different oil economies – oil refining, exporting, and importing economies – to determine the association between oil prices and stock markets. Japan was used to represent oil-importing economy, Singapore for oil refining, and Malaysia for oil exporting. The authors looked at data between the periods of 1997 to 2013. Within this fifteen-year range, the authors split the data into three sub-groups. Since the authors used a VAR model to examine the relationship they were able to run unit root tests, which allows for co-integration analysis, to show structural changes within the data range. The authors found that since the time range is so long there were various shocks that responded to different economic events thus decided to break the sample into 3 sub-groups (1997-2002, 2003-2008, and 2008-2013). The authors found that

none of the three different economies represented in the data passed the 5 percent statistically significant level thus illustrating no relationship between stock markets and oil prices in the entire sample. Once the author segregated the data, they found that the period of the sample affects the response of stock markets to oil price shocks in magnitude and sign. The effects vary between periods yet in the later period (2008-2013) the authors find similar results to the common theme where Japan (oil-importing economy) and Singapore (oil-refining) respond negatively and Malaysia (oil-exporting economy) responds positively.

Diaz and Moero (2016), Balciar and Gupta (2015), and Ramos & Veiga (2013) all focus on how an increase in oil price volatility affects stock returns. Diaz and Moero (2016), Balciar and Gupta (2015) both only focus on oil-consuming countries whereas Ramos & Veiga (2013) focus on both oil consuming and producing economies.

Diaz and Molero (2016) investigated the effects of fluctuations in oil price volatility in the stock markets of the G7 economies. The authors define oil price shocks as the ratio of the change in oil prices proportional to the current oil price volatility. A GARCH (1,1) model is used to measure oil price volatility. The authors split the data into two sections – pre and post 1986 – in order to identify if there are different impulse responses between periods of increase in prices versus decrease in prices. The authors believe that investment decisions would be affected by heightened volatility, reflecting stock prices in return. The authors concluded that increased oil price volatility post-1986 had the most significant negative effect on stock prices. The results show that an increase in oil price volatility would have a negative effect on stock prices in G7 economies.

Balcilar and Gupta (2015) believed that oil shocks should have an effect on the stock market returns through their effect on expected earnings in the US economy. The authors wanted to look at whether times of high-volatility are different from times of low-volatility from the period of September 1859 through December 2013. The authors use a Markov-switching vector error-correction (MS-VEC) model with two regimes – high and low-volatility. High-volatility regimes are distinguished by having the variance of stock price series and oil mutually exceeding the respective variance of low-volatile regimes. The results show that high-volatility regime existed before 1929 (Great Depression) and after the oil price shock OPEC caused in 1973 whereas low- volatility existed most frequently in-between those two periods. When the data was separated into high and low volatility they found no relationship between stock prices and oil shocks in low volatility regimes and a negative relationship for high volatility regimes. The findings that an increase in volatility causes a negative effect on stock returns are the same as what Diaz and Molero (2016) found. A key difference with these findings is that the authors found that historically, low volatility regimes occur most of the time—thus, oil price shocks do not have long-term significant effects on stock prices.

The results from Ramos and Veiga (2013) indicate that the volatility of oil prices do have a significant effect on the stock market, yet the effects are opposite in regards to whether the country mainly exports or imports oil. In oil-importing economies, increased oil price volatility has a negative effect on stock prices whereas for oil-exporting economies it has a positive effect. Ramos and Veiga believe that oil price volatility has asymmetric affects because volatility can be considers a transmission mechanism. The authors also found that only oil price hikes in regards to oil price volatility is statistically significant in comparison to negative oil price shocks. The

reason why the authors believe that drops in oil prices are statistically insignificant is because the positive impact of drops in oil prices is offset by oil price volatility.

Overall, previous literature has presented mixed empirical results yet when combined there is a common theme that oil price shocks have asymmetric effects on stock markets depending on the nature of the economy and the origin of the shock. Asymmetric affects can be defined as a difference between supply and demand shocks, oil exporting and importing economies, and whether the price of oil increases or decreases. This paper is going extend previous literature by looking in depth at developed countries to see if oil price shocks have different effects on the countries in the G7 plus Norway and whether those effects have changed in comparison to each countries historical transition as whether oil-producer or consumer. It differs from previous literature as it breaks down 8 countries in the OECD and separates them into oil producing and consuming economies.

In accordance with Cunado and Gracia (2014), Chang and Le (2015), and Diaz and Moero (2016) this paper is going to use a vector autoregressive (VAR) model to determine the relationship between oil price shocks and stock returns. Taking the results from the VAR model, impulse response function (IRF) will be generated to see the magnitude of the effects. The use of IRF aligns with Cunado and Gracia (2014), Chang and Le (2015), Balcilar and Gupta (2015), and Diaz and Moero (2016).

Chapter Four

IV. Do Oil Price Shocks Affect Stock Returns?

4.1 Introduction to Chapter:

This chapter is going to examine the relationship between stock returns and oil price shocks in oil consuming and producing economies. The first step in this process is to identify which countries in the sample are mainly oil producers and which countries are mainly oil consumers. By looking at descriptive statistics and graphs of the data it is determined that France, Germany, and Japan are all distinctly oil consuming countries whereas, Norway, Canada, United Kingdom, and the United States are all oil producing economies. These countries were separated to see if the effect of oil price shocks on stock returns depends on the nature of the economy.

Second, this chapter looks at the whole sample and runs vector autoregressive models and impulse response functions in order to determine the relationship between oil price shocks and stock returns. The results indicate that for the full sample, oil price shocks on stock returns are statistically insignificant for each country – there is no relationship. Since there was no relationship between the variables at a macro level, we decided to look at the sample in sub-groups to adjust for changes within the data. The data was segregated into 4 sub-groups. The sub-groups were decided by following the separation of data in previous literature. Once the data was separated, the results illustrated statistically significant effects. France and Canada presented the two most important results. In the second sub-group the French stock market responded negatively by a maximum of 3.6% to an increase in oil prices. In the third sub-group Canada responded positively by a maximum of 6.2% to an increase in oil prices.

4.2 Distinguishing Oil Producing Countries from Oil Consuming Countries:

Graph 1 illustrates the relationship and growth rates between the production and consumption of oil per country. *Table 2* shows the descriptive statistics of the annual ratio of oil production to consumption. The data of production and consumption for each country came from the U.S. Energy Information Administration. The descriptive statistics illustrate that Japan, France, and Germany are distinctly oil-consuming countries with a ratio of production to consumption less than 0.03 percent. Additionally, *Table 2* shows that Japan produces the least amount of oil in all the countries in the sample. Norway, Canada, United Kingdom (UK), and United States are on average oil producers where the production outweighs consumption. Although these countries can be separated into two categories, further distinction still needs to be shown. The United States is both a massive oil producer as it is a consumer with a ratio of oil production to consumption around 0.32 percent on average. Therefore, the effects of oil price shocks could be minimal due to the diversification. An increase in oil prices might be offset by the profits of its exportation of oil and vice versa. Although the United States has been a major consumer of oil, the country has increased its production immensely starting around 2007 due to the rise in fracking.

Norway is distinctly an oil producing country. Although the ratio has decreased over time, it is still the only country in this study where the oil production is at least 7 times larger than oil consumption with a mean of producing around eleven times more than consuming. The magnitude of Norway's production to consumption compared to the other countries can be seen in *graph 2*. *Graph 3* illustrates the production to consumption excluding Norway. In *graph 3* it can be seen that Canada, the UK, Germany, and the US are all oil producers with a ratio above 0.0.

In the UK, it can be seen that the production of oil started to drop dramatically in 2003 and constantly fell into 2014. The UK between 1994-2000 relatively was a high oil producer with a maximum ratio of around 1.5. After 2000, the nation started to drop its resources in producing oil as seen in 2014 having a minimum ratio of around 0.5 due to country reverting to a net oil importer. Although the country started to produce less, this paper still considers it an oil producing economy compared to its peers.

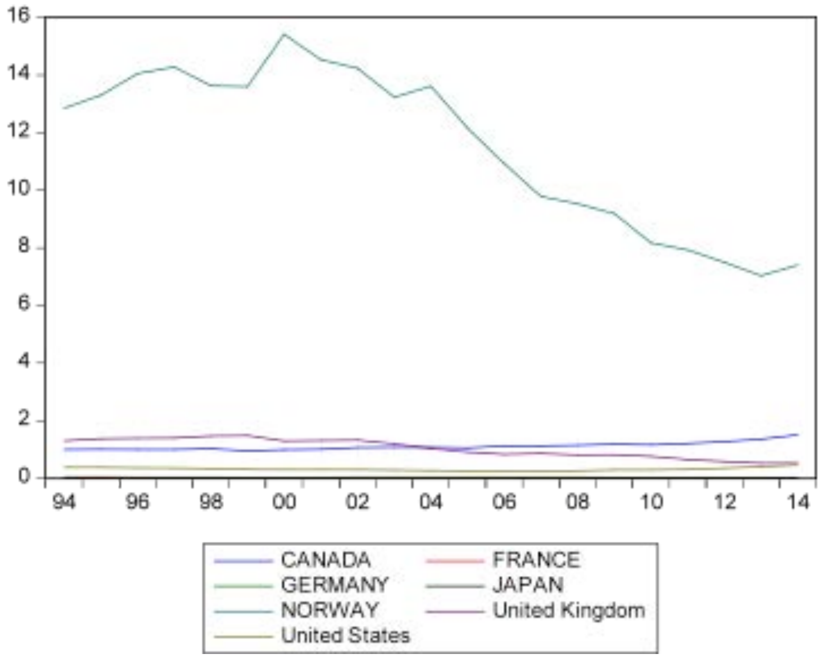
Although in Germany and Japan there seems to be a sharp increase and decrease in the production of oil, in all cases the ratio of production to consumption is less than 0.03 percent thus these changes do not need to be discussed. France's production of oil, as seen in appendix A, has gradually decreased over time. Since these three countries are decreasing their production in oil, they are increasing their reliance on the importation of oil and can be confirmed as an oil consuming economy.

As time progresses, Canada is increasing its production per consumption starting from a minimum of around 0.5 in 1999 jumping up to 1.5 in 2014. Therefore, a negative price shock could affect the Canadian market in 2016 whereas in 1994 the effects are probably less significant.

Using the descriptive statistics on production to consumption in all countries represented in the sample one can estimate how a shock in oil prices will affect each country's stock returns. Based on results of previous literature, in response to a positive oil price shock (oil price increase), Norway's stock market will have the greatest positive impact due to its massive reliance on production to consumption. Additionally, it can be assumed that countries that highly rely on the consumption of oil – for example, Japan – will have a negative reaction to a positive

oil price shock. The interesting case will be to see how the United States, which is both a massive oil consumer and producer, will react to an oil price shock.

Graph 1: Ratio of oil production to oil consumption, Annual



Graph 2: Production to consumption excluding Norway

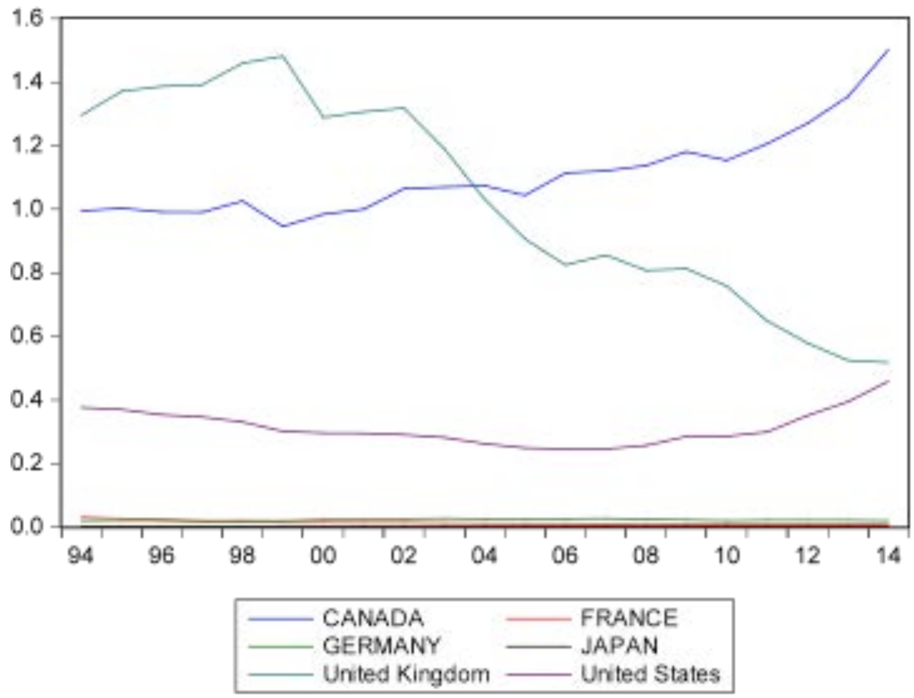


Table 1: Production per Consumption Descriptive Statistics

	CANADA	FRANCE	GERMANY	JAPAN	NORWAY	UK	US
Mean	1.106147	0.013889	0.022540	0.001328	11.53957	1.035979	0.313012
Median	1.070070	0.011454	0.021355	0.001171	12.85000	1.031302	0.295518
Maximum	1.501039	0.030011	0.027420	0.002104	15.41627	1.482054	0.458704
Minimum	0.945933	0.008865	0.019198	0.000926	7.032110	0.517763	0.245503
Std. Dev.	0.137713	0.005837	0.002648	0.000341	2.803297	0.332396	0.055817
Skewness	1.360351	1.537577	0.461535	1.128819	-0.372416	-0.165844	0.865810
Kurtosis	4.475848	4.427689	1.808301	2.949049	1.580456	1.537998	3.259739
Jarque-Bera	8.382802	10.05801	1.988179	4.462083	2.248644	1.966535	2.682728
Probability	0.015125	0.006545	0.370060	0.107416	0.324873	0.374087	0.261489
Sum	23.22908	0.291678	0.473342	0.027889	242.3310	21.75557	6.573246
Sum Sq. Dev.	0.379299	0.000681	0.000140	2.32E-06	157.1695	2.209747	0.062311
Observations	21	21	21	21	21	21	21

4.3 Data Description for VAR:

The variables that are going to be looked at include: APSP crude oil index, UK Brent crude oil, stock market indices, real gross domestic product, and short-term interest rates. All variables except for interest rates will be represented in the natural log form following previous research. The data are obtained from the U.S. Energy information Administration, FRED economic data, OECD data, yahoo finance, and the wall street journal. Table 1 exhibits the definition of the variables and the sources.

Table 1: Variable description and sources

Name	Description	Source
Real Stock Prices	Share Price, Average Quarterly Data Index	Yahoo Finance, WSJ
Oil Prices	1) Global price of APSP crude oil index©, Index 2005 = 100, Quarterly 2) UK Brent Crude Oil, Quarterly	Federal Reserve Economic Data, EIA short-term energy outlook
Real GDP	National Currency, Quarterly Data	Federal Reserve Economic Data, OECD
Interest Rates	Short-term interest rates, 3-month	OECD Data

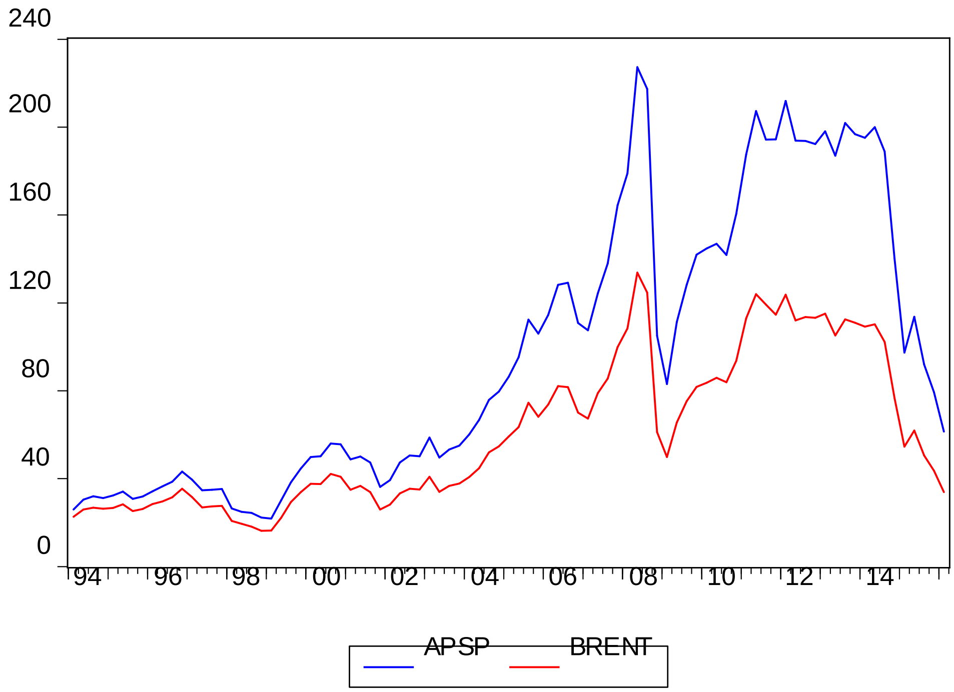
*Real stock prices and oil prices are calculated manually using the CPI per country

Oil prices are measured using APSP and the UK Brent crude oil index. APSP is defined as the average of spot price: WTI, Dubai, and Brent oil. In addition to the APSP the UK Brent oil price will also be looked at in this study. Real gross domestic product (GDP) is included as a proxy for economic activity and to examine the effects of shocks on GDP growth rates. Short-term interest rates will help control for inflation and has been represented in all literature reviewed in this paper. The stock markets will be segregated per country. Six of seven (G7) countries are included: the United States, Canada, France, Germany, Japan, and the United Kingdom. In addition to the G7 countries, Norway will also be examined. The stock market variables will be represented as quarterly average share prices.

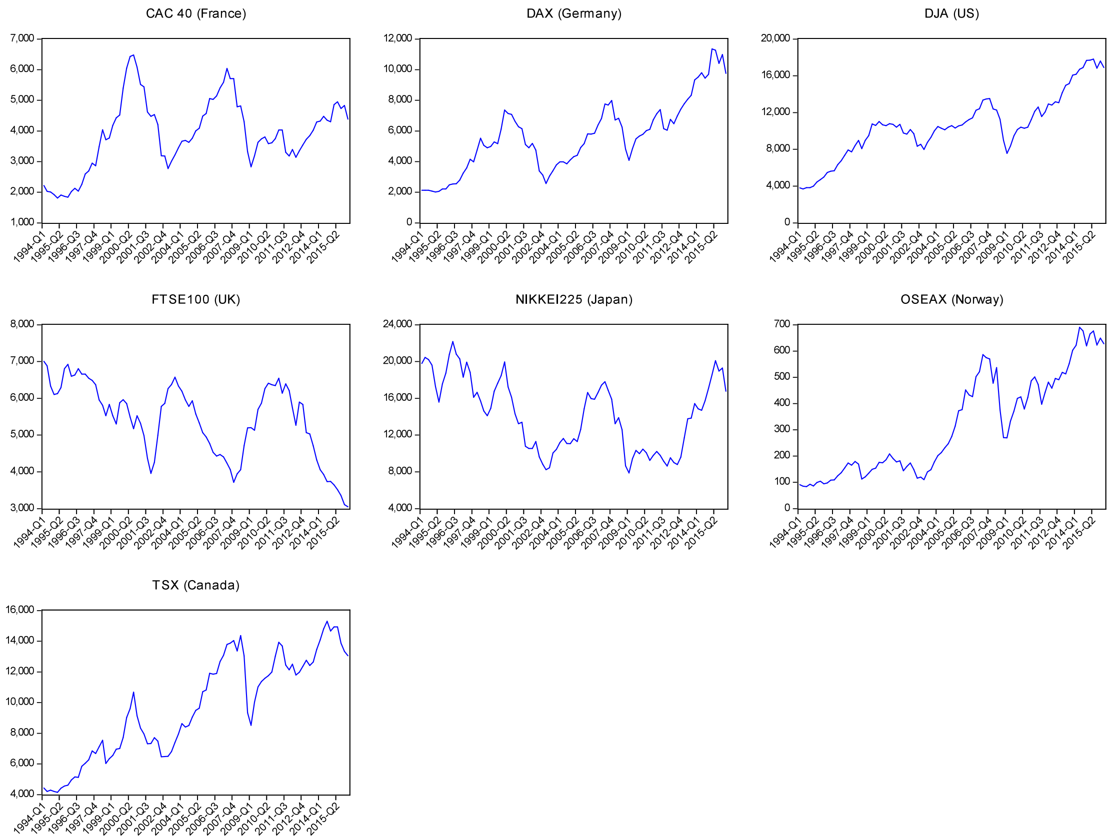
APSP and the UK Brent Crude oil prices are illustrated in *Graph 5*. In 1997, there was a decrease in the price of oil due to overproduction paired with a financial crisis in Asia and Europe. In 2001, we see a slight decrease in the price of oil due to overproduction by OPEC and non-OPEC countries paired with a decrease in demand of oil caused by the dot-com burst. Starting in 2003 the price of oil skyrocket and reached its peak in 2008, Q3. The increase in the price of oil can be contributed to increased tension in the Middle East, an increase in demand from China and Asian countries due to economic expansion, and the depreciation of US currency (BBC, 2008). In 2008, Q4 the price of oil plummeted due to the global financial crisis. Shortly

after the global financial crisis, oil prices started to recover as a result of a slowdown in global economic decline and an increase in consumer confidence (BBC, 2009). The drop in 2014 was associated to both demand and supply side factors where economic expansion halted and production of oil increased. A more in-depth analysis of oil prices can be seen in the introduction.

Graph 5: Oil Price

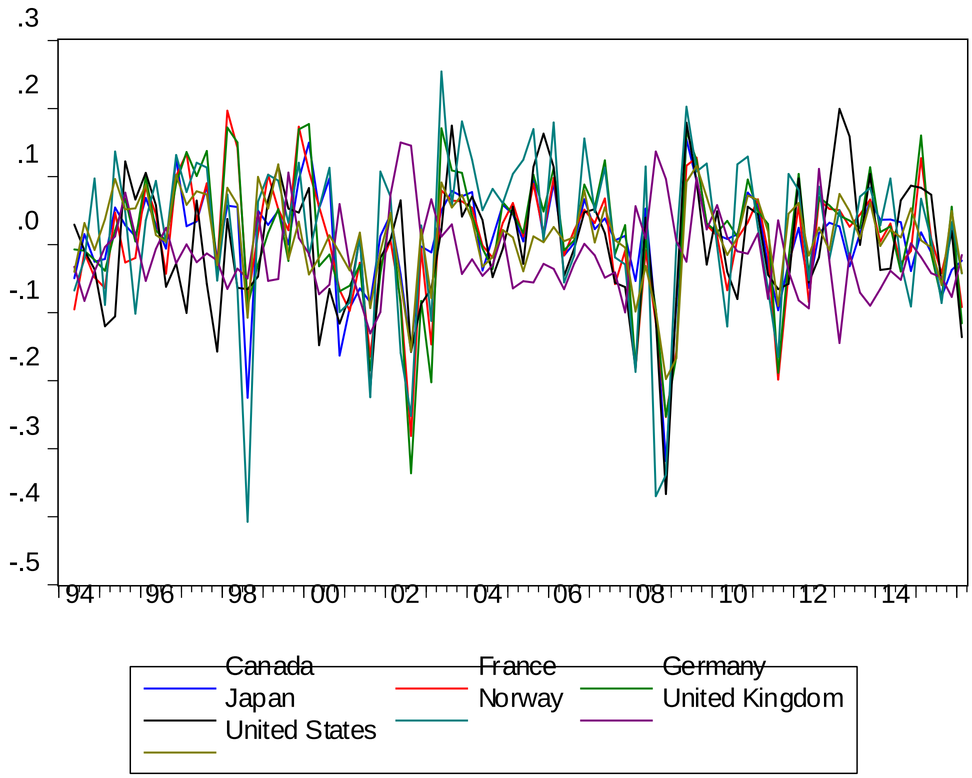


Graph 6: Stock prices per country



The stock prices for all seven countries are volatile and exhibit large increases and decreases as seen in *Graph 6*. As a whole, stock prices tend to increase from 1994-2016 in all countries except the United Kingdom. All stocks returns drop dramatically in 2001 – 2002 and 2008 and can be associated to the dot-com crash where the markets transitioned from bullish to bearish state and the latter to the global financial crisis. The growth rates of all stock prices also show this trend of correlation, as they seem to move in a similar relationship throughout time, as seen in *Graph 7*.

Graph 7: Growth rates of stock prices

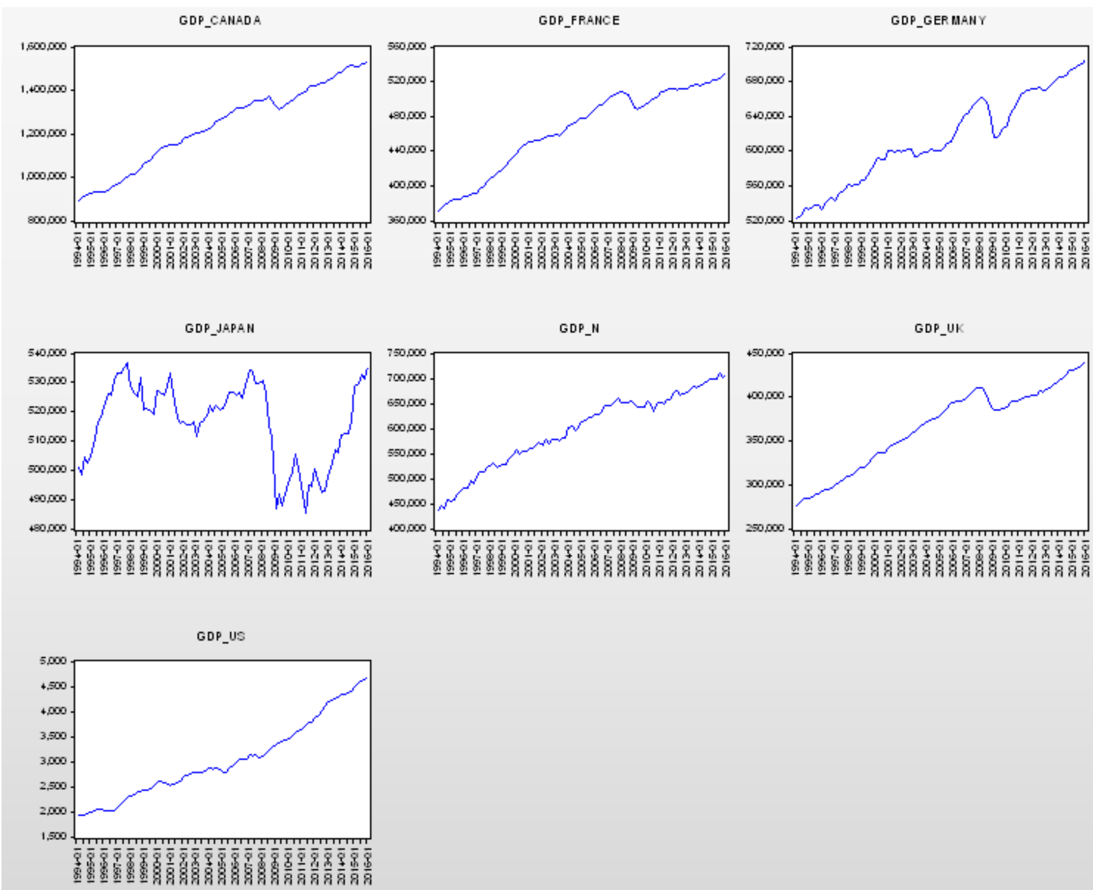


GDP between the periods of 1994 to 2016 looks strikingly similar across all seven countries with the exception of Japan, as seen in *Graph 8*. Canada, France, Germany, and the US all have a gradual and low volatility increase in real GDP. Each country exhibits a drop in real GDP during the financial crisis in 2008 except for the United States. Norway also show a gradual increase throughout time yet tend to be more volatile as seen with the short and sharp increases and decreases. The volatility in Norway GDP can also be seen in its growth rates, represented in *Graph 9*.

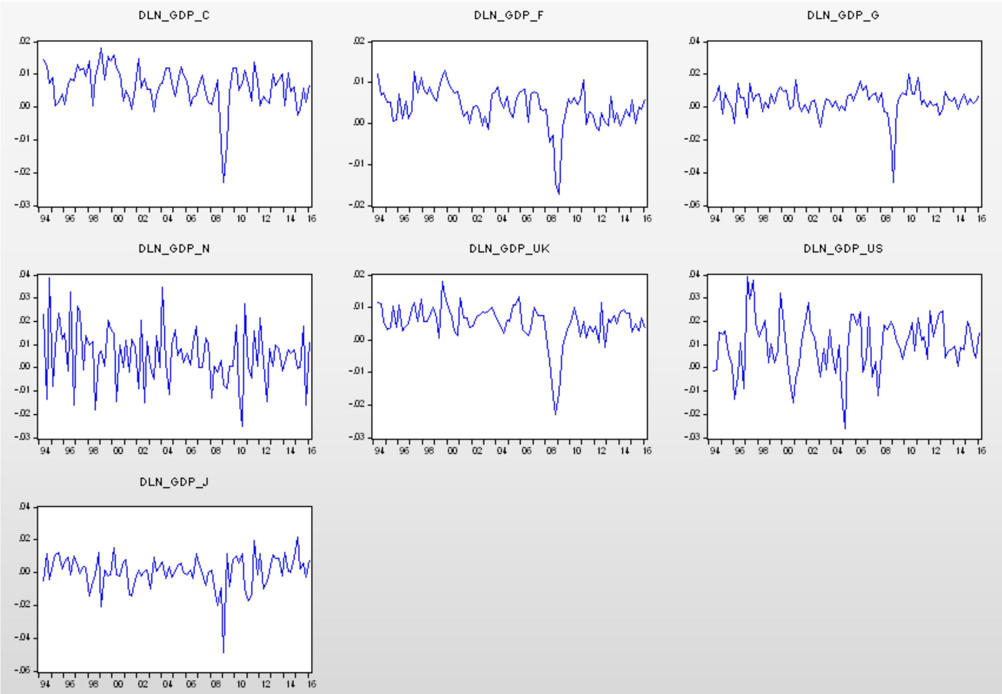
Interest rates tend to be correlated, moving together throughout time in all countries except Japan. The fall in interest rates in 2002 and 2008 can be attributed to economic recessions caused by the dot-com bubble burst and the global financial crisis. The majority of countries turned to a monetary policy of a zero interest-rate policy after the financial crisis in 2008 as a

way to stimulate the economy and prevent economic collapse. Japan was one of the first countries to employ this policy, as seen in *Graph 10.* This policy was first employed in Japan after it experienced an asset price bubble burst in the 1990's and stayed employed until the present as a way to combat deflation and advance economic recovery.

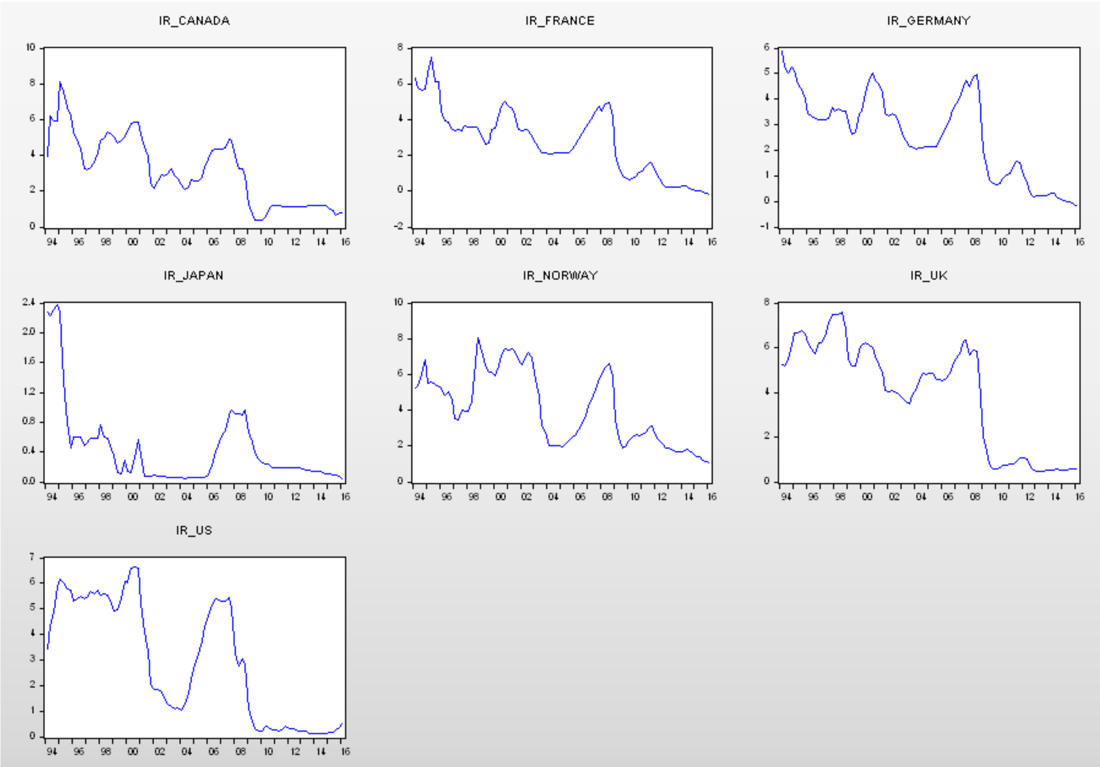
Graph 8: GDP per Country



Graph 9: GDP Growth Rates



Graph 10: Interest Rates per Country



4.4 VAR Estimations & Results:

In accordance with Cunado and Gracia (2014), Chang and Le (2015), and Diaz and Moero (2016) this paper is going to use a VAR model yet differs with using an unstructured reduced form vector-autoregressive model (VAR) to determine the relationship between oil price shocks and stock returns.[4] A VAR model is flexible and tests the effects of every variable on each other, making it so there are no strictly exogenous variables and no strictly endogenous variables. Therefore, each variable used in the paper is a linear function explained by its own lagged variable in addition to current and past values of the remaining variables. The amount of lags depends specifically on the data and variables yet it is common that any lag after 4 are insignificant. An example can be illustrated using three variables x, y, v in the following linear equation:

$$X_t = a_1X_{t-1} + a_1Y_{t-1} + a_1V_{t-1} + a_2X_{t-2} + a_2Y_{t-2} + a_2V_{t-2} + a_3X_{t-3} + a_3Y_{t-3} + a_3V_{t-3} + a_4X_{t-4} + a_4Y_{t-4} + a_4V_{t-4} + e_t$$
$$Y_t = a_1Y_{t-1} + a_1X_{t-1} + a_1V_{t-1} + a_2Y_{t-2} + a_2X_{t-2} + a_2V_{t-2} + a_3Y_{t-3} + a_3X_{t-3} + a_3V_{t-3} + a_4Y_{t-4} + a_4X_{t-4} + a_4V_{t-4} + e_t$$
$$V_t = a_1V_{t-1} + a_1X_{t-1} + a_1Y_{t-1} + a_2V_{t-2} + a_2X_{t-2} + a_2Y_{t-2} + a_3V_{t-3} + a_3X_{t-3} + a_3Y_{t-3} + a_4V_{t-4} + a_4X_{t-4} + a_4Y_{t-4} + e_t$$

In the linear equation above, each variable is being expressed of its own lag and lags of all other variables going back for four specified time periods. Before a VAR model can be used, we need to test whether the variables are stationary and cointegrated. The results of the VAR model allows for the creation of impulse response functions. Impulse response functions show the effect of a shock to one of the variables on another, with the outer dashed lines signifying confidence intervals. Thus, these impulses are ideal for testing the effect of oil price shocks on stock

[4] The discussion on the VAR model follows Stock and Watson (2001) on vector autoregressions in addition to econometric views (eviews) electronic guide

markets. In order to see the effect of a shock on each country's stock market, each stock market will need its own linear equation.

Since this paper is looking at macro data and the VAR model requires it, we need to consider the possibility that these time series are not stationary – there are trends in the data. For each country, an Augmented Dickey-Fuller unit root test needs to be completed on all variables to see if they are stationary in order to avoid a spurious relationship. Aligning with previous research all variables will be represented in the natural log form except for short-term interest rates as a way to stabilize the variability in the data. The results show that the majority of the variables are stationary in the first difference; they are intergraded in the order of one. The fact that the variables are stationary in the first difference means that the changes in the series between periods (growth rates) are constant over time. Two variables –Norway's GDP, and Japan's interest rate – do not follow this pattern. Norway's GDP appears to be stationary when tested with just a constant, yet non-stationary when the trend is included in the test equation. Japans interest rate is stationary without any corrections made. Therefore, all variables –except Japans interest rates - will be represented in the first difference. The Augmented Dickey-Fuller unit root tests can be seen in *Table 2*. The findings that the majority of variables are stationary at the first difference is also found in some previous studies, including: Cunado and Gracia (2014), Chang and Le (2015), and Diaz and Moero (2016).

Table 2: ADF unit root tests summary

	ADF test			
	Level		First Difference	
	(i)	(ii)	(i)	(ii)
Stock Prices				
Canada	-1.997	-3.023	-7.272**	-7.312**
France	-2.34	-2.171	-6.954**	-6.981**
Germany	-1.827	-2.473	-6.954**	-6.929**
Japan	-2.398	-2.237	-6.811**	-6.847**
Norway	-1.073	-2.284	-8.181**	-8.145**
UK	-1.258	-2.019	-6.482**	-6.494**
US	-2.534	-2.829	-7.179**	-7.284**
Oil Prices (APSP)	-1.577	-1.339	-6.794	-6.893
GDP				
Canada	-1.603	-1.523	-5.253**	-5.423**
France	-1.807	-1.359	-4.805**	-5.023**
Germany	-0.892	-3.283	-6.630**	-6.596**
Japan	-1.669	-1.717	-8.659**	-8.608**
Norway	-4.060**	-2.485	-20.334**	-21.948**
UK	-1.267	-1.714	-3.265**	-3.290**
US	0.04	-2.421	-6.139**	-6.116**
Interest Rates				
Canada	-2.042	-3.077	-7.871**	-7.791**
France	-1.643	-3.044	-6.316**	-6.275**
Germany	-1.747	-3.178	-5.276**	-5.239**
Japan	-3.917	-3.77**	-	-
Norway	-2.188	-3.376	-5.592**	-5.553**
UK	-1.341	-3.632	-4.893**	-4.893**
US	-1.672	-2.774	-5.217**	-5.155**

Notes. (i) Constant; (ii) constant and linear trend. ** Means significant at 1%

After a unit root test is run, the Johansen and Juselius test was used to test for cointegration. Both the trace and maximum eigenvalue tests statistics will be looked at and the

results can be seen in *Table 3.* In all countries and specifications of oil prices, the null hypothesis of no cointergration at the 5 percent level is rejected. These outcomes propose the all four variables examined in the paper (oil prices, interest rates, gross domestic product, and stock prices) have a long-term relationship in Canada, France, Germany, Japan, Norway, United Kingdom, and United States. The findings that the null hypothesis of no cointergration at the 5 percent level is rejected align with the findings of Balciar and Gupta (2015) and Diaz and Moero (2016).

Table 3: Johansen and Juselius cointegration tests (variables: oil prices, interest rates, GDP, and stock price)

		R=0	
		(i)	(ii)
Real UK Brent Oil Prices			
Canada	Trace statistic	85.26**	92.89**
	max-eig statistic	34.13**	34.17**
France	Trace statistic	91.55**	104.7**
	max-eig statistic	36.24**	38.66**
Germany	Trace statistic	97.72**	100.3**
	max-eig statistic	36.24**	37.62**
Japan	Trace statistic	115.0**	117.7**
	max-eig statistic	39.92**	42.76**
Norway	Trace statistic	229.2**	244.46**
	max-eig statistic	157.85**	171.65**
UK	Trace statistic	163.2**	182.89**
	max-eig statistic	99.56**	116.14**
US	Trace statistic	93.26**	96.34**
	max-eig statistic	37.89**	40.93**
APSP Oil Prices			
Canada	Trace statistic	85.14**	92.93**
	max-eig statistic	33.49**	33.54**
France	Trace statistic	92.26**	106.05**
	max-eig statistic	36.61**	39.36**
Germany	Trace statistic	96.32**	99.31**
	max-eig statistic	35.64**	37.28**
Japan	Trace statistic	114.9**	117.8**
	max-eig statistic	40.03**	43.08**
Norway	Trace statistic	228.9**	244.06**

	max-eig statistic	157.4**	171.04**
UK	Trace statistic	163.1**	182.78**
	max-eig statistic	99.48**	115.9**
US	Trace statistic	92.63**	95.81**
	max-eig statistic	37.95**	41.23**
Real Imported Crude Oil Price			
Canada	Trace statistic	84.61**	92.51**
	max-eig statistic	33.74**	33.89**
France	Trace statistic	93.17**	106.96**
	max-eig statistic	36.94**	40.20**
Germany	Trace statistic	97.43**	100.3**
	max-eig statistic	36.67**	38.26**
Japan	Trace statistic	116.9**	119.6**
	max-eig statistic	41.21**	44.12**
Norway	Trace statistic	225.8**	240.8**
	max-eig statistic	156.2**	169.7**
UK	Trace statistic	163.7**	182.99**
	max-eig statistic	98.36**	114.39**
US	Trace statistic	90.9**	93.95**
	max-eig statistic	36.98**	40.01**

Notes. (i) Constant; (ii) constant and linear trend. ** means significant at 5% level

4.5.1 Results for Entire Sample Period

The VAR model that is estimated in this paper is a common method to determine the effects of price shocks on stock returns and can be seen as the method used in Cunado and Gracia (2014), Chang and Le (2015), and Diaz and Moero (2016). Subsequent to the estimations of the VAR, impulse response functions can be run to determine the influence of oil price shocks on stock returns in multiple developed countries.

When the VAR estimate for the full sample (1994, Q1 – 2016, Q1) was run for each country the results indicate that oil price shocks on stock markets are statistically insignificant at the 95% confidence interval for each oil specification, which aligns with Le and Chang (2015) results for the full sample being insignificant at the 5% level. The estimated t-statistics for the full sample can be seen in *Table 4.* The Akaike information criteria and Schwarz information criteria were used to accurately determine the autoregressive lag length. Canada, France,

Germany, Japan, and the United states all were estimated with two lags whereas both Norway and the United Kingdom were estimated with four lags. These results can be backed by the efficient market hypothesis, which states that stock markets are efficient in reflecting information. In regards to this paper, the efficient market hypothesis would state that if the prices of stocks were unable to be enhanced by the utilization of other information – for example, fluctuations in oil price – then it can be said that the configuration of stock prices in the stock market are already incorporating accessible public and private information. Thus, it can be assumed that stock markets are able to incorporate information about the result of an oil price shock and integrate it efficiently and promptly into the stock prices as a result having no significant effect.

Table 4: Summary Statistics for Stock Prices in Full Sample

	Canada	France	Germany	Japan	Norway	UK	US
IR(-1)	0.012	-0.034	-0.074	-0.153	-0.072	-0.072	-0.020
	(-0.020)	(-0.025)	(-0.047)	(-0.074)	(-0.026)	(-0.026)	(-0.020)
	[0.619]	[-1.359]	[-1.583]	[-2.079]	[-2.804]	[-2.804]	[-0.979]
IR(-2)	0.004	-0.039	-0.016	0.107	0.002	0.002	0.027
	(-0.017)	(-0.024)	(-0.040)	(-0.068)	(-0.026)	(-0.026)	(-0.018)
	[0.259]	[-1.616]	[-0.384]	[1.573]	[0.080]	[0.080]	[1.473]
BRENT(-1)	-0.061	-0.094	-0.053	-0.086	-0.100	-0.100	0.015
	(-0.065)	(-0.068)	(-0.080)	(-0.076)	(-0.107)	(-0.107)	(-0.052)
	[-0.937]	[-1.390]	[-0.668]	[-1.136]	[-0.933]	[-0.933]	[0.281]
BRENT(-2)	0.033	0.008	0.049	-0.034	0.147	0.147	-0.052
	(-0.068)	(-0.068)	(-0.088)	(-0.078)	(-0.097)	(-0.097)	(-0.053)
	[0.487]	[0.116]	[0.558]	[-0.439]	[1.518]	[1.518]	[-0.985]
GDP(-1)	1.755	8.030	1.820	1.166	-0.857	-0.857	0.311
	(-1.782)	(-2.778)	(-1.721)	(-1.080)	(-1.212)	(-1.212)	(-0.654)
	[0.984]	[2.890]	[1.057]	[1.079]	[-0.707]	[-0.707]	[0.475]
GDP(-2)	-3.037	-2.935	-0.626	-0.089	1.132	1.132	-0.109
	(-1.697)	(-2.585)	(-1.702)	(-1.014)	(-1.148)	(-1.148)	(-0.643)
	[-1.789]	[-1.135]	[-0.367]	[-0.087]	[0.986]	[0.986]	[-0.168]
SP(-1)	0.317	0.185	0.269	0.266	0.124	0.124	0.251
	(-0.130)	(-0.116)	(-0.122)	(-0.123)	(-0.118)	(-0.118)	(-0.117)
	[2.444]	[1.590]	[2.198]	[2.172]	[1.047]	[1.047]	[2.133]
SP(-2)	-0.154	0.016	0.086	-0.105	-0.013	-0.013	0.073
	(-0.133)	(-0.119)	(-0.124)	(-0.125)	(-0.133)	(-0.133)	(-0.119)
	[-1.154]	[0.132]	[0.689]	[-0.837]	[-0.098]	[-0.098]	[0.613]
C	0.016	-0.020	-0.001	0.013	0.010	0.010	0.006
	(-0.014)	(-0.016)	(-0.015)	(-0.013)	(-0.016)	(-0.016)	(-0.010)
	[1.152]	[-1.277]	[-0.070]	[1.011]	[0.616]	[0.616]	[0.593]

**<u>Note:</u> () = Standard Error, [] = t-statistic

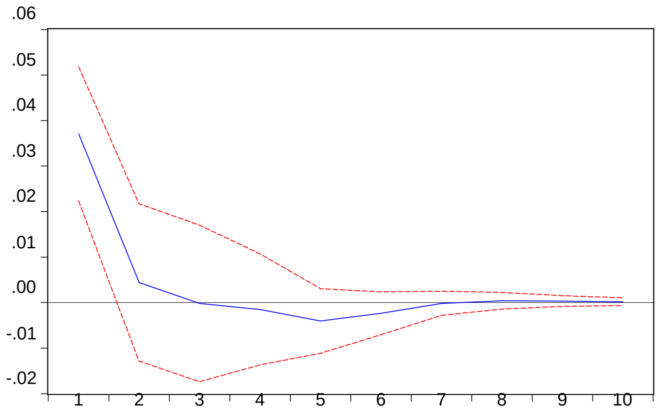
Findings indicate no relationship between oil price shocks and stock returns in the full sample, therefore the use of impulse response functions can be looked at to confirm these results. A generalized impulse response function of stock market returns to UK Brent oil prices to the

full sample can be seen in *Figure 1* for all countries represented in the sample: Canada, France, Germany, Norway, United Kingdom, and the United States. Using a generalized impulse response functions is invariant to how the variables are ordered in the VAR model and was used in previous literature by Cunado and Gracia (2014), Chang and Le (2015), and Diaz and Moero (2016).

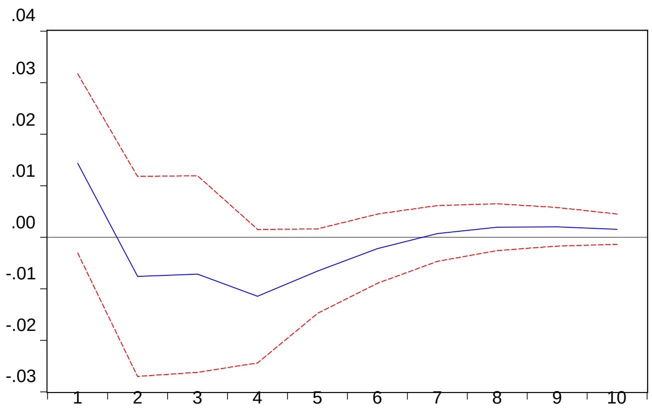
Canada and Norway's stock market both have a positive response to a shock in oil prices. Although there is a positive relationship, it cannot be trusted since the estimated t-statistic is statistically insignificant as seen in *Table 4*. In Canada, the generalized impulse response function shows that within a time period of ten quarters a shock in oil prices will cause a positive response in the stock market. The impulse response illustrates that a ten percent standard deviation of a shock will immediately cause a three percent increase in stock returns in the first quarter and then die down halfway after the first quarter. An oil price shock in Norway has a positive 4 percent on stock returns and similarly becomes insignificant right after the first quarter. Both France and Germany also has an immediate positive response of around 1.4 percent that soon turns negative after the first quarter, yet was not significant as seen by the 95% confidence intervals. The United Kingdom stock price has no response to a one standard deviation shock of oil prices. The United States stock market has little to no effect in response to a one standard deviation shock in oil prices. A reason as to why the United States stock prices are not affected by oil price shocks could be because of its diverse portfolio and due to it being both a huge producer and consumer of oil thus offsetting an increase or decrease in oil prices.

Figure 1: IRF for the Full Sample

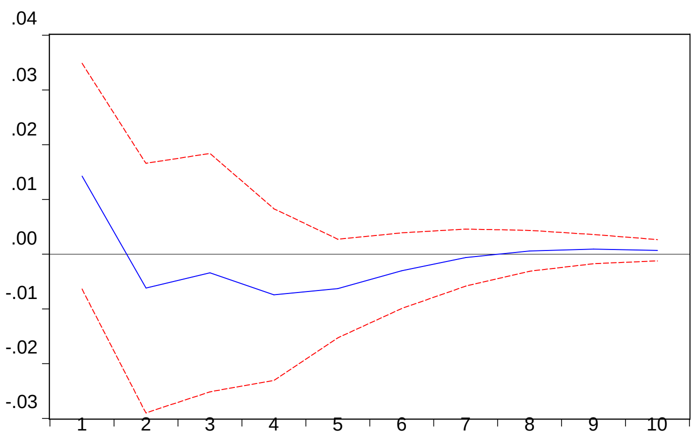
Canada: Response of DLN_SP_C to Generalized One S.D. DLN_BRENT Innovation



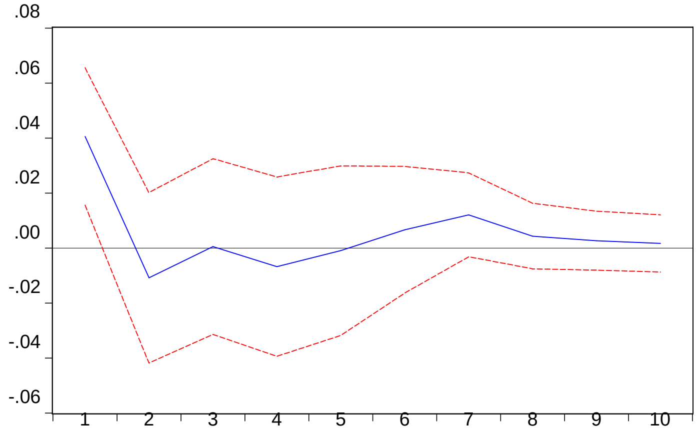
France: Response of DLN_SP_F to Generalized One S.D. DLN_BRENT Innovation



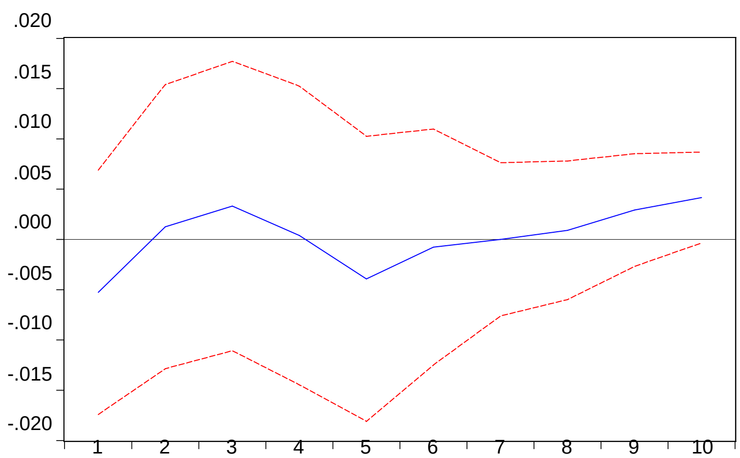
Germany: Response of DLN_SP_G to Generalized One S.D. DLN_BRENT Innovation



Norway:



UK:



4.5.2 Results for Sub-Periods

Since oil price shocks have no effect on stock returns in the full sample, this paper is going to separate the data into smaller samples to adjust for changes to see if the results are different. To take into account different geo-political and economic events, the whole sample will be divided into multiple sub-groups based on the segregation of data in previous literature. The segregation of the entire sample into sub-groups will help examine how oil price shocks affect the stock market in addition to whether the nature of the shock is important. The data will

be segregated into 4 sub-groups that will try and correct structural changes within the data: Q1, 1994 to Q4, 2002 is looked at in sub-group one; Q1, 2003 to Q3, 2008 will be covered by the second sub-group; Q4, 2008 to Q2, 2012 by the third sub-group; and, Q3, 2012 to Q1, 2016 by the fourth sub-group. These sub-groups will help look at the disparity between the relationships in oil price shocks on stock returns in the long run versus the short-term and aligns with Le and Change (2015) division of their full sample.

The first sub-group will represent a time in which the price of oil had little fluctuation between sixteen and forty-two dollars a barrel with changes associated to demand pressures. In 1997 to 1998 there was a decrease in the demand for oil caused by a financial crisis in Asia and decreased activity in Europe, causing oil prices to drop to sixteen dollars a barrel, as seen in section one of this paper. Due to changes in demand pressures caused by the Iraq War, there was a constant rise in oil prices from 2003 to quarter 3, 2008 where oil prices peaked; this reason is why the second sub-group will cover Q1, 2003 to Q3, 2008. Oil prices fell after 2008, quarter 3 due to economic weakness, the third sub-group will represent the rebound in oil prices, and the fourth sub-group will represent the immense drop in oil prices caused by both supply and demand side factors.

When the sample is segregated into four sub-groups, it presents mixed results. Both Germany and the UK are statistically insignificant at the 95% confidence interval in all four sub-groups. In the first sub-group that represented the time period of 1994, Q1 to 2002, Q4, both Canada and the United States were statistically significant. Canada was significant in the second lag with a t-statistic of 2.35, as seen in *Table 5*. In the first quarter, the response of Canada's stock market was positive, with a 1.4% margin, although the impulse response is not significant. There is some uncertainty in the result of a positive relationship since the response lies within the

confidence intervals signaled by the red dotted lines in *Figure 2*. The United States is significant in the first lag with a t-statistic of -2.16 yet similarly to Canada its stock market positive response of 1.2% does not pass the confidence intervals. Both Germany and Norway were statistically significant in the second lag yet when the appropriate lags were added to the regression the two countries became insignificant.

Table 5: Summary Estimated T-Statistics for Stock Prices in Sub-groups

A) Sub-group 1:

	Canada	France	Germany	Japan	Norway	UK	US
IR(-1)	0.003	-0.013	-0.037	-0.163	-0.055	0.040	0.001
	(-0.025)	(-0.035)	(-0.072)	(-0.090)	(-0.040)	(-0.030)	(-0.034)
	[0.135]	[-0.360]	[-0.514]	[-1.813]	[-1.355]	[1.324]	[0.026]
IR(-2)	-0.002	-0.034	-0.014	0.148	0.015	-0.050	0.030
	(-0.021)	(-0.034)	(-0.059)	(-0.085)	(-0.037)	(-0.032)	(-0.030)
	[-0.100]	[-1.017]	[-0.232]	[1.734]	[0.402]	[-1.587]	[1.002]
BRENT(-1)	-0.085	-0.200	-0.211	-0.155	-0.129	0.019	-0.231
	(-0.119)	(-0.142)	(-0.164)	(-0.183)	(-0.202)	(-0.098)	(-0.107)
	[-0.711]	[-1.409]	[-1.285]	[-0.847]	[-0.639]	[0.195]	[-2.159]**
BRENT(-2)	0.262	0.243	0.328	0.125	0.444	0.012	0.065
	(-0.111)	(-0.141)	(-0.166)	(-0.151)	(-0.181)	(-0.089)	(-0.118)
	[2.351]**	[1.724]	[1.684]	[0.823]	[2.447]	[0.137]	[0.550]
GDP(-1)	6.873	13.364	2.605	-0.233	-0.563	-5.275	-0.226
	(-3.153)	(-6.537)	(-3.134)	(-2.262)	(-2.140)	(-2.777)	(-1.041)
	[2.179]	[2.044]	[0.831]	[-0.102]	[-0.263]	[-1.899]	[-0.217]
GDP(-2)	-5.815	-5.150	-0.194	-0.385	0.866	-2.305	-0.109
	(-3.879)	(-5.820)	(-3.421)	(-2.127)	(-2.051)	(-2.857)	(-0.991)
	[-1.499]	[-0.884]	[-0.056]	[-0.180]	[0.422]	[-0.806]	[-0.109]
SP(-1)	0.191	0.308	0.434	0.166	0.011	0.435	0.101
	(-0.193)	(-0.192)	(-0.193)	(-0.199)	(-0.196)	(-0.192)	(-0.198)
	[0.992]	[1.602]	[2.243]	[0.835]	[0.057]	[2.273]	[0.511]
SP(-2)	0.024	-0.137	-0.010	0.114	-0.249	-0.205	0.234
	(-0.194)	(-0.231)	(-0.255)	(-0.257)	(-0.236)	(-0.200)	(-0.218)
	[0.125]	[-0.593]	[-0.041]	[0.445]	[-1.056]	[-1.024]	[1.075]
C	-0.004	-0.044	-0.011	-0.020	0.003	0.049	0.018
	(-0.039)	(-0.050)	(-0.031)	(-0.024)	(-0.038)	(-0.032)	(-0.019)
	[-0.109]	[-0.885]	[-0.368]	[-0.806]	[0.067]	[1.536]	[0.946]

**<u>Note:</u> () = Standard Error, [] = t-statistic, ** = statistically significant at 5% level

B) Sub-group 2:

	Canada	France	Germany	Japan	Norway	UK	US
IR(-1)	0.043	-0.038	0.071	-0.090	-0.166	-0.067	0.028
	(-0.044)	(-0.065)	(-0.144)	(-0.243)	(-0.067)	(-0.044)	(-0.030)
	[0.990]	[-0.589]	[0.491]	[-0.371]	[-2.485]	[-1.523]	[0.940]
IR(-2)	0.023	-0.087	-0.144	-0.002	0.087	0.002	-0.002
	(-0.039)	(-0.068)	(-0.119)	(-0.266)	(-0.074)	(-0.043)	(-0.031)
	[0.596]	[-1.281]	[-1.208]	[-0.007]	[1.179]	[0.049]	[-0.053]
BRENT(-1)	-0.251	-0.355	-0.472	-0.186	-0.541	0.051	-0.236
	(-0.104)	(-0.109)	(-0.200)	(-0.187)	(-0.209)	(-0.107)	(-0.142)
	[-2.420]**	[-3.263]**	[-2.362]	[-0.994]	[-2.585]**	[0.478]	[-1.660]
BRENT(-2)	0.110	-0.018	-0.131	0.355	0.232	0.103	-0.103
	(-0.133)	(-0.127)	(-0.218)	(-0.185)	(-0.256)	(-0.102)	(-0.132)
	[0.828]	[-0.142]	[-0.600]	[1.920]	[0.906]	[1.007]	[-0.775]
GDP(-1)	7.052	-6.650	-1.783	6.320	-2.447	-5.057	0.310
	(-3.775)	(-5.149)	(-4.263)	(-3.486)	(-2.214)	(-2.920)	(-0.899)
	[1.868]	[-1.291]	[-0.418]	[1.812]	[-1.105]	[-1.731]	[0.345]
GDP(-2)	-7.607	-1.302	-2.887	5.939	4.037	-1.917	0.297
	(-4.619)	(-3.988)	(-5.191)	(-3.515)	(-2.353)	(-3.590)	(-0.937)
	[-1.646]	[-0.326]	[-0.556]	[1.689]	[1.715]	[-0.534]	[0.317]
SP(-1)	-0.334	-0.032	-0.325	0.085	-0.067	-0.086	-0.268
	(-0.257)	(-0.201)	(-0.296)	(-0.225)	(-0.284)	(-0.278)	(-0.320)
	[-1.298]	[-0.158]	[-1.100]	[0.380]	[-0.234]	[-0.310]	[-0.838]
SP(-2)	0.178	0.783	0.526	-0.071	0.562	0.566	0.317
	(-0.172)	(-0.175)	(-0.178)	(-0.187)	(-0.199)	(-0.202)	(-0.217)
	[1.037]	[4.477]	[2.945]	[-0.381]	[2.826]	[2.802]	[1.458]
C	0.043	0.071	0.083	0.021	0.033	0.033	0.019
	(-0.028)	(-0.029)	(-0.037)	(-0.029)	(-0.043)	(-0.026)	(-0.019)
	[1.534]	[2.416]	[2.266]	[0.719]	[0.778]	[1.263]	[1.025]

**Note: () = Standard Error, [] = t-statistic, ** = statistically significant at 5% level

C)Sub-group 3:

	Canada	France	Germany	Japan	Norway	UK	US
IR(-1)	-0.103	-0.115	-0.148	-1.064	-0.024	0.020	-0.104
	(-0.112)	(-0.122)	(-0.150)	(-0.646)	(-0.146)	(-0.045)	(-0.099)
	[-0.919]	[-0.945]	[-0.988]	[-1.646]	[-0.168]	[0.434]	[-1.055]
IR(-2)	0.154	-0.060	-0.127	0.658	-0.017	-0.093	0.078
	(-0.081)	(-0.072)	(-0.096)	(-0.560)	(-0.085)	(-0.038)	(-0.074)
	[1.906]	[-0.840]	[-1.325]	[1.176]	[-0.199]	[-2.450]	[1.049]
BRENT(-1)	-0.636	-0.147	0.252	-0.302	0.104	0.086	0.268
	(-0.281)	(-0.229)	(-0.237)	(-0.410)	(-0.524)	(-0.105)	(-0.211)
	[-2.260]**	[-0.640]	[1.062]	[-0.736]	[0.199]	[0.822]	[1.269]
BRENT(-2)	0.196	-0.189	-0.238	-0.490	0.118	0.055	0.033
	(-0.460)	(-0.316)	(-0.363)	(-0.408)	(-0.520)	(-0.108)	(-0.307)
	[0.424]	[-0.598]	[-0.654]	[-1.200]	[0.227]	[0.510]	[0.106]
GDP(-1)	3.232	18.969	7.634	0.913	0.262	-7.974	-5.125
	(-4.109)	(-7.105)	(-4.525)	(-2.048)	(-3.585)	(-3.025)	(-3.747)
	[0.786]	[2.669]	[1.687]	[0.446]	[0.072]	[-2.635]	[-1.367]
GDP(-2)	-4.507	0.320	6.403	-1.109	-0.185	7.504	-5.969
	(-4.158)	(-7.028)	(-4.032)	(-1.923)	(-3.214)	(-4.781)	(-5.163)
	[-1.084]	[0.045]	[1.587]	[-0.576]	[-0.057]	[1.569]	[-1.156]
SP(-1)	1.942	0.051	-0.459	0.035	0.466	0.259	0.233
	(-0.692)	(-0.481)	(-0.508)	(-0.619)	(-0.351)	(-0.263)	(-0.452)
	[2.807]	[0.105]	[-0.902]	[0.056]	[1.328]	[0.984]	[0.515]
SP(-2)	-0.811	-0.250	-0.463	0.531	-0.659	0.328	-0.647
	(-0.814)	(-0.434)	(-0.592)	(-0.677)	(-0.732)	(-0.280)	(-0.664)
	[-0.996]	[-0.576]	[-0.782]	[0.783]	[-0.901]	[1.172]	[-0.974]
C	0.021	-0.083	-0.082	0.115	-0.001	-0.028	0.149
	(-0.038)	(-0.062)	(-0.058)	(-0.075)	(-0.052)	(-0.016)	(-0.100)
	[0.538]	[-1.349]	[-1.412]	[1.541]	[-0.026]	[-1.743]	[1.488]

**Note: () = Standard Error, [] = t-statistic, ** = statistically significant at 5% level

D)Sub-group 4:

	Canada	France	Germany	Japan	Norway	UK	US
IR(-1)	0.171	0.045	0.330	1.967	0.090	-0.770	-0.457
	(-0.145)	(-0.435)	(-0.342)	(-7.232)	(-0.281)	(-0.300)	(-0.283)
	[1.181]	[0.102]	[0.964]	[0.272]	[0.320]	[-2.568]	[-1.617]
IR(-2)	0.390	-0.194	-0.479	-0.394	-0.279	0.424	0.649
	(-0.195)	(-0.344)	(-0.290)	(-7.635)	(-0.210)	(-0.226)	(-0.302)
	[2.005]	[-0.564]	[-1.649]	[-0.051]	[-1.328]	[1.877]	[2.147]
BRENT(-1)	0.046	-0.106	0.026	0.007	-0.233	-0.181	-0.021
	(-0.111)	(-0.213)	(-0.176)	(-0.229)	(-0.271)	(-0.108)	(-0.068)
	[0.415]	[-0.495]	[0.149]	[0.031]	[-0.860]	[-1.676]	[-0.310]
BRENT(-2)	0.011	0.247	0.247	0.098	0.215	-0.107	0.328
	(-0.117)	(-0.200)	(-0.164)	(-0.234)	(-0.196)	(-0.128)	(-0.074)
	[0.090]	[1.234]	[1.504]	[0.418]	[1.096]	[-0.837]	[4.431]**
GDP(-1)	-0.362	-1.066	10.499	8.223	3.891	2.209	2.868
	(-3.085)	(- 13.546)	(-6.305)	(-5.149)	(-3.342)	(-4.612)	(-1.214)
	[-0.117]	[-0.078]	[1.665]	[1.597]	[1.164]	[0.478]	[2.363]
GDP(-2)	0.627	8.835	4.640	-0.557	-1.297	-1.038	-1.518
	(-3.014)	(-9.909)	(-5.342)	(-4.576)	(-2.779)	(-4.966)	(-0.959)
	[0.208]	[0.891]	[0.868]	[-0.121]	[-0.466]	[-0.208]	[-1.583]
SP(-1)	-0.085	0.208	-0.055	0.155	0.308	-1.131	-0.210
	(-0.365)	(-0.593)	(-0.376)	(-0.576)	(-0.468)	(-0.459)	(-0.199)
	[-0.231]	[0.350]	[-0.146]	[0.269]	[0.658]	[-2.466]	[-1.058]
SP(-2)	-0.311	-0.042	-0.183	-0.530	-0.057	-0.435	0.110
	(-0.269)	(-0.454)	(-0.377)	(-0.504)	(-0.464)	(-0.407)	(-0.298)
	[-1.154]	[-0.093]	[-0.484]	[-1.053]	[-0.122]	[-1.071]	[0.370]
C	0.026	-0.005	-0.018	-0.181	-0.022	-0.147	0.029
	(-0.027)	(-0.043)	(-0.040)	(-0.190)	(-0.051)	(-0.083)	(-0.017)
	[0.941]	[-0.110]	[-0.445]	[-0.948]	[-0.439]	[-1.780]	[1.775]

**Note: () = Standard Error, [] = t-statistic, ** = statistically significant at 5% level

In the second sub-group (2003, Q1 – 2008, Q3), Canada, Norway, and France all were statistically significant, as seen in *Table 5*. Canada follows the same result as in sub-group one; it

has a positive response to an oil price shock yet the confident intervals lay positive and negative providing uncertainty in the results. The stock markets in Norway have no response to a one standard deviation shock in oil prices, as seen by the impulse response function. This result was not expected since oil production represents “22 percent of Norwegian GDP and 67% of Norwegian exports”, according to the European commission (European). The French stock market showed a negative response to an oil price shock. In the first quarter, stocks fell around 1.8% and dropped further to around 3.6% in the second quarter before turning insignificant. The response by the French market makes sense since it is considered an oil consuming country. Within the second sub-group, the price of oil reached its highest peak due to an immense growth in the global economy. The growth caused an increase in global demand for oil due to the expansionary impacts. Since France is a highly consuming country one would assume that an immense increase in oil prices would cause the stock markets to decrease a certain amount.

In the third sub-group (2008, Q4 – 2012, Q2) the only country that was statistically significant was Canada in the first lag with a t-statistic of -2.26. According to the impulse response function, the stock markets responded positively by 6.2% in the first quarter then fell to around 4.2% in the second quarter and becomes insignificant right after quarter two. In the fourth sub-group (2012, Q3 – 2016, Q1) only the United States was statically significant and had a t-statistic of 4.43 in the second lag. Although the oil price shock on stock returns in the United States was statistically significant at the 95% confidence interval, in the second lag the impulse response shows no effect on the stock market.

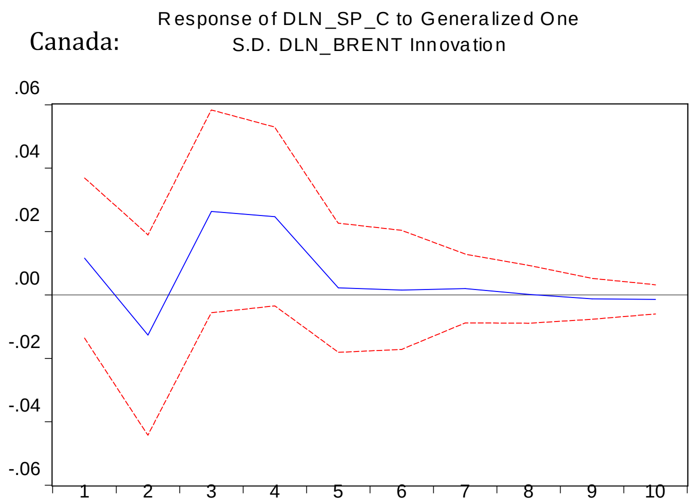
These results show the necessity to segregate the data in order to take into account structural changes. The full sample compared to the sub-groups represented mixed results yet mainly showed no relationship between oil price shocks and the stock market. The results of this

paper are similar to Le and Chang (2015) findings. Le and Chang (2015) found no causality between oil price shocks and the stock market at the 5 percent significance level. They also found that, when segregated, the significance level changes within some sub-groups, particularly between the periods of 2003-2008 and 2008-2013. Additionally, this paper found that the UK Brent crude oil best represents shocks for the countries included in this paper.

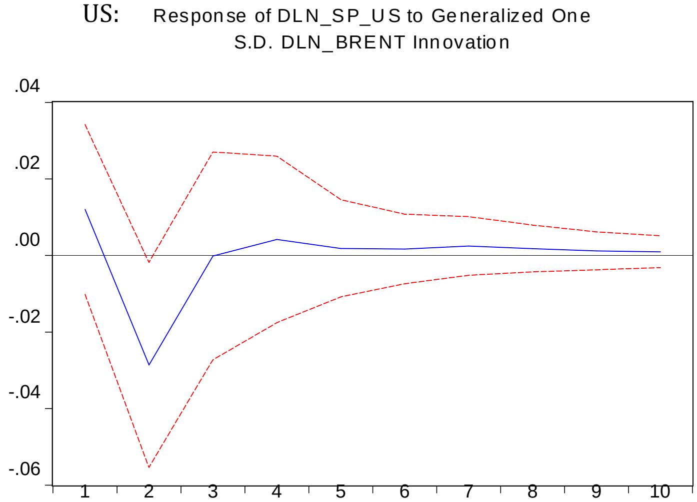
Figure 2: Statistically Significant IRF for sub-groups

A) Sub-group 1:

Canada:

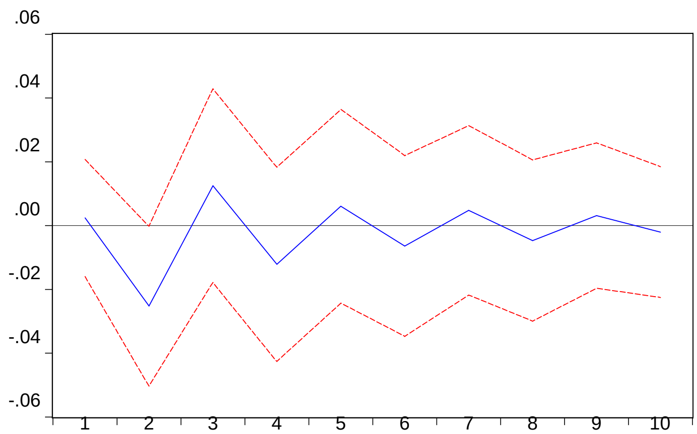


US:

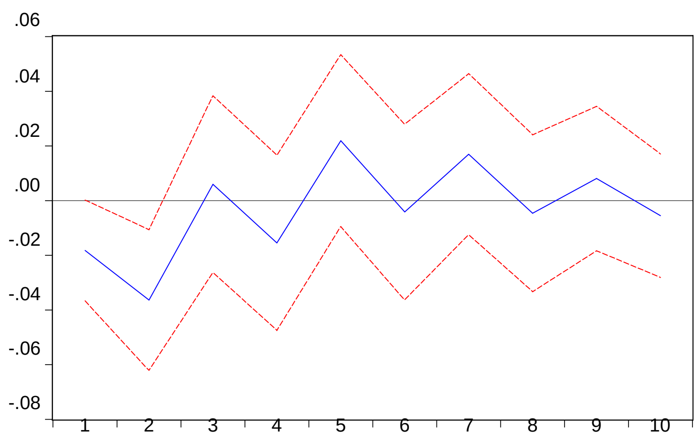


B) Sub-group 2:

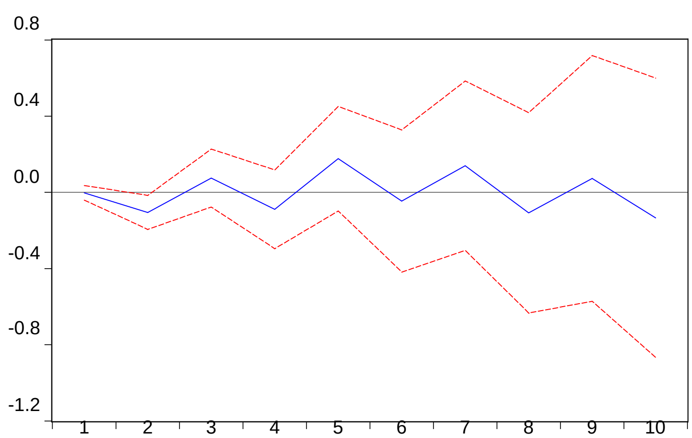
Canada: Response of DLN_SP_C to Generalized One S.D. DLN_BRENT Innovation



France: Response of DLN_SP_F to Generalized One S.D. DLN_BRENT Innovation

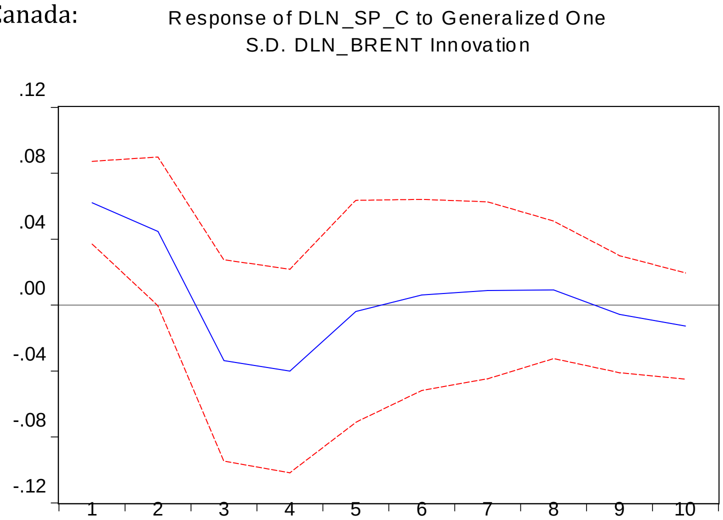


Norway: Response of DLN_SP_N to Generalized One S.D. DLN_BRENT Innovation



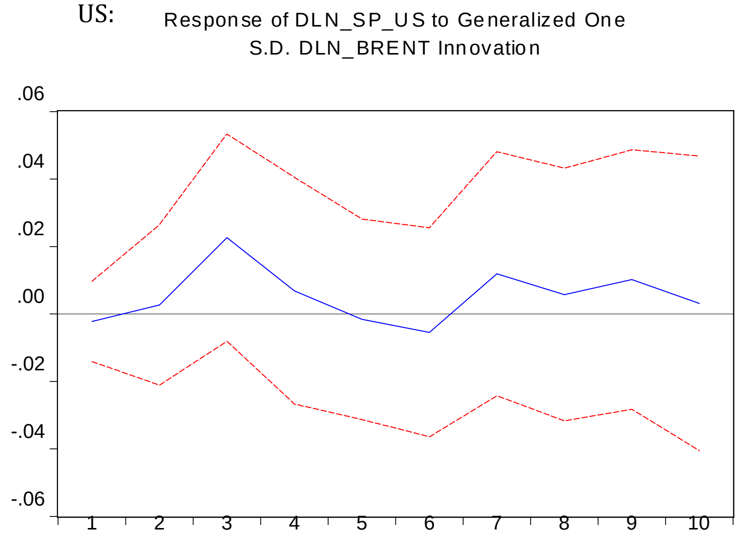
C) Sub-group 3:

Canada:



D) Sub-group 4:

US:



4.6 Conclusion of Results Section:

This paper took two approaches in order to answer the question of whether oil price shocks had any effects on stock returns in developed countries. First, it was necessary to separate the sample into oil consuming and producing countries to see if the nature of the economy had any effect on the response of stock markets to a shock. Once this was completed, the first approach was to answer this question by analyzing the entire sample. After a vector

autoregressive model was run, the results illustrated statically insignificant effects of oil price shocks on the stock market at 95% confidence interval for both oil consuming and producing economies. These results indicate that at a macro level, stock markets are able to immediately incorporate information on the result of an oil price shock and integrate it proficiently and quickly into the stock prices thus having no considerable effects. These results align with Le and Change (2015) who found no relationship between oil price shocks and stock returns at the 5% significance level when looking at the full sample.

After finding no effect at the macro level when looking at the full sample, I segregated the data and looked at it at a micro level to adjust for possible structural changes within the data. Once the sample was divided into four sub-groups, I found some statistically significant results. Although there are countries in each sub-group that are statistically significant, only two countries – Canada and France - show a relationship between oil shocks and stock returns through the impulse response functions. France's stock market showed a negative response to an oil price shock by 1.8% in the first quarter and 3.6% in the second quarter in the second sub-group (2003, Q1 to 2008, Q3). This result makes sense since France is an oil-consuming country—when oil prices peaked, the stock market was negatively hit. Canada's stock market in the third sub-group had a positive response to an oil price shock by 6.2% in the first quarter that decreased to 4.2% in the second quarter before becoming insignificant. This relationship was expected since Canada is an oil producing country. In all other cases for each country, according to the impulse response function, there is no relationship present. Overall, these results show the necessity to segregate the data in order to account for changes throughout time; looking only at the full sample could provide misleading results.

Chapter Five

V. Conclusion:

This paper examined the relationship between oil price shocks on stock returns in developed countries, specifically the G7 countries and Norway. The sample period examined ranged from the first quarter in 1994 to the first quarter in 2016. The empirical method used was an unstructured reduced form vector autoregressive (VAR) model including the following variables: oil price (APSP and UK Brent oil crude index), interest rates, gross domestic product (GDP), and stock returns per country. The VAR model allows us to run impulse response functions from its estimated outputs in order to see how stock returns react to a one standard deviation shock in oil prices. Additionally, I distinguish between oil producing and oil consuming economies within the sample of countries examined in order to see whether the effects are different. This method aligns with Ramos and Veiga (2013) and Jammaz (2015) who proposed that there are asymmetric effects of oil price shocks on stock returns depending on the nature of the economy – whether it is mainly an oil exporter or importer.

In order to determine which countries were oil producers and which oil consumer we looked at the production and consumption of oil within each country. By looking at the ratio of oil production to consumption, we were able to clearly label the nature of each economy in regards to its reliance on oil. Through this process it was determined that France, Japan, and Germany were all oil-consuming countries with a ratio oil production to consumption of less than 0.03 percent. Among these countries, Japan is the most reliant on the consumption of oil. Norway, Canada, United Kingdom, and the United States are all considered oil producers. Among these countries, Norway is the largest oil producer to consumption.

The main results of this paper are following. First, when looking at the full sample there is no relationship between oil price shocks and stock returns in both oil consuming and producing economies. This result differs from what I assumed for Norway yet aligns with my assumptions of the United States. It was assumed that Norway would have the most significant effect since it on average produces seven times more than it consumes. The United States is both a massive oil producer as it is consumer therefore, it was assumed that there would be no effects of an oil price shocks due to its diversification. These results align with Le and Chang (2015) and suggest that stock markets are efficiently able to incorporate the results of a shock immediately into the valuation of stock prices.

Second, since there was no relationship found when we examined the full sample this paper segregated the data into four sub-groups to account for changes within the data. The idea of separating the data in order to account for geo-political and structural changes within the sample was used in previous literature by Diaz and Moero (2016) and Le and Change (2015). These results show that for the majority of the countries in all sub-groups there still exists no relationship between oil price shocks and stock returns.

There was a relationship between oil shocks and stock returns in two cases – France and Canada. France experienced an immediate negative effect of 1.8% on stock returns in the first quarter and reaches a maximum negative impact of 3.8% in the second quarter between the period of 2003, Q1 to 2008, Q3. This negative impact makes sense since during this time period the price of oil peaked thus an economy in which relies on the importation of oil will be hit negatively. Canada's stock market was positively impacted by 6.2% in the first quarter and 4.2% in the second quarter during the period of 2008, Q3 to 2012, Q2. These results are backed by the findings in previous literature, which found that a shock in oil prices had asymmetric effects

depending on whether a country is an oil importer or exporter. Overall, the results suggest few effects of oil shocks on stock returns. Additionally the results suggest the necessity to separate the data, as the whole sample may present misleading results.

Limitations of this study and further improvements are as following. In order to increase the accuracy of the data, monthly observations should be used instead of quarterly. The smaller the frequency of observations will capture a greater extent of the relationship between the variables. This paper was unable to use monthly data since GDP is not available in monthly terms. Previous research had used industrial production data instead of GDP as a measure of economic activity, which is in monthly terms. Additionally, a larger sample period will allow a more in depth analysis of how the dynamics of oil price shocks on stock returns changed throughout time. This paper was unable to attain monthly data and have a larger sample period due to the costs associated with attaining the information. Moreover, due to the limitations of my econometric knowledge there could be more sophisticated models used to answer the research question. For example, Jammazi (2015) and Bacliar and Gupta (2015) both use models in which takes into account structural changes within the model. Jammazi uses a two-regime MS-EGARCH model and Bacliar and Gupta uses a Markov switching vector autoregressive (MC-VAR) and Markov switching vector error-correction (MS-VEC) model, which is an updated version of a VAR.

In light of these results, further research is needed. Further research can look at whether the volatility of oil prices affects stock returns in countries specified in this paper, additionally whether there are different affects depending on the nature of the economy – oil producing versus consuming economies. Furthermore, the analysis of looking at how oil price shocks or oil price volatility affected stock returns can be done on a micro or industry level.

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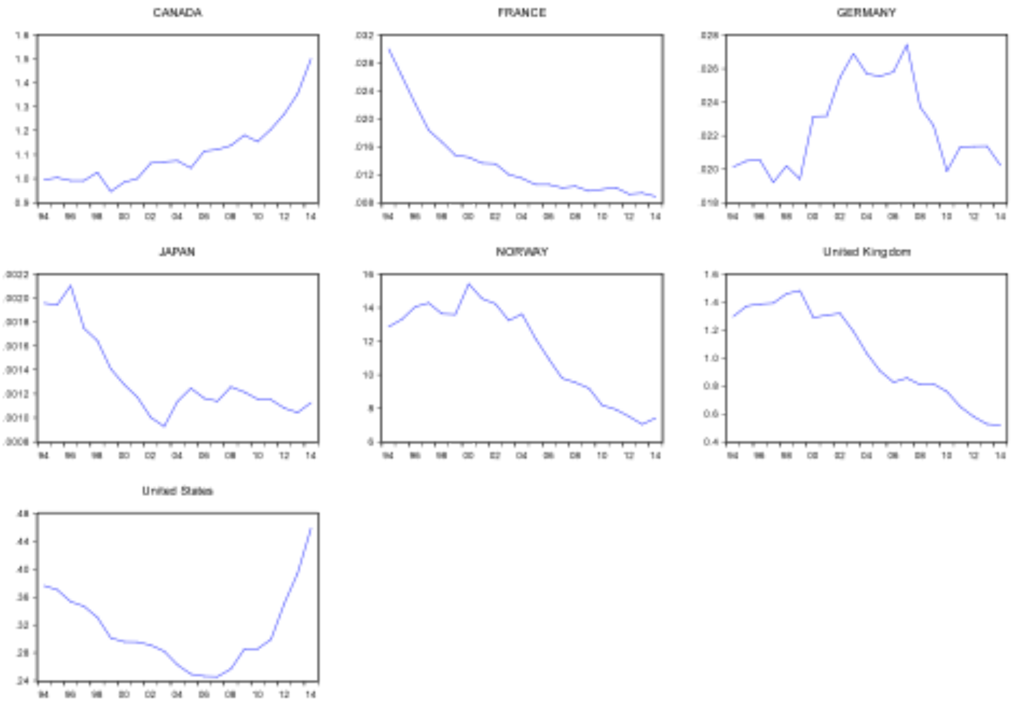
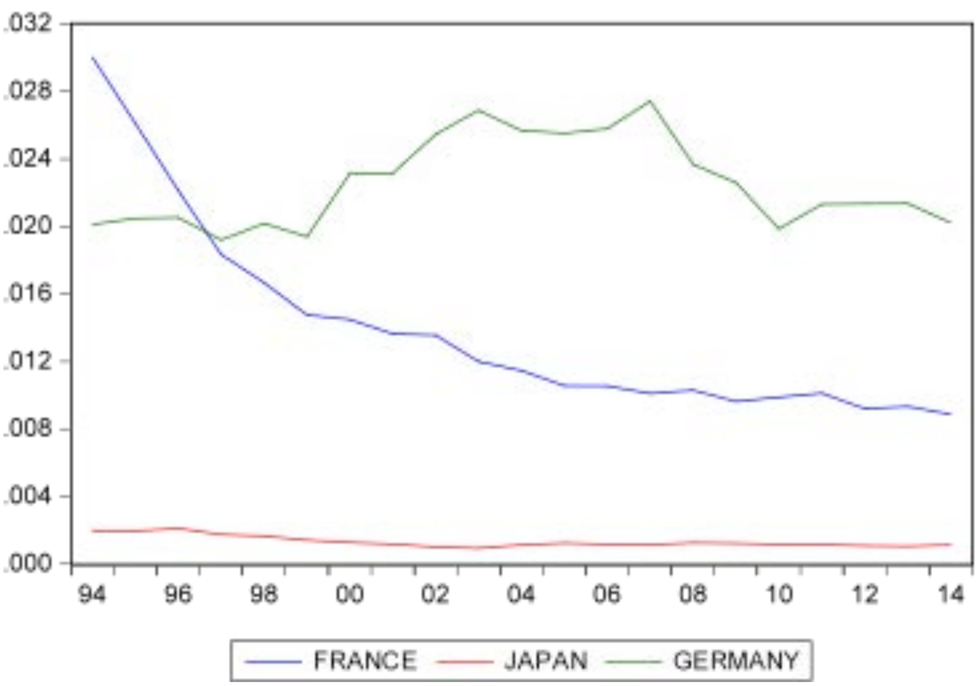
VII. Appendix

Appendix A:

Annual Ratio of Production to Consumption



Production to consumption in oil-consuming countries



<u>Appendix B Regressions:</u>

<u>A) Full Sample:</u>

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:49
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_C	DLN_BRENT	DLN_GDP_C	DLN_SP_C
D_IR_C(-1)	0.253076	-0.025302	-0.002304	0.012153
	(0.11163)	(0.03868)	(0.00132)	(0.01963)
	[2.26711]	[-0.65407]	[-1.74394]	[0.61901]
D_IR_C(-2)	-0.072471	-0.009592	-5.84E-05	0.004422
	(0.09691)	(0.03358)	(0.00115)	(0.01704)
	[-0.74783]	[-0.28563]	[-0.05097]	[0.25948]
DLN_BRENT(-1)	0.312928	0.255043	0.009433	-0.061260
	(0.37139)	(0.12870)	(0.00439)	(0.06532)
	[0.84258]	[1.98165]	[2.14643]	[-0.93788]
DLN_BRENT(-2)	-0.570120	-0.117633	-0.000121	0.032936
	(0.38449)	(0.13324)	(0.00455)	(0.06762)
	[-1.48278]	[-0.88285]	[-0.02665]	[0.48706]
DLN_GDP_C(-1)	19.31783	0.031049	0.430778	1.754650
	(10.1324)	(3.51129)	(0.11990)	(1.78201)
	[1.90654]	[0.00884]	[3.59290]	[0.98465]
DLN_GDP_C(-2)	12.29351	2.750164	0.000823	-3.037344
	(9.65032)	(3.34423)	(0.11419)	(1.69722)
	[1.27390]	[0.82236]	[0.00721]	[-1.78960]
DLN_SP_C(-1)	1.358861	0.456614	0.014851	0.316761
	(0.73688)	(0.25536)	(0.00872)	(0.12960)
	[1.84406]	[1.78812]	[1.70324]	[2.44419]
DLN_SP_C(-2)	0.119658	-0.280011	0.009452	-0.154055
	(0.75869)	(0.26292)	(0.00898)	(0.13343)
	[0.15772]	[-1.06502]	[1.05286]	[-1.15456]
C	-0.249587	-0.018607	0.002968	0.016152
	(0.07966)	(0.02761)	(0.00094)	(0.01401)
	[-3.13296]	[-0.67398]	[3.14895]	[1.15285]
R-squared	0.336953	0.173256	0.430757	0.125691
Adj. R-squared	0.268065	0.087360	0.371615	0.034854
Sum sq. resids	13.30862	1.598238	0.001863	0.411648
S.E. equation	0.415739	0.144071	0.004919	0.073117
F-statistic	4.891325	2.017052	7.283420	1.383694
Log likelihood	-41.79348	49.34545	339.7766	107.6744
Akaike AIC	1.181244	-0.938266	-7.692480	-2.294754
Schwarz SC	1.438094	-0.681416	-7.435629	-2.037904
Mean dependent	-0.059262	0.002707	0.006007	0.008348
S.D. dependent	0.485943	0.150808	0.006206	0.074425

Determinant resid covariance (dof adj.)	2.95E-10
Determinant resid covariance	1.90E-10
Log likelihood	474.5008
Akaike information criterion	-10.19769
Schwarz criterion	-9.170292

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:51
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_F	DLN_BRENT	DLN_GDP_F	DLN_SP_F
D_IR_F(-1)	0.047280	-0.088267	7.87E-06	-0.034168
	(0.11442)	(0.04267)	(0.00103)	(0.02514)
	[0.41323]	[-2.06839]	[0.00766]	[-1.35908]
D_IR_F(-2)	0.074323	-0.053141	-0.003028	-0.038916
	(0.10959)	(0.04087)	(0.00098)	(0.02408)
	[0.67820]	[-1.30013]	[-3.07943]	[-1.61613]
DLN_BRENT(-1)	0.750530	0.277747	0.001684	-0.094396
	(0.30899)	(0.11524)	(0.00277)	(0.06789)
	[2.42897]	[2.41006]	[0.60730]	[-1.39036]
DLN_BRENT(-2)	-0.062320	-0.133541	-0.004864	0.007984
	(0.31149)	(0.11618)	(0.00280)	(0.06844)
	[-0.20007]	[-1.14945]	[-1.74004]	[0.11666]
DLN_GDP_F(-1)	19.68529	7.285304	0.366236	8.030472
	(12.6435)	(4.71566)	(0.11345)	(2.77811)
	[1.55695]	[1.54492]	[3.22813]	[2.89062]
DLN_GDP_F(-2)	16.75329	6.195157	0.327296	-2.935221
	(11.7655)	(4.38818)	(0.10557)	(2.58519)
	[1.42394]	[1.41178]	[3.10019]	[-1.13540]
DLN_SP_F(-1)	0.484961	0.156548	0.013957	0.184786
	(0.52869)	(0.19719)	(0.00474)	(0.11617)
	[0.91729]	[0.79391]	[2.94194]	[1.59069]
DLN_SP_F(-2)	0.511999	-0.354505	0.003316	0.015785
	(0.54168)	(0.20203)	(0.00486)	(0.11902)
	[0.94520]	[-1.75469]	[0.68218]	[0.13262]
C	-0.214015	-0.060559	0.000871	-0.020124
	(0.07171)	(0.02675)	(0.00064)	(0.01576)
	[-2.98431]	[-2.26416]	[1.35299]	[-1.27711]
R-squared	0.385854	0.242505	0.565468	0.227652
Adj. R-squared	0.322046	0.163804	0.520321	0.147408
Sum sq. resids	10.52687	1.464367	0.000848	0.508235
S.E. equation	0.369747	0.137905	0.003318	0.081243
F-statistic	6.047161	3.081356	12.52524	2.836995
Log likelihood	-31.71082	53.10703	373.6520	98.61113
Akaike AIC	0.946763	-1.025745	-8.480280	-2.083980
Schwarz SC	1.203614	-0.768895	-8.223429	-1.827130
Mean dependent	-0.067540	0.002707	0.003934	0.005648
S.D. dependent	0.449060	0.150808	0.004790	0.087987

Determinant resid covariance (dof adj.)	1.49E-10
Determinant resid covariance	9.57E-11
Log likelihood	503.8976
Akaike information criterion	-10.88134
Schwarz criterion	-9.853938

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:51
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_G	DLN_BRENT	DLN_GDP_G	DLN_SP_G
D_IR_G(-1)	0.078405	-0.147242	-0.000484	-0.074151
	(0.12394)	(0.06833)	(0.00349)	(0.04682)
	[0.63259]	[-2.15498]	[-0.13845]	[-1.58375]
D_IR_G(-2)	0.103377	-0.026779	0.000323	-0.015563
	(0.10714)	(0.05906)	(0.00302)	(0.04047)
	[0.96488]	[-0.45339]	[0.10707]	[-0.38454]
DLN_BRENT(-1)	0.979017	0.336575	0.020800	-0.053446
	(0.21149)	(0.11659)	(0.00596)	(0.07989)
	[4.62905]	[2.88682]	[3.48811]	[-0.66898]
DLN_BRENT(-2)	-0.204793	-0.098421	-0.003104	0.048841
	(0.23169)	(0.12773)	(0.00653)	(0.08752)
	[-0.88389]	[-0.77056]	[-0.47520]	[0.55804]
DLN_GDP_G(-1)	11.98849	3.349387	0.120869	1.819977
	(4.55631)	(2.51175)	(0.12846)	(1.72114)
	[2.63118]	[1.33349]	[0.94088]	[1.05742]
DLN_GDP_G(-2)	5.558207	3.426987	0.056866	-0.625516
	(4.50449)	(2.48319)	(0.12700)	(1.70157)
	[1.23392]	[1.38008]	[0.44775]	[-0.36761]
DLN_SP_G(-1)	0.899143	0.248195	0.025484	0.268632
	(0.32343)	(0.17830)	(0.00912)	(0.12218)
	[2.78001]	[1.39202]	[2.79460]	[2.19873]
DLN_SP_G(-2)	0.335983	-0.164590	0.004998	0.085551
	(0.32854)	(0.18111)	(0.00926)	(0.12411)
	[1.02266]	[-0.90877]	[0.53955]	[0.68934]
C	-0.130846	-0.033822	0.002208	-0.001025
	(0.03875)	(0.02136)	(0.00109)	(0.01464)
	[-3.37629]	[-1.58314]	[2.02075]	[-0.07004]
R-squared	0.576918	0.215760	0.337941	0.142072
Adj. R-squared	0.532961	0.134281	0.269156	0.052936
Sum sq. resids	4.988753	1.516069	0.003966	0.711865
S.E. equation	0.254537	0.140318	0.007177	0.096151
F-statistic	13.12472	2.648034	4.912986	1.593884
Log likelihood	0.399226	51.61503	307.3009	84.12251
Akaike AIC	0.200018	-0.991047	-6.937231	-1.747035
Schwarz SC	0.456868	-0.734197	-6.680380	-1.490185
Mean dependent	-0.060458	0.002707	0.003385	0.014306
S.D. dependent	0.372455	0.150808	0.008395	0.098802
Determinant resid covariance (dof adj.)	4.18E-10			
Determinant resid covariance	2.69E-10			
Log likelihood	459.5162			
Akaike information criterion	-9.849214			
Schwarz criterion	-8.821813			

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:52
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	IR_JAPAN	DLN_BRENT	DLN_GDP_J	DLN_SP_J
IR_JAPAN(-1)	1.275913	-0.006035	-0.000132	-0.153138
	(0.09856)	(0.11930)	(0.00790)	(0.07362)
	[12.9457]	[-0.05059]	[-0.01671]	[-2.07998]
IR_JAPAN(-2)	-0.399878	0.005203	0.000919	0.107030
	(0.09107)	(0.11024)	(0.00730)	(0.06803)
	[-4.39067]	[0.04720]	[0.12590]	[1.57319]
DLN_BRENT(-1)	0.197009	0.292217	0.006517	-0.086433
	(0.10185)	(0.12329)	(0.00817)	(0.07608)
	[1.93427]	[2.37015]	[0.79817]	[-1.13601]
DLN_BRENT(-2)	-0.063240	-0.151380	-0.001909	-0.034179
	(0.10415)	(0.12608)	(0.00835)	(0.07781)
	[-0.60717]	[-1.20069]	[-0.22859]	[-0.43929]
DLN_GDP_J(-1)	-0.461713	-0.165210	-0.025097	1.165713
	(1.44562)	(1.74990)	(0.11589)	(1.07990)
	[-0.31939]	[-0.09441]	[-0.21656]	[1.07947]
DLN_GDP_J(-2)	0.927572	0.567066	0.127738	-0.088866
	(1.35707)	(1.64271)	(0.10879)	(1.01375)
	[0.68351]	[0.34520]	[1.17416]	[-0.08766]
DLN_SP_J(-1)	-0.059948	0.242071	0.026969	0.266450
	(0.16415)	(0.19870)	(0.01316)	(0.12262)
	[-0.36521]	[1.21829]	[2.04948]	[2.17297]
DLN_SP_J(-2)	0.198925	-0.060333	0.010388	-0.104537
	(0.16715)	(0.20233)	(0.01340)	(0.12486)
	[1.19013]	[-0.29820]	[0.77528]	[-0.83724]
C	0.031826	0.002455	0.000299	0.013344
	(0.01766)	(0.02138)	(0.00142)	(0.01319)
	[1.80225]	[0.11486]	[0.21102]	[1.01153]
R-squared	0.923813	0.135806	0.140283	0.197625
Adj. R-squared	0.915898	0.046020	0.050961	0.114262
Sum sq. resids	1.140152	1.670634	0.007327	0.636240
S.E. equation	0.121685	0.147297	0.009755	0.090900
F-statistic	116.7097	1.512545	1.570540	2.370640
Log likelihood	63.86829	47.44047	280.9021	88.95195
Akaike AIC	-1.276007	-0.893964	-6.323305	-1.859348
Schwarz SC	-1.019156	-0.637114	-6.066455	-1.602497
Mean dependent	0.369185	0.002707	0.000694	-0.002413
S.D. dependent	0.419597	0.150808	0.010014	0.096586
Determinant resid covariance (dof adj.)	1.97E-10			
Determinant resid covariance	1.27E-10			
Log likelihood	491.8304			
Akaike information criterion	-10.60071			
Schwarz criterion	-9.573305			

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:53
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_N	DLN_BRENT	DLN_OIL_P...	DLN_SP_N
D_IR_N(-1)	0.589392	-0.016980	-0.013307	-0.070700
	(0.10353)	(0.03024)	(0.03018)	(0.02711)
	[5.69291]	[-0.56156]	[-0.44087]	[-2.60789]
D_IR_N(-2)	-0.046941	0.020189	0.021625	-0.000141
	(0.10226)	(0.02987)	(0.02981)	(0.02678)
	[-0.45905]	[0.67600]	[0.72534]	[-0.00526]
DLN_BRENT(-1)	0.263940	1.273756	1.539112	-0.159333
	(3.14226)	(0.91775)	(0.91613)	(0.82281)
	[0.08400]	[1.38791]	[1.68001]	[-0.19364]
DLN_BRENT(-2)	1.463487	1.112604	1.222777	0.276217
	(3.17693)	(0.92787)	(0.92624)	(0.83189)
	[0.46066]	[1.19909]	[1.32015]	[0.33203]
DLN_OIL_PRICES(-1)	0.024112	-1.016723	-1.263831	0.068979
	(3.14557)	(0.91872)	(0.91710)	(0.82368)
	[0.00767]	[-1.10668]	[-1.37807]	[0.08374]
DLN_OIL_PRICES(-2)	-2.446783	-1.172365	-1.293306	-0.145310
	(3.12014)	(0.91129)	(0.90969)	(0.81702)
	[-0.78419]	[-1.28649]	[-1.42171]	[-0.17785]
DLN_SP_N(-1)	-0.068473	0.468736	0.478561	0.095978
	(0.45116)	(0.13177)	(0.13154)	(0.11814)
	[-0.15177]	[3.55730]	[3.63826]	[0.81243]
DLN_SP_N(-2)	2.080200	-0.151852	-0.144596	-0.024375
	(0.47322)	(0.13821)	(0.13797)	(0.12391)
	[4.39588]	[-1.09870]	[-1.04804]	[-0.19671]
C	-0.045110	0.007266	0.014010	0.013212
	(0.05728)	(0.01673)	(0.01670)	(0.01500)
	[-0.78749]	[0.43428]	[0.83888]	[0.88078]
R-squared	0.462032	0.289078	0.309490	0.137886
Adj. R-squared	0.406139	0.215216	0.237749	0.048315
Sum sq. resids	16.11122	1.374334	1.369500	1.104710
S.E. equation	0.457424	0.133598	0.133363	0.119778
F-statistic	8.266395	3.913750	4.313979	1.539412
Log likelihood	-50.01097	55.83554	55.98705	65.22615
Akaike AIC	1.372348	-1.089199	-1.092722	-1.307585
Schwarz SC	1.629198	-0.832348	-0.835872	-1.050735
Mean dependent	-0.057364	0.002707	0.007610	0.018290
S.D. dependent	0.593576	0.150808	0.152752	0.122781
Determinant resid covariance (dof adj.)	1.26E-08			
Determinant resid covariance	8.09E-09			
Log likelihood	313.0850			
Akaike information criterion	-6.443836			
Schwarz criterion	-5.416435			

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:53
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_UK	DLN_BRENT	DLN_GDP_UK	DLN_SP_UK
D_IR_UK(-1)	0.542370	-0.050404	0.011944	0.025811
	(0.12217)	(0.05049)	(0.00500)	(0.01924)
	[4.43941]	[-0.99826]	[2.38749]	[1.34189]
D_IR_UK(-2)	-0.058458	-0.054213	-0.003682	-0.052209
	(0.11604)	(0.04796)	(0.00475)	(0.01827)
	[-0.50377]	[-1.13043]	[-0.77476]	[-2.85764]
DLN_BRENT(-1)	0.941907	0.353473	0.010791	-0.002173
	(0.29447)	(0.12170)	(0.01206)	(0.04636)
	[3.19866]	[2.90448]	[0.89486]	[-0.04687]
DLN_BRENT(-2)	-0.423234	-0.053149	0.011497	0.052073
	(0.29892)	(0.12354)	(0.01224)	(0.04706)
	[-1.41588]	[-0.43023]	[0.93924]	[1.10646]
DLN_GDP_UK(-1)	-0.297244	-0.460607	-0.089556	-0.556860
	(1.71675)	(0.70950)	(0.07030)	(0.27029)
	[-0.17314]	[-0.64920]	[-1.27391]	[-2.06022]
DLN_GDP_UK(-2)	1.533515	1.248590	-0.743871	-0.121011
	(1.72195)	(0.71166)	(0.07051)	(0.27111)
	[0.89057]	[1.75448]	[-10.5493]	[-0.44635]
DLN_SP_UK(-1)	-0.262219	-0.098542	-0.042012	0.343797
	(0.69224)	(0.28609)	(0.02835)	(0.10899)
	[-0.37880]	[-0.34444]	[-1.48207]	[3.15445]
DLN_SP_UK(-2)	-0.901976	0.092988	-0.006648	-0.066093
	(0.68559)	(0.28335)	(0.02808)	(0.10794)
	[-1.31561]	[0.32818]	[-0.23681]	[-0.61230]
C	-0.055882	-0.009060	0.009610	-0.007278
	(0.04299)	(0.01777)	(0.00176)	(0.00677)
	[-1.29980]	[-0.50988]	[5.45869]	[-1.07513]
R-squared	0.448577	0.210404	0.666026	0.264371
Adj. R-squared	0.391287	0.128368	0.631327	0.187942
Sum sq. resids	8.936689	1.526423	0.014986	0.221527
S.E. equation	0.340677	0.140797	0.013951	0.053637
F-statistic	7.829847	2.564782	19.19460	3.459047
Log likelihood	-24.66888	51.32235	250.1362	134.3182
Akaike AIC	0.782997	-0.984241	-5.607818	-2.914377
Schwarz SC	1.039848	-0.727390	-5.350967	-2.657527
Mean dependent	-0.056979	0.002707	0.005219	-0.013387
S.D. dependent	0.436653	0.150808	0.022976	0.059522
Determinant resid covariance (dof adj.)	1.02E-09			
Determinant resid covariance	6.58E-10			
Log likelihood	421.0009			
Akaike information criterion	-8.953510			
Schwarz criterion	-7.926109			

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:54
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_US	DLN_BRENT	DLN_GDP_US	DLN_SP_US
D_IR_US(-1)	0.411110	-0.096069	-0.000874	-0.019906
	(0.11832)	(0.04611)	(0.00365)	(0.02033)
	[3.47463]	[-2.08355]	[-0.23958]	[-0.97918]
D_IR_US(-2)	0.118796	0.083803	-0.001377	0.027049
	(0.10686)	(0.04164)	(0.00330)	(0.01836)
	[1.11171]	[2.01242]	[-0.41789]	[1.47324]
DLN_BRENT(-1)	0.941455	0.381412	-0.009416	0.014532
	(0.30062)	(0.11715)	(0.00927)	(0.05165)
	[3.13176]	[3.25574]	[-1.01575]	[0.28136]
DLN_BRENT(-2)	-0.239225	-0.152873	0.001288	-0.052367
	(0.30943)	(0.12058)	(0.00954)	(0.05316)
	[-0.77312]	[-1.26777]	[0.13501]	[-0.98500]
DLN_GDP_US(-1)	6.747529	1.031297	0.370958	0.310792
	(3.80757)	(1.48382)	(0.11742)	(0.65420)
	[1.77214]	[0.69503]	[3.15933]	[0.47507]
DLN_GDP_US(-2)	-1.852336	-1.898221	-0.003019	-0.108528
	(3.74038)	(1.45764)	(0.11534)	(0.64266)
	[-0.49523]	[-1.30226]	[-0.02617]	[-0.16887]
DLN_SP_US(-1)	1.159113	0.432263	0.016812	0.250597
	(0.68358)	(0.26639)	(0.02108)	(0.11745)
	[1.69564]	[1.62265]	[0.79751]	[2.13364]
DLN_SP_US(-2)	-0.198481	-0.109472	0.003637	0.072978
	(0.69193)	(0.26965)	(0.02134)	(0.11889)
	[-0.28685]	[-0.40598]	[0.17043]	[0.61385]
C	-0.092088	0.004984	0.006295	0.006213
	(0.06093)	(0.02375)	(0.00188)	(0.01047)
	[-1.51133]	[0.20989]	[3.35016]	[0.59349]
R-squared	0.417636	0.208667	0.168012	0.105083
Adj. R-squared	0.357131	0.126450	0.081572	0.012105
Sum sq. resids	10.07310	1.529782	0.009579	0.297366
S.E. equation	0.361690	0.140951	0.011154	0.062144
F-statistic	6.902467	2.538014	1.943681	1.130192
Log likelihood	-29.81614	51.22782	269.3793	121.6583
Akaike AIC	0.902701	-0.982042	-6.055333	-2.619960
Schwarz SC	1.159551	-0.725192	-5.798483	-2.363110
Mean dependent	-0.050039	0.002707	0.010327	0.011801
S.D. dependent	0.451102	0.150808	0.011638	0.062524

Determinant resid covariance (dof adj.)	1.07E-09
Determinant resid covariance	6.90E-10
Log likelihood	418.9142
Akaike information criterion	-8.904980
Schwarz criterion	-7.877579

B) Sub-Group 1:

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:54
Sample (adjusted): 1994Q4 2002Q4
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_C	DLN_BRENT	DLN_GDP_C	DLN_SP_C
D_IR_C(-1)	0.018472	-0.027421	-0.003146	0.003401
	(0.20392)	(0.04153)	(0.00165)	(0.02515)
	[0.09059]	[-0.66023]	[-1.90945]	[0.13524]
D_IR_C(-2)	-0.168220	-0.027989	-0.001322	-0.002127
	(0.17239)	(0.03511)	(0.00139)	(0.02126)
	[-0.97582]	[-0.79718]	[-0.94878]	[-0.10008]
DLN_BRENT(-1)	-0.688164	0.376681	-0.003000	-0.084528
	(0.96404)	(0.19634)	(0.00779)	(0.11888)
	[-0.71384]	[1.91850]	[-0.38511]	[-0.71102]
DLN_BRENT(-2)	-0.290989	-0.185797	0.007112	0.262176
	(0.90399)	(0.18411)	(0.00730)	(0.11148)
	[-0.32190]	[-1.00916]	[0.97373]	[2.35184]
DLN_GDP_C(-1)	28.97821	10.52281	0.383498	6.873428
	(25.5715)	(5.20804)	(0.20662)	(3.15340)
	[1.13322]	[2.02049]	[1.85605]	[2.17969]
DLN_GDP_C(-2)	70.36771	0.456544	0.442517	-5.815040
	(31.4548)	(6.40629)	(0.25416)	(3.87892)
	[2.23710]	[0.07126]	[1.74110]	[-1.49914]
DLN_SP_C(-1)	-0.319608	0.105756	-0.008430	0.191455
	(1.56476)	(0.31869)	(0.01264)	(0.19296)
	[-0.20425]	[0.33185]	[-0.66674]	[0.99219]
DLN_SP_C(-2)	0.599278	-0.199086	-0.001037	0.024389
	(1.57545)	(0.32087)	(0.01273)	(0.19428)
	[0.38039]	[-0.62047]	[-0.08150]	[0.12553]
C	-0.945153	-0.088800	0.000835	-0.004315
	(0.31925)	(0.06502)	(0.00258)	(0.03937)
	[-2.96056]	[-1.36573]	[0.32371]	[-0.10959]
R-squared	0.390054	0.357073	0.345709	0.409737
Adj. R-squared	0.186739	0.142764	0.127612	0.212983
Sum sq. resids	8.409259	0.348816	0.000549	0.127881
S.E. equation	0.591934	0.120557	0.004783	0.072996
F-statistic	1.918470	1.666158	1.585114	2.082482
Log likelihood	-24.26660	28.24540	134.7389	44.80227
Akaike AIC	2.016157	-1.166388	-7.620540	-2.169835
Schwarz SC	2.424296	-0.758249	-7.212401	-1.761696
Mean dependent	-0.092031	0.008121	0.008251	0.007436
S.D. dependent	0.656384	0.130209	0.005121	0.082282

Determinant resid covariance (dof adj.)	4.65E-10
Determinant resid covariance	1.30E-10
Log likelihood	188.2955
Akaike information criterion	-9.230032
Schwarz criterion	-7.597478

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:55
Sample (adjusted): 1994Q4 2002Q4
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_F	DLN_BRENT	DLN_GDP_C	DLN_SP_F
D_IR_F(-1)	-0.090232	-0.074822	-0.003056	0.006291
	(0.19184)	(0.04588)	(0.00186)	(0.03602)
	[-0.47034]	[-1.63087]	[-1.64446]	[0.17465]
D_IR_F(-2)	0.164422	-0.022712	-0.001797	0.000348
	(0.18195)	(0.04351)	(0.00176)	(0.03416)
	[0.90366]	[-0.52195]	[-1.01969]	[0.01018]
DLN_BRENT(-1)	-0.184678	0.394059	-0.004219	-0.073644
	(0.81751)	(0.19550)	(0.00792)	(0.15350)
	[-0.22590]	[2.01560]	[-0.53274]	[-0.47977]
DLN_BRENT(-2)	0.529369	-0.214602	0.008527	0.206877
	(0.73019)	(0.17462)	(0.00707)	(0.13710)
	[0.72498]	[-1.22895]	[1.20541]	[1.50890]
DLN_GDP_C(-1)	48.96665	10.96143	0.283716	7.633897
	(20.0740)	(4.80065)	(0.19446)	(3.76921)
	[2.43930]	[2.28332]	[1.45896]	[2.02533]
DLN_GDP_C(-2)	16.19131	2.099262	0.315576	-6.516780
	(24.9071)	(5.95646)	(0.24128)	(4.67670)
	[0.65007]	[0.35243]	[1.30790]	[-1.39346]
DLN_SP_F(-1)	-0.907268	0.040879	-0.003502	0.307880
	(1.07215)	(0.25640)	(0.01039)	(0.20131)
	[-0.84621]	[0.15943]	[-0.33715]	[1.52936]
DLN_SP_F(-2)	1.437298	-0.233068	0.015495	0.094956
	(1.11446)	(0.26652)	(0.01080)	(0.20926)
	[1.28968]	[-0.87449]	[1.43521]	[0.45378]
C	-0.641079	-0.108152	0.002475	-0.003821
	(0.25104)	(0.06003)	(0.00243)	(0.04714)
	[-2.55371]	[-1.80149]	[1.01787]	[-0.08106]
R-squared	0.379873	0.403518	0.367166	0.355169
Adj. R-squared	0.173163	0.204691	0.156222	0.140225
Sum sq. resids	5.658499	0.323617	0.000531	0.199495
S.E. equation	0.485562	0.116121	0.004704	0.091172
F-statistic	1.837716	2.029493	1.740583	1.652381
Log likelihood	-17.72971	29.48262	135.2891	37.46483
Akaike AIC	1.619983	-1.241371	-7.653885	-1.725141
Schwarz SC	2.028121	-0.833232	-7.245746	-1.317003
Mean dependent	-0.076168	0.008121	0.008251	0.010355
S.D. dependent	0.533993	0.130209	0.005121	0.098326

Determinant resid covariance (dof adj.)	4.82E-10
Determinant resid covariance	1.35E-10
Log likelihood	187.7069
Akaike information criterion	-9.194359
Schwarz criterion	-7.561805

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:56
Sample (adjusted): 1995Q1 2002Q4
Included observations: 32 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_G	DLN_BRENT	DLN_GDP_G	DLN_SP_G
D_IR_G(-1)	0.053638	-0.081527	0.003426	-0.083146
	(0.21559)	(0.08160)	(0.00371)	(0.06506)
	[0.24879]	[-0.99916]	[0.92468]	[-1.27807]
D_IR_G(-2)	0.043555	-0.003422	0.004796	-0.120530
	(0.21359)	(0.08084)	(0.00367)	(0.06445)
	[0.20392]	[-0.04233]	[1.30657]	[-1.87008]
D_IR_G(-3)	0.190617	-0.007685	0.005621	-0.034586
	(0.17483)	(0.06617)	(0.00300)	(0.05275)
	[1.09031]	[-0.11614]	[1.87072]	[-0.65561]
DLN_BRENT(-1)	1.001784	0.526426	0.010109	-0.139918
	(0.50983)	(0.19295)	(0.00876)	(0.15384)
	[1.96494]	[2.72825]	[1.15368]	[-0.90949]
DLN_BRENT(-2)	0.325197	-0.205365	0.031144	0.173786
	(0.55259)	(0.20914)	(0.00950)	(0.16674)
	[0.58850]	[-0.98197]	[3.27930]	[1.04223]
DLN_BRENT(-3)	0.190083	0.307208	-0.012719	0.200363
	(0.59620)	(0.22564)	(0.01025)	(0.17990)
	[0.31882]	[1.36148]	[-1.24125]	[1.11372]
DLN_GDP_G(-1)	7.867346	2.983757	-0.436805	3.488982
	(10.4071)	(3.93877)	(0.17887)	(3.14039)
	[0.75596]	[0.75754]	[-2.44206]	[1.11100]
DLN_GDP_G(-2)	-4.253027	-3.227210	-0.374011	1.052570
	(11.0653)	(4.18786)	(0.19018)	(3.33898)
	[-0.38436]	[-0.77061]	[-1.96663]	[0.31524]
DLN_GDP_G(-3)	-8.359772	-9.343962	-0.469809	7.632096
	(10.3541)	(3.91872)	(0.17796)	(3.12440)
	[-0.80738]	[-2.38444]	[-2.64001]	[2.44274]
DLN_SP_G(-1)	1.114887	0.112696	0.025787	0.390456
	(0.60351)	(0.22841)	(0.01037)	(0.18211)
	[1.84732]	[0.49339]	[2.48605]	[2.14403]
DLN_SP_G(-2)	0.663145	-0.046586	0.011374	-0.234611
	(0.82530)	(0.31235)	(0.01418)	(0.24904)
	[0.80352]	[-0.14915]	[0.80184]	[-0.94207]
DLN_SP_G(-3)	0.865522	0.057663	-0.016934	0.634327
	(0.78135)	(0.29572)	(0.01343)	(0.23578)
	[1.10772]	[0.19500]	[-1.26096]	[2.69039]
C	-0.086429	0.038448	0.009642	-0.072357
	(0.11871)	(0.04493)	(0.00204)	(0.03582)
	[-0.72806]	[0.85577]	[4.72595]	[-2.01993]

R-squared	0.552995	0.565944	0.618044	0.598859
Adj. R-squared	0.270676	0.291803	0.376808	0.345508
Sum sq. resids	1.641770	0.235165	0.000485	0.149492
S.E. equation	0.293954	0.111252	0.005052	0.088702
F-statistic	1.958759	2.064430	2.561992	2.363746
Log likelihood	2.113339	33.20525	132.1486	40.45398
Akaike AIC	0.680416	-1.262828	-7.446785	-1.715874
Schwarz SC	1.275872	-0.667373	-6.851329	-1.120418
Mean dependent	-0.067746	0.008969	0.003697	0.009321
S.D. dependent	0.344207	0.132200	0.006400	0.109643

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:57
Sample (adjusted): 1994Q4 2002Q4
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	IR_JAPAN	DLN_BRENT	DLN_GDP_J	DLN_SP_J
IR_JAPAN(-1)	1.228647	0.006529	0.005353	-0.163027
	(0.18241)	(0.10503)	(0.00833)	(0.08989)
	[6.73577]	[0.06217]	[0.64294]	[-1.81362]
IR_JAPAN(-2)	-0.399439	-0.003395	-0.001375	0.147975
	(0.17314)	(0.09969)	(0.00790)	(0.08532)
	[-2.30701]	[-0.03406]	[-0.17404]	[1.73426]
DLN_BRENT(-1)	0.120016	0.186302	0.014269	-0.155442
	(0.37219)	(0.21430)	(0.01699)	(0.18341)
	[0.32246]	[0.86936]	[0.84001]	[-0.84749]
DLN_BRENT(-2)	-0.172694	-0.121601	0.008077	0.124717
	(0.30736)	(0.17697)	(0.01403)	(0.15147)
	[-0.56186]	[-0.68712]	[0.57577]	[0.82340]
DLN_GDP_J(-1)	2.348771	-2.514380	-0.078037	-0.232677
	(4.58926)	(2.64241)	(0.20946)	(2.26160)
	[0.51180]	[-0.95155]	[-0.37256]	[-0.10288]
DLN_GDP_J(-2)	3.042616	0.819810	-0.014959	-0.384876
	(4.31534)	(2.48469)	(0.19696)	(2.12661)
	[0.70507]	[0.32994]	[-0.07595]	[-0.18098]
DLN_SP_J(-1)	-0.019966	0.787757	0.007558	0.166466
	(0.40442)	(0.23286)	(0.01846)	(0.19930)
	[-0.04937]	[3.38296]	[0.40947]	[0.83525]
DLN_SP_J(-2)	0.509702	0.237784	-0.002241	0.114421
	(0.52153)	(0.30029)	(0.02380)	(0.25701)
	[0.97732]	[0.79185]	[-0.09416]	[0.44520]
C	0.062813	0.030010	-0.001531	-0.019668
	(0.04946)	(0.02848)	(0.00226)	(0.02437)
	[1.26997]	[1.05378]	[-0.67831]	[-0.80691]

R-squared	0.907249	0.455089	0.148694	0.156774
Adj. R-squared	0.876333	0.273452	-0.135075	-0.124302
Sum sq. resids	0.891754	0.295637	0.001858	0.216566
S.E. equation	0.192760	0.110988	0.008798	0.094993
F-statistic	29.34483	2.505489	0.523997	0.557763
Log likelihood	12.75772	30.97466	114.6264	36.11008
Akaike AIC	-0.227741	-1.331797	-6.401600	-1.643035
Schwarz SC	0.180398	-0.923659	-5.993461	-1.234897
Mean dependent	0.519200	0.008121	0.000715	-0.025109
S.D. dependent	0.548137	0.130209	0.008258	0.089588

Determinant resid covariance (dof adj.)	2.24E-10
Determinant resid covariance	6.27E-11
Log likelihood	200.3307
Akaike information criterion	-9.959435
Schwarz criterion	-8.326881

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:57
Sample (adjusted): 1995Q2 2002Q4
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_N	DLN_BRENT	DLN_GDP_N	DLN_SP_N
D_IR_N(-1)	0.604331	0.122664	-0.006912	-0.060198
	(0.23187)	(0.04891)	(0.01061)	(0.07008)
	[2.60635]	[2.50803]	[-0.65142]	[-0.85902]
D_IR_N(-2)	0.019085	0.002507	-0.016138	-0.011012
	(0.22484)	(0.04743)	(0.01029)	(0.06795)
	[0.08488]	[0.05286]	[-1.56847]	[-0.16206]
D_IR_N(-3)	-0.157808	-0.049669	0.001330	0.071577
	(0.22399)	(0.04725)	(0.01025)	(0.06769)
	[-0.70454]	[-1.05131]	[0.12978]	[1.05735]
D_IR_N(-4)	0.217766	0.038396	-0.011935	-0.044188
	(0.17271)	(0.03643)	(0.00790)	(0.05220)
	[1.26090]	[1.05400]	[-1.51015]	[-0.84657]
DLN_BRENT(-1)	-1.359888	0.348731	0.027369	-0.028066
	(0.89190)	(0.18813)	(0.04081)	(0.26956)
	[-1.52471]	[1.85367]	[0.67057]	[-0.10412]
DLN_BRENT(-2)	-0.975673	-0.064155	0.020181	0.368342
	(0.93490)	(0.19720)	(0.04278)	(0.28255)
	[-1.04361]	[-0.32533]	[0.47172]	[1.30362]
DLN_BRENT(-3)	2.009286	0.530561	-0.063591	-0.197879
	(0.92308)	(0.19471)	(0.04224)	(0.27898)
	[2.17671]	[2.72492]	[-1.50541]	[-0.70929]
DLN_BRENT(-4)	-1.213766	-0.382076	-0.031216	0.287389
	(0.90562)	(0.19102)	(0.04144)	(0.27371)
	[-1.34025]	[-2.00014]	[-0.75325]	[1.04999]
DLN_GDP_N(-1)	-1.082842	0.327870	-1.139009	0.537366
	(5.46669)	(1.15310)	(0.25016)	(1.65219)
	[-0.19808]	[0.28434]	[-4.55308]	[0.32525]
DLN_GDP_N(-2)	3.915053	2.893370	-1.197435	0.670724
	(5.58364)	(1.17776)	(0.25551)	(1.68753)
	[0.70116]	[2.45666]	[-4.68637]	[0.39746]
DLN_GDP_N(-3)	7.024556	0.801785	-1.096357	-0.159865
	(4.86412)	(1.02600)	(0.22259)	(1.47007)
	[1.44416]	[0.78147]	[-4.92549]	[-0.10875]
DLN_GDP_N(-4)	-1.124104	1.008478	-0.256654	1.414145
	(5.02179)	(1.05925)	(0.22980)	(1.51773)
	[-0.22385]	[0.95207]	[-1.11684]	[0.93175]
DLN_SP_N(-1)	-1.752613	0.420289	0.033492	0.181504
	(0.91711)	(0.19345)	(0.04197)	(0.27718)
	[-1.91101]	[2.17262]	[0.79804]	[0.65483]
DLN_SP_N(-2)	3.222878	0.055268	0.068723	-0.460002
	(1.07440)	(0.22663)	(0.04917)	(0.32471)
	[2.99969]	[0.24387]	[1.39778]	[-1.41663]
DLN_SP_N(-3)	0.251008	-0.408864	0.016954	0.136181
	(1.10413)	(0.23290)	(0.05053)	(0.33370)
	[0.22734]	[-1.75557]	[0.33554]	[0.40810]
DLN_SP_N(-4)	0.292907	-0.909482	0.104612	-0.177488
	(1.16676)	(0.24611)	(0.05339)	(0.35263)

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:58
Sample (adjusted): 1994Q4 2002Q4
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_UK	DLN_BRENT	DLN_GDP_UK	DLN_SP_UK
D_IR_UK(-1)	0.628324	-0.022749	0.003081	0.042596
	(0.22320)	(0.06599)	(0.00638)	(0.03210)
	[2.81512]	[-0.34475]	[0.48283]	[1.32695]
D_IR_UK(-2)	-0.207271	-0.151442	0.002460	-0.058672
	(0.24392)	(0.07212)	(0.00697)	(0.03508)
	[-0.84974]	[-2.10000]	[0.35278]	[-1.67243]
DLN_BRENT(-1)	0.062753	0.152778	0.036314	0.012754
	(0.74137)	(0.21918)	(0.02119)	(0.10663)
	[0.08464]	[0.69703]	[1.71349]	[0.11961]
DLN_BRENT(-2)	0.493876	-0.044953	-0.004853	-0.015165
	(0.64842)	(0.19170)	(0.01854)	(0.09326)
	[0.76166]	[-0.23449]	[-0.26180]	[-0.16261]
DLN_GDP_UK(-1)	-1.951124	-0.364245	-0.067262	-0.523786
	(3.13527)	(0.92693)	(0.08963)	(0.45093)
	[-0.62231]	[-0.39296]	[-0.75048]	[-1.16158]
DLN_GDP_UK(-2)	-0.466296	0.665234	-0.834822	-0.172375
	(2.95111)	(0.87249)	(0.08436)	(0.42444)
	[-0.15801]	[0.76246]	[-9.89574]	[-0.40612]
DLN_SP_UK(-1)	0.266570	0.270980	0.002293	0.524945
	(1.24059)	(0.36678)	(0.03546)	(0.17843)
	[0.21487]	[0.73881]	[0.06465]	[2.94207]
DLN_SP_UK(-2)	-0.668287	0.318765	-0.031372	-0.330795
	(1.34384)	(0.39730)	(0.03842)	(0.19328)
	[-0.49730]	[0.80232]	[-0.81666]	[-1.71152]
C	-0.023134	0.006182	0.014718	-0.000729
	(0.08289)	(0.02451)	(0.00237)	(0.01192)
	[-0.27910]	[0.25225]	[6.21160]	[-0.06116]
R-squared	0.354804	0.396574	0.829832	0.426763
Adj. R-squared	0.139738	0.195432	0.773109	0.235684
Sum sq. resids	3.745520	0.327385	0.003061	0.077477
S.E. equation	0.395049	0.116795	0.011293	0.056817
F-statistic	1.649746	1.971612	14.62960	2.233439
Log likelihood	-10.92185	29.29163	106.3873	53.07061
Akaike AIC	1.207385	-1.229796	-5.902263	-2.670946
Schwarz SC	1.615523	-0.821657	-5.494124	-2.262807
Mean dependent	-0.046841	0.008121	0.007999	-0.006406
S.D. dependent	0.425927	0.130209	0.023708	0.064990

Determinant resid covariance (dof adj.)	5.94E-10
Determinant resid covariance	1.66E-10
Log likelihood	184.2570
Akaike information criterion	-8.985271
Schwarz criterion	-7.352717

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:58
Sample (adjusted): 1994Q4 2002Q4
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D_IR_US	DLN_BRENT	DLN_GDP_US	DLN_SP_US
D_IR_US(-1)	0.251149	0.014216	-0.000895	0.000904
	(0.21534)	(0.07069)	(0.00680)	(0.03425)
	[1.16629]	[0.20112]	[-0.13173]	[0.02639]
D_IR_US(-2)	0.149461	-0.006725	-0.006499	0.029927
	(0.18771)	(0.06162)	(0.00592)	(0.02986)
	[0.79625]	[-0.10914]	[-1.09691]	[1.00227]
DLN_BRENT(-1)	0.907392	0.427753	-0.014904	-0.230565
	(0.67120)	(0.22033)	(0.02119)	(0.10677)
	[1.35189]	[1.94143]	[-0.70349]	[-2.15947]
DLN_BRENT(-2)	0.480297	-0.144269	0.040619	0.064673
	(0.73916)	(0.24263)	(0.02333)	(0.11758)
	[0.64979]	[-0.59459]	[1.74099]	[0.55004]
DLN_GDP_US(-1)	7.786722	1.247040	0.454981	-0.225977
	(6.54365)	(2.14801)	(0.20654)	(1.04091)
	[1.18997]	[0.58056]	[2.20282]	[-0.21710]
DLN_GDP_US(-2)	2.129045	-1.616740	0.102480	-0.108543
	(6.22959)	(2.04492)	(0.19663)	(0.99095)
	[0.34176]	[-0.79061]	[0.52118]	[-0.10953]
DLN_SP_US(-1)	2.383306	0.450492	0.070130	0.101141
	(1.24304)	(0.40804)	(0.03924)	(0.19773)
	[1.91731]	[1.10404]	[1.78740]	[0.51150]
DLN_SP_US(-2)	0.207816	-0.352397	0.001909	0.234201
	(1.36886)	(0.44934)	(0.04321)	(0.21775)
	[0.15182]	[-0.78425]	[0.04417]	[1.07556]
C	-0.244815	0.009277	0.002992	0.017779
	(0.11805)	(0.03875)	(0.00373)	(0.01878)
	[-2.07379]	[0.23940]	[0.80299]	[0.94677]
R-squared	0.498015	0.221639	0.337059	0.253940
Adj. R-squared	0.330687	-0.037815	0.116079	0.005253
Sum sq. resids	3.919070	0.422294	0.003905	0.099167
S.E. equation	0.404097	0.132648	0.012755	0.064280
F-statistic	2.976278	0.854251	1.525289	1.021122
Log likelihood	-11.66919	25.09127	102.3701	48.99808
Akaike AIC	1.252678	-0.975228	-5.658792	-2.424126
Schwarz SC	1.660817	-0.567090	-5.250654	-2.015988
Mean dependent	-0.102121	0.008121	0.011063	0.018298
S.D. dependent	0.493937	0.130209	0.013567	0.064450

Determinant resid covariance (dof adj.)	1.39E-09
Determinant resid covariance	3.90E-10
Log likelihood	170.1725
Akaike information criterion	-8.131668
Schwarz criterion	-6.499114

C) Sub-group 2:

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:59
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_C	DLN_BRENT	DLN_GDP_C	DLN_SP_C
D_IR_C(-1)	0.607084	-0.236287	-0.004824	0.043446
	(0.25000)	(0.09674)	(0.00292)	(0.04387)
	[2.42832]	[-2.44248]	[-1.65439]	[0.99042]
D_IR_C(-2)	-0.165759	0.035612	-0.001096	0.022986
	(0.21948)	(0.08493)	(0.00256)	(0.03851)
	[-0.75523]	[0.41931]	[-0.42827]	[0.59687]
DLN_BRENT(-1)	0.089778	-0.325111	-0.013828	-0.250758
	(0.59040)	(0.22846)	(0.00689)	(0.10359)
	[0.15206]	[-1.42305]	[-2.00793]	[-2.42060]
DLN_BRENT(-2)	-1.074434	-0.213788	0.006389	0.110316
	(0.75866)	(0.29357)	(0.00885)	(0.13312)
	[-1.41623]	[-0.72824]	[0.72204]	[0.82872]
DLN_GDP_C(-1)	58.83410	-3.449527	0.671566	7.052138
	(21.5149)	(8.32539)	(0.25095)	(3.77506)
	[2.73457]	[-0.41434]	[2.67604]	[1.86809]
DLN_GDP_C(-2)	-12.82222	24.94566	-0.148779	-7.607470
	(26.3275)	(10.1877)	(0.30709)	(4.61949)
	[-0.48703]	[2.44861]	[-0.48448]	[-1.64682]
DLN_SP_C(-1)	-1.188008	-0.447939	0.010879	-0.333683
	(1.46404)	(0.56652)	(0.01708)	(0.25688)
	[-0.81146]	[-0.79068]	[0.63704]	[-1.29896]
DLN_SP_C(-2)	-1.328941	0.432029	0.016767	0.178050
	(0.97801)	(0.37845)	(0.01141)	(0.17160)
	[-1.35882]	[1.14157]	[1.46977]	[1.03756]
C	-0.129941	-0.037509	0.002831	0.042549
	(0.15804)	(0.06115)	(0.00184)	(0.02773)
	[-0.82223]	[-0.61335]	[1.53582]	[1.53445]
R-squared	0.706053	0.433197	0.626165	0.502877
Adj. R-squared	0.538083	0.109310	0.412545	0.218806
Sum sq. resids	0.882572	0.132154	0.000120	0.027172
S.E. equation	0.251079	0.097157	0.002929	0.044055
F-statistic	4.203457	1.337494	2.931209	1.770253
Log likelihood	4.859125	26.69616	107.2374	44.88673
Akaike AIC	0.360076	-1.538796	-8.542382	-3.120585
Schwarz SC	0.804400	-1.094472	-8.098058	-2.676261
Mean dependent	0.018334	0.055169	0.005829	0.024622
S.D. dependent	0.369427	0.102947	0.003821	0.049844

Determinant resid covariance (dof adj.)	7.02E-12
Determinant resid covariance	9.64E-13
Log likelihood	187.6381
Akaike information criterion	-13.18592
Schwarz criterion	-11.40863

Vector Autoregression Estimates
Date: 03/01/17 Time: 19:59
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_F	DLN_BRENT	DLN_GDP_F	DLN_SP_F
D_IR_F(-1)	0.429481	-0.149212	0.000197	-0.038273
	(0.27779)	(0.15573)	(0.00359)	(0.06492)
	[1.54607]	[-0.95814]	[0.05497]	[-0.58953]
D_IR_F(-2)	0.122069	0.079053	-0.000182	-0.087261
	(0.29140)	(0.16336)	(0.00377)	(0.06810)
	[0.41890]	[0.48391]	[-0.04830]	[-1.28129]
DLN_BRENT(-1)	-0.112419	-0.168958	-0.012306	-0.354966
	(0.46537)	(0.26089)	(0.00601)	(0.10876)
	[-0.24157]	[-0.64762]	[-2.04624]	[-3.26369]
DLN_BRENT(-2)	-0.113877	0.087835	-0.000734	-0.018027
	(0.54148)	(0.30356)	(0.00700)	(0.12655)
	[-0.21031]	[0.28935]	[-0.10493]	[-0.14245]
DLN_GDP_F(-1)	-3.788552	8.961743	0.000206	-6.649682
	(22.0335)	(12.3522)	(0.28473)	(5.14947)
	[-0.17194]	[0.72552]	[0.00072]	[-1.29133]
DLN_GDP_F(-2)	5.909721	13.35867	-0.059280	-1.302256
	(17.0627)	(9.56547)	(0.22050)	(3.98772)
	[0.34635]	[1.39655]	[-0.26885]	[-0.32657]
DLN_SP_F(-1)	-0.307006	-0.105756	0.034092	-0.031756
	(0.85949)	(0.48184)	(0.01111)	(0.20087)
	[-0.35720]	[-0.21948]	[3.06945]	[-0.15809]
DLN_SP_F(-2)	1.006402	-0.245963	0.012523	0.783171
	(0.74840)	(0.41956)	(0.00967)	(0.17491)
	[1.34474]	[-0.58624]	[1.29482]	[4.47760]
C	0.051902	-0.033870	0.004839	0.070720
	(0.12520)	(0.07019)	(0.00162)	(0.02926)
	[0.41454]	[-0.48255]	[2.99048]	[2.41685]
R-squared	0.551452	0.269732	0.714207	0.752639
Adj. R-squared	0.295139	-0.147564	0.550897	0.611290
Sum sq. resids	0.541765	0.170267	9.05E-05	0.029592
S.E. equation	0.196717	0.110281	0.002542	0.045975
F-statistic	2.151479	0.646381	4.373319	5.324675
Log likelihood	10.47121	23.78206	110.4929	43.90565
Akaike AIC	-0.127931	-1.285396	-8.825468	-3.035274
Schwarz SC	0.316393	-0.841072	-8.381144	-2.590950
Mean dependent	0.081435	0.055169	0.004261	0.008024
S.D. dependent	0.234309	0.102947	0.003793	0.073741

Determinant resid covariance (dof adj.)	4.39E-12
Determinant resid covariance	6.03E-13
Log likelihood	193.0279
Akaike information criterion	-13.65460
Schwarz criterion	-11.87730

Vector Autoregression Estimates
Date: 03/01/17 Time: 20:00
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_G	DLN_BRENT	DLN_GDP_G	DLN_SP_G
D_IR_G(-1)	0.327232	-0.012681	0.004354	0.070843
	(0.30574)	(0.19929)	(0.00961)	(0.14405)
	[1.07030]	[-0.06363]	[0.45298]	[0.49180]
D_IR_G(-2)	-0.092430	0.220532	0.010106	-0.143769
	(0.25246)	(0.16456)	(0.00794)	(0.11894)
	[-0.36612]	[1.34017]	[1.27318]	[-1.20870]
DLN_BRENT(-1)	0.103743	-0.137129	-0.003701	-0.472275
	(0.42434)	(0.27659)	(0.01334)	(0.19993)
	[0.24448]	[-0.49578]	[-0.27743]	[-2.36221]
DLN_BRENT(-2)	-0.074307	0.050292	-0.005849	-0.130568
	(0.46173)	(0.30097)	(0.01452)	(0.21755)
	[-0.16093]	[0.16710]	[-0.40291]	[-0.60018]
DLN_GDP_G(-1)	19.95566	0.721037	-0.008124	-1.782786
	(9.04728)	(5.89719)	(0.28445)	(4.26264)
	[2.20571]	[0.12227]	[-0.02856]	[-0.41824]
DLN_GDP_G(-2)	0.963193	-10.00380	-0.208464	-2.887390
	(11.0173)	(7.18128)	(0.34639)	(5.19081)
	[0.08743]	[-1.39304]	[-0.60182]	[-0.55625]
DLN_SP_G(-1)	-0.441215	-0.030468	0.019299	-0.325240
	(0.62726)	(0.40886)	(0.01972)	(0.29553)
	[-0.70340]	[-0.07452]	[0.97858]	[-1.10051]
DLN_SP_G(-2)	0.511370	0.129118	0.017312	0.525586
	(0.37875)	(0.24688)	(0.01191)	(0.17845)
	[1.35016]	[0.52301]	[1.45380]	[2.94532]
C	-0.014623	0.090408	0.003864	0.083000
	(0.07773)	(0.05067)	(0.00244)	(0.03662)
	[-0.18812]	[1.78433]	[1.58086]	[2.26629]
R-squared	0.666783	0.266610	0.526421	0.509505
Adj. R-squared	0.476374	-0.152470	0.255805	0.229223
Sum sq. resids	0.402466	0.170995	0.000398	0.089341
S.E. equation	0.169551	0.110517	0.005331	0.079884
F-statistic	3.501837	0.636179	1.945266	1.817827
Log likelihood	13.88926	23.73299	93.46131	31.19849
Akaike AIC	-0.425153	-1.281130	-7.344462	-1.930303
Schwarz SC	0.019171	-0.836806	-6.900138	-1.485980
Mean dependent	0.081435	0.055169	0.003857	0.025230
S.D. dependent	0.234309	0.102947	0.006179	0.090991

Determinant resid covariance (dof adj.)	1.81E-11
Determinant resid covariance	2.49E-12
Log likelihood	176.7449
Akaike information criterion	-12.23868
Schwarz criterion	-10.46139

Vector Autoregression Estimates
Date: 03/01/17 Time: 20:00
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	IR_JAPAN	DLN_BRENT	DLN_GDP_J	DLN_SP_J
IR_JAPAN(-1)	1.499622	-0.633362	0.025179	-0.090086
	(0.21889)	(0.35210)	(0.02421)	(0.24253)
	[6.85107]	[-1.79881]	[1.04000]	[-0.37144]
IR_JAPAN(-2)	-0.489104	0.763391	-0.036075	-0.002048
	(0.23972)	(0.38561)	(0.02651)	(0.26562)
	[-2.04029]	[1.97967]	[-1.36057]	[-0.00771]
DLN_BRENT(-1)	-0.004821	-0.338127	-0.015935	-0.186241
	(0.16899)	(0.27184)	(0.01869)	(0.18724)
	[-0.02853]	[-1.24386]	[-0.85254]	[-0.99465]
DLN_BRENT(-2)	-0.205986	0.078969	-0.017665	0.355249
	(0.16693)	(0.26852)	(0.01846)	(0.18496)
	[-1.23398]	[0.29409]	[-0.95677]	[1.92071]
DLN_GDP_J(-1)	0.424122	1.939704	-0.267815	6.319691
	(3.14631)	(5.06110)	(0.34800)	(3.48614)
	[0.13480]	[0.38326]	[-0.76959]	[1.81281]
DLN_GDP_J(-2)	-0.720560	5.837076	-0.342568	5.938609
	(3.17277)	(5.10367)	(0.35093)	(3.51546)
	[-0.22711]	[1.14370]	[-0.97619]	[1.68929]
DLN_SP_J(-1)	-0.094556	-0.568676	-0.008930	0.085484
	(0.20284)	(0.32629)	(0.02244)	(0.22475)
	[-0.46615]	[-1.74285]	[-0.39801]	[0.38035]
DLN_SP_J(-2)	0.273105	0.645304	0.016107	-0.071447
	(0.16896)	(0.27178)	(0.01869)	(0.18720)
	[1.61643]	[2.37437]	[0.86194]	[-0.38165]
C	0.026012	0.055238	0.004381	0.021093
	(0.02645)	(0.04254)	(0.00293)	(0.02931)
	[0.98348]	[1.29835]	[1.49748]	[0.71978]
R-squared	0.983644	0.463985	0.443823	0.625270
Adj. R-squared	0.974298	0.157691	0.126008	0.411138
Sum sq. resids	0.048299	0.124976	0.000591	0.059296
S.E. equation	0.058736	0.094482	0.006497	0.065080
F-statistic	105.2473	1.514836	1.396482	2.920023
Log likelihood	38.27155	27.33843	88.91265	35.91259
Akaike AIC	-2.545352	-1.594646	-6.948926	-2.340225
Schwarz SC	-2.101029	-1.150322	-6.504602	-1.895901
Mean dependent	0.337113	0.055169	-6.82E-05	0.014561
S.D. dependent	0.366374	0.102947	0.006949	0.084809

Determinant resid covariance (dof adj.)	1.96E-12
Determinant resid covariance	2.69E-13
Log likelihood	202.3344
Akaike information criterion	-14.46386
Schwarz criterion	-12.68656

Vector Autoregression Estimates
Date: 03/01/17 Time: 20:01
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_N	DLN_BRENT	DLN_GDP_N	DLN_SP_N
D_IR_N(-1)	0.568244	0.050547	-0.006282	-0.080125
	(0.18696)	(0.07344)	(0.02593)	(0.06055)
	[3.03935]	[0.68831]	[-0.24227]	[-1.32335]
D_IR_N(-2)	0.353264	-0.021147	0.005084	-0.006233
	(0.20738)	(0.08145)	(0.02876)	(0.06716)
	[1.70349]	[-0.25961]	[0.17676]	[-0.09281]
DLN_BRENT(-1)	0.520809	-0.192090	-0.025887	-0.590332
	(0.72558)	(0.28500)	(0.10063)	(0.23498)
	[0.71778]	[-0.67400]	[-0.25725]	[-2.51228]
DLN_BRENT(-2)	-0.714808	0.070259	0.063765	0.171977
	(0.86348)	(0.33916)	(0.11975)	(0.27964)
	[-0.82782]	[0.20715]	[0.53248]	[0.61500]
DLN_GDP_N(-1)	-1.019795	-0.070164	-0.439688	-0.266276
	(1.56125)	(0.61324)	(0.21652)	(0.50561)
	[-0.65319]	[-0.11442]	[-2.03067]	[-0.52664]
DLN_GDP_N(-2)	-0.512957	0.320857	-0.534532	0.454578
	(1.56817)	(0.61596)	(0.21748)	(0.50785)
	[-0.32711]	[0.52091]	[-2.45781]	[0.89510]
DLN_SP_N(-1)	0.298949	-0.017576	0.007478	-0.320627
	(0.84625)	(0.33239)	(0.11736)	(0.27406)
	[0.35326]	[-0.05288]	[0.06372]	[-1.16993]
DLN_SP_N(-2)	2.124793	0.106251	0.099017	0.564644
	(0.61098)	(0.23998)	(0.08473)	(0.19786)
	[3.47768]	[0.44274]	[1.16856]	[2.85368]
C	-0.080189	0.058653	0.001384	0.060438
	(0.12895)	(0.05065)	(0.01788)	(0.04176)
	[-0.62187]	[1.15802]	[0.07741]	[1.44728]
R-squared	0.824897	0.113289	0.415398	0.658865
Adj. R-squared	0.724839	-0.393404	0.081340	0.463930
Sum sq. resids	1.340037	0.206743	0.025774	0.140540
S.E. equation	0.309382	0.121521	0.042907	0.100193
F-statistic	8.244134	0.223585	1.243492	3.379927
Log likelihood	0.056579	21.54981	45.49407	25.98859
Akaike AIC	0.777689	-1.091288	-3.173398	-1.477269
Schwarz SC	1.222013	-0.646964	-2.729074	-1.032945
Mean dependent	-0.014783	0.055169	0.002512	0.044879
S.D. dependent	0.589794	0.102947	0.044766	0.136844

Determinant resid covariance (dof adj.)	2.01E-08
Determinant resid covariance	2.76E-09
Log likelihood	96.12023
Akaike information criterion	-5.227846
Schwarz criterion	-3.450550

Vector Autoregression Estimates
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Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_UK	DLN_BRENT	DLN_GDP_UK	DLN_SP_UK
D_IR_UK(-1)	0.439965	-0.013346	-0.014510	-0.023304
	(0.25366)	(0.12078)	(0.01247)	(0.05287)
	[1.73444]	[-0.11050]	[-1.16372]	[-0.44080]
D_IR_UK(-2)	-0.058762	0.121326	0.015324	-0.015031
	(0.26224)	(0.12486)	(0.01289)	(0.05465)
	[-0.22408]	[0.97171]	[1.18881]	[-0.27502]
DLN_BRENT(-1)	-0.622792	-0.188955	-0.060670	0.147704
	(0.58211)	(0.27716)	(0.02861)	(0.12132)
	[-1.06988]	[-0.68176]	[-2.12034]	[1.21745]
DLN_BRENT(-2)	-1.024015	0.115307	0.037453	0.166726
	(0.56591)	(0.26944)	(0.02782)	(0.11794)
	[-1.80950]	[0.42795]	[1.34642]	[1.41359]
DLN_GDP_UK(-1)	-3.229224	-1.292636	-0.071054	-0.015101
	(2.27670)	(1.08399)	(0.11191)	(0.47450)
	[-1.41838]	[-1.19248]	[-0.63492]	[-0.03183]
DLN_GDP_UK(-2)	-1.951157	0.719743	-1.017100	0.021740
	(2.77333)	(1.32045)	(0.13632)	(0.57801)
	[-0.70354]	[0.54507]	[-7.46102]	[0.03761]
DLN_SP_UK(-1)	2.052922	-0.362630	-0.166047	0.153646
	(1.49751)	(0.71300)	(0.07361)	(0.31210)
	[1.37089]	[-0.50860]	[-2.25580]	[0.49229]
DLN_SP_UK(-2)	-2.031949	0.147507	0.131991	0.509675
	(1.20338)	(0.57296)	(0.05915)	(0.25080)
	[-1.68854]	[0.25745]	[2.23140]	[2.03217]
C	0.180706	0.048388	0.012738	-0.018645
	(0.07966)	(0.03793)	(0.00392)	(0.01660)
	[2.26859]	[1.27585]	[3.25325]	[-1.12309]
R-squared	0.480960	0.232676	0.842457	0.423702
Adj. R-squared	0.184366	-0.205796	0.752433	0.094388
Sum sq. resids	0.789200	0.178907	0.001907	0.034281
S.E. equation	0.237427	0.113045	0.011671	0.049484
F-statistic	1.621609	0.530652	9.358107	1.286621
Log likelihood	6.145055	23.21282	75.43913	42.21404
Akaike AIC	0.248256	-1.235898	-5.777315	-2.888177
Schwarz SC	0.692580	-0.791574	-5.332991	-2.443854
Mean dependent	0.082206	0.055169	0.004579	-0.015238
S.D. dependent	0.262895	0.102947	0.023456	0.051998

Determinant resid covariance (dof adj.)	1.66E-10
Determinant resid covariance	2.27E-11
Log likelihood	151.2884
Akaike information criterion	-10.02508
Schwarz criterion	-8.247785

Vector Autoregression Estimates
Date: 03/01/17 Time: 20:02
Sample: 2003Q1 2008Q3
Included observations: 23
Standard errors in ( ) & t-statistics in [ ]

	D_IR_US	DLN_BRENT	DLN_GDP_US	DLN_SP_US
D_IR_US(-1)	0.814936	-0.076730	-0.005647	0.028046
	(0.27949)	(0.06900)	(0.00859)	(0.02982)
	[2.91581]	[-1.11207]	[-0.65712]	[0.94057]
D_IR_US(-2)	-0.226673	0.069815	0.005403	-0.001661
	(0.29016)	(0.07163)	(0.00892)	(0.03096)
	[-0.78121]	[0.97464]	[0.60557]	[-0.05365]
DLN_BRENT(-1)	-0.684582	-0.000911	0.000528	-0.235666
	(1.33023)	(0.32839)	(0.04090)	(0.14192)
	[-0.51464]	[-0.00278]	[0.01291]	[-1.66057]
DLN_BRENT(-2)	-0.797662	0.053517	-0.048938	-0.102659
	(1.24072)	(0.30630)	(0.03815)	(0.13237)
	[-0.64290]	[0.17472]	[-1.28277]	[-0.77555]
DLN_GDP_US(-1)	7.751563	1.087210	0.328842	0.310239
	(8.42777)	(2.08057)	(0.25914)	(0.89914)
	[0.91976]	[0.52255]	[1.26896]	[0.34504]
DLN_GDP_US(-2)	-2.959286	-2.561607	-0.201193	0.297435
	(8.78003)	(2.16753)	(0.26997)	(0.93672)
	[-0.33705]	[-1.18181]	[-0.74523]	[0.31753]
DLN_SP_US(-1)	-3.113376	0.293069	-0.039079	-0.268453
	(2.99939)	(0.74046)	(0.09223)	(0.32000)
	[-1.03800]	[0.39579]	[-0.42373]	[-0.83892]
DLN_SP_US(-2)	-0.872878	0.114849	-0.025298	0.317103
	(2.03782)	(0.50308)	(0.06266)	(0.21741)
	[-0.42834]	[0.22829]	[-0.40374]	[1.45855]
C	0.129339	0.056572	0.008320	0.019267
	(0.17614)	(0.04348)	(0.00542)	(0.01879)
	[0.73429]	[1.30096]	[1.53621]	[1.02525]
R-squared	0.472685	0.213602	0.236473	0.408525
Adj. R-squared	0.171363	-0.235768	-0.199829	0.070539
Sum sq. resids	3.008505	0.183354	0.002844	0.034243
S.E. equation	0.463566	0.114441	0.014254	0.049457
F-statistic	1.568702	0.475336	0.541994	1.208702
Log likelihood	-9.244001	22.93046	70.83991	42.22659
Akaike AIC	1.586435	-1.211344	-5.377383	-2.889269
Schwarz SC	2.030759	-0.767021	-4.933060	-2.444945
Mean dependent	0.068261	0.055169	0.006276	0.003686
S.D. dependent	0.509248	0.102947	0.013013	0.051299

Determinant resid covariance (dof adj.)	6.72E-10
Determinant resid covariance	9.22E-11
Log likelihood	135.1859
Akaike information criterion	-8.624861
Schwarz criterion	-6.847566

<u>D) Sub-group 3:</u>

Vector Autoregression Estimates
Date: 03/01/17 Time: 20:02
Sample: 2008Q4 2012Q2
Included observations: 15
Standard errors in ( ) & t-statistics in [ ]

	D_IR_C	DLN_BRENT	DLN_GDP_C	DLN_SP_C
D_IR_C(-1)	0.077909	-0.374409	0.002253	-0.103404
	(0.45334)	(0.23447)	(0.01209)	(0.11246)
	[0.17186]	[-1.59685]	[0.18633]	[-0.91945]
D_IR_C(-2)	0.195217	0.489650	0.013794	0.154245
	(0.32615)	(0.16868)	(0.00870)	(0.08091)
	[0.59855]	[2.90275]	[1.58549]	[1.90636]
DLN_BRENT(-1)	1.140674	-0.942713	0.021238	-0.635524
	(1.13320)	(0.58609)	(0.03023)	(0.28112)
	[1.00660]	[-1.60848]	[0.70259]	[-2.26067]
DLN_BRENT(-2)	-0.198157	1.055989	0.023721	0.195570
	(1.85580)	(0.95982)	(0.04950)	(0.46038)
	[-0.10678]	[1.10020]	[0.47916]	[0.42480]
DLN_GDP_C(-1)	16.30329	1.138483	0.068092	3.232044
	(16.5620)	(8.56583)	(0.44180)	(4.10866)
	[0.98438]	[0.13291]	[0.15412]	[0.78664]
DLN_GDP_C(-2)	2.862312	-7.815805	-0.550074	-4.507343
	(16.7598)	(8.66816)	(0.44708)	(4.15774)
	[0.17078]	[-0.90167]	[-1.23037]	[-1.08408]
DLN_SP_C(-1)	0.968032	3.987027	0.029496	1.941804
	(2.78767)	(1.44178)	(0.07436)	(0.69156)
	[0.34726]	[2.76535]	[0.39665]	[2.80786]
DLN_SP_C(-2)	-0.733723	-2.337576	-0.030910	-0.811177
	(3.28162)	(1.69725)	(0.08754)	(0.81410)
	[-0.22359]	[-1.37727]	[-0.35310]	[-0.99641]
C	-0.141728	0.068974	0.007160	0.020676
	(0.15469)	(0.08001)	(0.00413)	(0.03838)
	[-0.91621]	[0.86212]	[1.73521]	[0.53879]
R-squared	0.854959	0.845326	0.802262	0.845791
Adj. R-squared	0.661572	0.639093	0.538612	0.640178
Sum sq. resids	0.418804	0.112028	0.000298	0.025774
S.E. equation	0.264198	0.136643	0.007048	0.065542
F-statistic	4.420969	4.098892	3.042900	4.113517
Log likelihood	5.553938	15.44383	59.91393	26.46409
Akaike AIC	0.459475	-0.859178	-6.788524	-2.328546
Schwarz SC	0.884305	-0.434348	-6.363694	-1.903716
Mean dependent	-0.141143	-0.007133	0.002685	-0.010168
S.D. dependent	0.454147	0.227452	0.010376	0.109263

Determinant resid covariance (dof adj.)	4.26E-13
Determinant resid covariance	1.09E-14
Log likelihood	155.9840
Akaike information criterion	-15.99787
Schwarz criterion	-14.29855

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	D_IR_F	DLN_BRENT	DLN_GDP_F	DLN_SP_F
D_IR_F(-1)	-0.277346	-0.256974	-0.000808	-0.114898
	(0.34153)	(0.27566)	(0.00898)	(0.12155)
	[-0.81207]	[-0.93223]	[-0.09006]	[-0.94527]
D_IR_F(-2)	-0.096413	-0.263608	-0.006123	-0.060136
	(0.20094)	(0.16218)	(0.00528)	(0.07151)
	[-0.47982]	[-1.62540]	[-1.15934]	[-0.84090]
DLN_BRENT(-1)	2.809531	-0.051281	0.012946	-0.146737
	(0.64359)	(0.51945)	(0.01692)	(0.22905)
	[4.36543]	[-0.09872]	[0.76533]	[-0.64062]
DLN_BRENT(-2)	-0.568190	-0.495432	-0.023042	-0.189006
	(0.88662)	(0.71562)	(0.02330)	(0.31555)
	[-0.64085]	[-0.69232]	[-0.98875]	[-0.59897]
DLN_GDP_F(-1)	26.27582	22.75475	0.414025	18.96897
	(19.9636)	(16.1131)	(0.52472)	(7.10509)
	[1.31618]	[1.41219]	[0.78904]	[2.66977]
DLN_GDP_F(-2)	46.68858	29.71257	0.716879	0.320026
	(19.7460)	(15.9375)	(0.51900)	(7.02763)
	[2.36446]	[1.86432]	[1.38127]	[0.04554]
DLN_SP_F(-1)	-2.664531	-0.341090	-0.014833	0.050669
	(1.35125)	(1.09063)	(0.03552)	(0.48091)
	[-1.97190]	[-0.31275]	[-0.41763]	[0.10536]
DLN_SP_F(-2)	0.614159	-0.247422	0.023881	-0.249770
	(1.21828)	(0.98330)	(0.03202)	(0.43359)
	[0.50412]	[-0.25162]	[0.74578]	[-0.57606]
C	-0.441228	-0.163386	-0.000748	-0.083485
	(0.17388)	(0.14034)	(0.00457)	(0.06188)
	[-2.53756]	[-1.16420]	[-0.16367]	[-1.34906]
R-squared	0.953913	0.774291	0.782203	0.815702
Adj. R-squared	0.892464	0.473346	0.491806	0.569972
Sum sq. resids	0.250943	0.163477	0.000173	0.031786
S.E. equation	0.204509	0.165064	0.005375	0.072785
F-statistic	15.52357	2.572868	2.693566	3.319501
Log likelihood	9.395258	12.60942	63.97727	24.89177
Akaike AIC	-0.052701	-0.481256	-7.330303	-2.118903
Schwarz SC	0.372129	-0.056426	-6.905473	-1.694073
Mean dependent	-0.285718	-0.007133	0.000661	-0.024454
S.D. dependent	0.623641	0.227452	0.007540	0.110993

Determinant resid covariance (dof adj.)	1.16E-11
Determinant resid covariance	2.96E-13
Log likelihood	131.2180
Akaike information criterion	-12.69573
Schwarz criterion	-10.99641

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	D_IR_G	DLN_BRENT	DLN_GDP_G	DLN_SP_G
D_IR_G(-1)	0.018723	-0.085643	-0.001981	-0.148016
	(0.16732)	(0.30976)	(0.01544)	(0.14973)
	[0.11190]	[-0.27648]	[-0.12832]	[-0.98857]
D_IR_G(-2)	-0.254370	-0.317084	-0.010983	-0.127233
	(0.10727)	(0.19858)	(0.00990)	(0.09599)
	[-2.37136]	[-1.59675]	[-1.10951]	[-1.32553]
DLN_BRENT(-1)	2.953140	0.204581	0.062222	0.251739
	(0.26489)	(0.49038)	(0.02445)	(0.23703)
	[11.1487]	[0.41719]	[2.54535]	[1.06205]
DLN_BRENT(-2)	-1.243277	-0.838885	-0.027631	-0.237644
	(0.40547)	(0.75063)	(0.03742)	(0.36283)
	[-3.06625]	[-1.11757]	[-0.73841]	[-0.65497]
DLN_GDP_G(-1)	11.57037	7.580058	0.168929	7.634492
	(5.05669)	(9.36129)	(0.46666)	(4.52491)
	[2.28813]	[0.80972]	[0.36199]	[1.68722]
DLN_GDP_G(-2)	26.26688	15.13248	0.821912	6.402544
	(4.50611)	(8.34202)	(0.41585)	(4.03223)
	[5.82917]	[1.81401]	[1.97646]	[1.58784]
DLN_SP_G(-1)	-2.416305	-0.365962	-0.020797	-0.458671
	(0.56808)	(1.05167)	(0.05243)	(0.50834)
	[-4.25345]	[-0.34798]	[-0.39670]	[-0.90229]
DLN_SP_G(-2)	0.617706	-0.064050	-0.014019	-0.463292
	(0.66157)	(1.22474)	(0.06105)	(0.59200)
	[0.93370]	[-0.05230]	[-0.22962]	[-0.78259]
C	-0.349335	-0.111047	-0.001816	-0.082176
	(0.06503)	(0.12038)	(0.00600)	(0.05819)
	[-5.37229]	[-0.92248]	[-0.30265]	[-1.41227]
R-squared	0.988894	0.713865	0.854287	0.755050
Adj. R-squared	0.974087	0.332351	0.660003	0.428450
Sum sq. resids	0.060470	0.207243	0.000515	0.048420
S.E. equation	0.100391	0.185851	0.009265	0.089834
F-statistic	66.78303	1.871136	4.397102	2.311850
Log likelihood	20.06831	10.83027	55.81128	21.73505
Akaike AIC	-1.475775	-0.244035	-6.241504	-1.698007
Schwarz SC	-1.050945	0.180795	-5.816674	-1.273177
Mean dependent	-0.285718	-0.007133	0.001523	-0.000522
S.D. dependent	0.623641	0.227452	0.015889	0.118826

Determinant resid covariance (dof adj.)	7.14E-11
Determinant resid covariance	1.83E-12
Log likelihood	117.5686
Akaike information criterion	-10.87582
Schwarz criterion	-9.176499

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	IR_JAPAN	DLN_BRENT	DLN_GDP_J	DLN_SP_J
IR_JAPAN(-1)	1.344205	-2.163815	-0.186660	-1.064172
	(0.34443)	(1.07375)	(0.10685)	(0.64639)
	[3.90264]	[-2.01519]	[-1.74685]	[-1.64634]
IR_JAPAN(-2)	-0.235351	1.157277	0.160331	0.658115
	(0.29820)	(0.92961)	(0.09251)	(0.55962)
	[-0.78924]	[1.24490]	[1.73311]	[1.17601]
DLN_BRENT(-1)	0.724730	-0.976753	0.078172	-0.301711
	(0.21839)	(0.68081)	(0.06775)	(0.40984)
	[3.31856]	[-1.43470]	[1.15382]	[-0.73617]
DLN_BRENT(-2)	0.334973	-0.732113	0.009532	-0.489540
	(0.21737)	(0.67765)	(0.06744)	(0.40794)
	[1.54099]	[-1.08037]	[0.14134]	[-1.20004]
DLN_GDP_J(-1)	-0.027942	-1.378636	0.077659	0.913482
	(1.09110)	(3.40142)	(0.33849)	(2.04762)
	[-0.02561]	[-0.40531]	[0.22942]	[0.44612]
DLN_GDP_J(-2)	2.439817	-3.126259	0.169104	-1.109134
	(1.02471)	(3.19446)	(0.31790)	(1.92303)
	[2.38098]	[-0.97865]	[0.53194]	[-0.57676]
DLN_SP_J(-1)	-0.568231	0.780469	-0.146741	0.035015
	(0.32991)	(1.02846)	(0.10235)	(0.61913)
	[-1.72239]	[0.75887]	[-1.43374]	[0.05656]
DLN_SP_J(-2)	-0.822271	1.191668	0.005339	0.531092
	(0.36097)	(1.12531)	(0.11199)	(0.67743)
	[-2.27792]	[1.05897]	[0.04767]	[0.78399]
C	-0.099130	0.346500	-0.002404	0.114885
	(0.03972)	(0.12383)	(0.01232)	(0.07454)
	[-2.49560]	[2.79820]	[-0.19508]	[1.54116]
R-squared	0.980814	0.818738	0.681420	0.777762
Adj. R-squared	0.955234	0.577055	0.256647	0.481444
Sum sq. resids	0.013509	0.131285	0.001300	0.047577
S.E. equation	0.047450	0.147922	0.014720	0.089047
F-statistic	38.34192	3.387652	1.604199	2.624755
Log likelihood	31.30930	14.25417	48.86582	21.86689
Akaike AIC	-2.974573	-0.700556	-5.315442	-1.715585
Schwarz SC	-2.549743	-0.275726	-4.890612	-1.290755
Mean dependent	0.330207	-0.007133	-0.002694	-0.020147
S.D. dependent	0.224264	0.227452	0.017074	0.123658

Determinant resid covariance (dof adj.)	9.81E-13
Determinant resid covariance	2.51E-14
Log likelihood	149.7264
Akaike information criterion	-15.16351
Schwarz criterion	-13.46419

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	D_IR_N	DLN_BRENT	DLN_GDP_N	DLN_SP_N
D_IR_N(-1)	0.028906	-0.037253	-0.043983	-0.026787
	(0.43924)	(0.19229)	(0.05174)	(0.13952)
	[0.06581]	[-0.19374]	[-0.85004]	[-0.19200]
D_IR_N(-2)	0.410933	0.041704	0.027920	0.016972
	(0.26261)	(0.11496)	(0.03094)	(0.08342)
	[1.56480]	[0.36275]	[0.90251]	[0.20347]
DLN_BRENT(-1)	2.396510	0.115488	0.108188	0.022193
	(1.79067)	(0.78391)	(0.21094)	(0.56878)
	[1.33833]	[0.14732]	[0.51289]	[0.03902]
DLN_BRENT(-2)	0.125770	-0.062719	0.208043	-0.087564
	(1.55499)	(0.68074)	(0.18318)	(0.49392)
	[0.08088]	[-0.09213]	[1.13575]	[-0.17728]
DLN_GDP_N(-1)	-1.682790	0.059031	-0.352780	-0.080132
	(3.38429)	(1.48156)	(0.39867)	(1.07498)
	[-0.49724]	[0.03984]	[-0.88490]	[-0.07454]
DLN_GDP_N(-2)	-1.238407	-0.151466	-0.535156	-0.971550
	(3.09048)	(1.35294)	(0.36405)	(0.98165)
	[-0.40072]	[-0.11195]	[-1.46999]	[-0.98971]
DLN_SP_N(-1)	0.820266	1.122362	0.008353	0.497962
	(1.25699)	(0.55028)	(0.14807)	(0.39927)
	[0.65256]	[2.03962]	[0.05641]	[1.24719]
DLN_SP_N(-2)	0.394982	-0.472163	-0.144984	-0.370072
	(2.08081)	(0.91093)	(0.24512)	(0.66094)
	[0.18982]	[-0.51833]	[-0.59149]	[-0.55992]
C	-0.163722	0.001592	-0.001591	0.012296
	(0.15646)	(0.06849)	(0.01843)	(0.04970)
	[-1.04642]	[0.02324]	[-0.08632]	[0.24741]
R-squared	0.871665	0.754996	0.609629	0.663413
Adj. R-squared	0.700551	0.428324	0.089134	0.214631
Sum sq. resids	0.925930	0.177452	0.012849	0.093420
S.E. equation	0.392838	0.171975	0.046276	0.124780
F-statistic	5.094065	2.311176	1.171248	1.478253
Log likelihood	-0.396530	11.99420	31.68512	16.80614
Akaike AIC	1.252871	-0.399227	-3.024682	-1.040818
Schwarz SC	1.677701	0.025603	-2.599852	-0.615988
Mean dependent	-0.285111	-0.007133	0.002707	0.009147
S.D. dependent	0.717880	0.227452	0.048487	0.140802

Determinant resid covariance (dof adj.)	3.46E-08
Determinant resid covariance	8.86E-10
Log likelihood	71.19864
Akaike information criterion	-4.693153
Schwarz criterion	-2.993832

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	D_IR_UK	DLN_BRENT	DLN_GDP_UK	DLN_SP_UK
D_IR_UK(-1)	0.038400	-0.146892	0.010980	0.014979
	(0.41520)	(0.20550)	(0.01454)	(0.05546)
	[0.09249]	[-0.71482]	[0.75522]	[0.27008]
D_IR_UK(-2)	0.350893	-0.085156	-0.007801	-0.040693
	(0.28350)	(0.14032)	(0.00993)	(0.03787)
	[1.23770]	[-0.60688]	[-0.78585]	[-1.07453]
DLN_BRENT(-1)	2.928459	0.333485	0.011376	0.034651
	(0.93020)	(0.46039)	(0.03257)	(0.12426)
	[3.14821]	[0.72436]	[0.34924]	[0.27887]
DLN_BRENT(-2)	-1.006080	-0.209189	0.023769	0.109730
	(1.13555)	(0.56202)	(0.03976)	(0.15169)
	[-0.88599]	[-0.37221]	[0.59777]	[0.72339]
DLN_GDP_UK(-1)	8.290850	4.317155	0.072392	-0.381703
	(6.96358)	(3.44651)	(0.24384)	(0.93020)
	[1.19060]	[1.25262]	[0.29688]	[-0.41035]
DLN_GDP_UK(-2)	1.604317	3.559689	-0.699778	-0.682524
	(6.74549)	(3.33857)	(0.23620)	(0.90107)
	[0.23784]	[1.06623]	[-2.96262]	[-0.75746]
DLN_SP_UK(-1)	-2.119351	-1.496251	-0.140459	0.251224
	(2.83819)	(1.40472)	(0.09938)	(0.37913)
	[-0.74673]	[-1.06516]	[-1.41331]	[0.66264]
DLN_SP_UK(-2)	0.450948	-0.382535	0.059461	0.513650
	(3.23713)	(1.60217)	(0.11335)	(0.43242)
	[0.13930]	[-0.23876]	[0.52457]	[1.18786]
C	-0.161118	-0.047260	0.000178	-0.023069
	(0.14973)	(0.07411)	(0.00524)	(0.02000)
	[-1.07604]	[-0.63772]	[0.03402]	[-1.15337]
R-squared	0.858233	0.651502	0.824514	0.623612
Adj. R-squared	0.669210	0.186838	0.590533	0.121760
Sum sq. resids	1.030421	0.252411	0.001263	0.018387
S.E. equation	0.414411	0.205106	0.014511	0.055357
F-statistic	4.540367	1.402092	3.523852	1.242622
Log likelihood	-1.198456	9.351508	49.08064	28.99731
Akaike AIC	1.359794	-0.046868	-5.344085	-2.666308
Schwarz SC	1.784624	0.377962	-4.919255	-2.241478
Mean dependent	-0.319904	-0.007133	-0.001361	-9.02E-05
S.D. dependent	0.720536	0.227452	0.022677	0.059070

Determinant resid covariance (dof adj.)	6.96E-10
Determinant resid covariance	1.78E-11
Log likelihood	100.4964
Akaike information criterion	-8.599522
Schwarz criterion	-6.900202

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	D_IR_US	DLN_BRENT	DLN_GDP_US	DLN_SP_US
D_IR_US(-1)	-0.216154	-0.226290	0.018179	-0.104276
	(0.20484)	(0.25168)	(0.00818)	(0.09875)
	[-1.05522]	[-0.89912]	[2.22334]	[-1.05592]
D_IR_US(-2)	0.570931	0.184667	0.000707	0.078032
	(0.15422)	(0.18948)	(0.00616)	(0.07435)
	[3.70213]	[0.97461]	[0.11492]	[1.04956]
DLN_BRENT(-1)	3.382721	0.028815	-0.015378	0.267672
	(0.43734)	(0.53734)	(0.01746)	(0.21084)
	[7.73471]	[0.05362]	[-0.88090]	[1.26954]
DLN_BRENT(-2)	0.801937	-0.460471	-0.038058	0.032609
	(0.63647)	(0.78200)	(0.02541)	(0.30684)
	[1.25998]	[-0.58884]	[-1.49803]	[0.10627]
DLN_GDP_US(-1)	-24.99529	-8.797493	-0.097518	-5.125188
	(7.77144)	(9.54839)	(0.31021)	(3.74659)
	[-3.21630]	[-0.92136]	[-0.31436]	[-1.36796]
DLN_GDP_US(-2)	-22.99570	-1.969218	0.513466	-5.969463
	(10.7091)	(13.1577)	(0.42746)	(5.16280)
	[-2.14731]	[-0.14966]	[1.20119]	[-1.15624]
DLN_SP_US(-1)	-3.704144	1.658619	0.031691	0.232783
	(0.93727)	(1.15157)	(0.03741)	(0.45185)
	[-3.95207]	[1.44031]	[0.84707]	[0.51517]
DLN_SP_US(-2)	-1.666696	-0.006601	0.022684	-0.647012
	(1.37775)	(1.69277)	(0.05499)	(0.66421)
	[-1.20972]	[-0.00390]	[0.41248]	[-0.97411]
C	0.535635	0.137768	0.011203	0.148896
	(0.20754)	(0.25499)	(0.00828)	(0.10005)
	[2.58088]	[0.54028]	[1.35236]	[1.48815]
R-squared	0.958663	0.743763	0.639035	0.757689
Adj. R-squared	0.903546	0.402113	0.157748	0.434607
Sum sq. resids	0.122940	0.185588	0.000196	0.028573
S.E. equation	0.143143	0.175873	0.005714	0.069009
F-statistic	17.39335	2.176974	1.327763	2.345192
Log likelihood	14.74672	11.65797	63.06133	25.69088
Akaike AIC	-0.766230	-0.354397	-7.208177	-2.225450
Schwarz SC	-0.341399	0.070434	-6.783347	-1.800620
Mean dependent	-0.183778	-0.007133	0.013376	0.005589
S.D. dependent	0.460905	0.227452	0.006226	0.091776

Determinant resid covariance (dof adj.)	5.99E-12
Determinant resid covariance	1.53E-13
Log likelihood	136.1574
Akaike information criterion	-13.35432
Schwarz criterion	-11.65500

E) Sub-group 4:

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Standard errors in ( ) & t-statistics in [ ]

	D_IR_C	DLN_BRENT	DLN_GDP_C	DLN_SP_C
D_IR_C(-1)	-0.175548	-0.475319	0.002167	0.170958
	(0.25215)	(0.59153)	(0.01712)	(0.14465)
	[-0.69620]	[-0.80355]	[0.12657]	[1.18185]
D_IR_C(-2)	-0.318090	1.313491	-0.009865	0.390215
	(0.33914)	(0.79559)	(0.02303)	(0.19455)
	[-0.93794]	[1.65097]	[-0.42839]	[2.00569]
DLN_BRENT(-1)	0.093997	0.519885	0.023674	0.046265
	(0.19403)	(0.45518)	(0.01317)	(0.11131)
	[0.48444]	[1.14215]	[1.79696]	[0.41564]
DLN_BRENT(-2)	0.735286	0.057107	0.006185	0.010609
	(0.20377)	(0.47802)	(0.01384)	(0.11690)
	[3.60846]	[0.11947]	[0.44705]	[0.09075]
DLN_GDP_C(-1)	-2.960227	-11.63496	-0.253189	-0.362109
	(5.37733)	(12.6148)	(0.36512)	(3.08484)
	[-0.55050]	[-0.92232]	[-0.69344]	[-0.11738]
DLN_GDP_C(-2)	4.543483	3.711574	0.404448	0.627047
	(5.25428)	(12.3262)	(0.35676)	(3.01425)
	[0.86472]	[0.30111]	[1.13366]	[0.20803]
DLN_SP_C(-1)	0.499847	-0.279990	-0.010943	-0.084683
	(0.63639)	(1.49292)	(0.04321)	(0.36508)
	[0.78544]	[-0.18755]	[-0.25324]	[-0.23196]
DLN_SP_C(-2)	-1.284710	-1.085271	0.009406	-0.311220
	(0.46974)	(1.10197)	(0.03189)	(0.26948)
	[-2.73496]	[-0.98485]	[0.29490]	[-1.15491]
C	0.007087	0.031370	0.005704	0.025553
	(0.04730)	(0.11097)	(0.00321)	(0.02714)
	[0.14983]	[0.28270]	[1.77610]	[0.94169]
R-squared	0.777139	0.527718	0.574418	0.640114
Adj. R-squared	0.479992	-0.101992	0.006975	0.160266
Sum sq. resids	0.022771	0.125318	0.000105	0.007494
S.E. equation	0.061605	0.144521	0.004183	0.035341
F-statistic	2.615332	0.838033	1.012291	1.333994
Log likelihood	27.39328	14.60307	67.73915	35.72866
Akaike AIC	-2.452437	-0.747076	-7.831886	-3.563821
Schwarz SC	-2.027607	-0.322246	-7.407056	-3.138991
Mean dependent	-0.024267	-0.079804	0.004663	0.003918
S.D. dependent	0.085430	0.137671	0.004198	0.038567
Determinant resid covariance (dof adj.)		5.52E-13		
Determinant resid covariance		1.41E-14		
Log likelihood		154.0440		
Akaike information criterion		-15.73920		
Schwarz criterion		-14.03988		

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Standard errors in ( ) & t-statistics in [ ]

	D_IR_F	DLN_BRENT	DLN_GDP_F	DLN_SP_F
D_IR_F(-1)	0.551267	-0.080976	0.035715	0.044615
	(0.42989)	(1.04843)	(0.01246)	(0.43451)
	[1.28236]	[-0.07724]	[2.86560]	[0.10268]
D_IR_F(-2)	-0.266385	-0.209650	-0.017691	-0.194377
	(0.34073)	(0.83099)	(0.00988)	(0.34440)
	[-0.78181]	[-0.25229]	[-1.79083]	[-0.56440]
DLN_BRENT(-1)	0.181057	-0.057897	0.006356	-0.105729
	(0.21121)	(0.51511)	(0.00612)	(0.21348)
	[0.85724]	[-0.11240]	[1.03790]	[-0.49526]
DLN_BRENT(-2)	0.315257	0.243980	-0.016001	0.247087
	(0.19802)	(0.48293)	(0.00574)	(0.20015)
	[1.59208]	[0.50521]	[-2.78722]	[1.23453]
DLN_GDP_F(-1)	20.00466	3.231532	-0.068059	-1.065740
	(13.4021)	(32.6858)	(0.38856)	(13.5463)
	[1.49265]	[0.09887]	[-0.17516]	[-0.07867]
DLN_GDP_F(-2)	22.59687	-13.97995	-0.260748	8.834690
	(9.80345)	(23.9092)	(0.28422)	(9.90893)
	[2.30499]	[-0.58471]	[-0.91740]	[0.89159]
DLN_SP_F(-1)	0.767707	1.953552	-0.058505	0.207972
	(0.58631)	(1.42994)	(0.01700)	(0.59262)
	[1.30938]	[1.36618]	[-3.44178]	[0.35093]
DLN_SP_F(-2)	0.263373	1.180377	-0.037703	-0.042471
	(0.44919)	(1.09551)	(0.01302)	(0.45402)
	[0.58633]	[1.07747]	[-2.89506]	[-0.09354]
C	-0.115083	-0.153219	0.005743	-0.004813
	(0.04296)	(0.10478)	(0.00125)	(0.04342)
	[-2.67876]	[-1.46234]	[4.61111]	[-0.11084]
R-squared	0.853031	0.555137	0.792316	0.469522
Adj. R-squared	0.657072	-0.038013	0.515404	-0.237781
Sum sq. resids	0.019846	0.118042	1.67E-05	0.020275
S.E. equation	0.057512	0.140263	0.001667	0.058130
F-statistic	4.353112	0.935913	2.861254	0.663820
Log likelihood	28.42460	15.05165	81.53551	28.26408
Akaike AIC	-2.589947	-0.806887	-9.671401	-2.568544
Schwarz SC	-2.165117	-0.382057	-9.246571	-2.143714
Mean dependent	-0.058807	-0.079804	0.002477	0.021751
S.D. dependent	0.098210	0.137671	0.002395	0.052249
Determinant resid covariance (dof adj.)		3.69E-14		
Determinant resid covariance		9.45E-16		
Log likelihood		174.3276		
Akaike information criterion		-18.44369		
Schwarz criterion		-16.74437		

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	D_IR_G	DLN_BRENT	DLN_GDP_G	DLN_SP_G
D_IR_G(-1)	0.774729	-0.113662	0.002969	0.329537
	(0.40500)	(0.63045)	(0.02060)	(0.34183)
	[1.91289]	[-0.18029]	[0.14413]	[0.96403]
D_IR_G(-2)	-0.212241	-0.124843	0.015285	-0.478729
	(0.34393)	(0.53538)	(0.01750)	(0.29028)
	[-0.61711]	[-0.23319]	[0.87365]	[-1.64919]
DLN_BRENT(-1)	0.165392	0.053583	-0.011394	0.026343
	(0.20831)	(0.32427)	(0.01060)	(0.17582)
	[0.79396]	[0.16524]	[-1.07522]	[0.14983]
DLN_BRENT(-2)	0.026119	0.476736	-0.001288	0.247023
	(0.19452)	(0.30280)	(0.00990)	(0.16418)
	[0.13427]	[1.57442]	[-0.13017]	[1.50459]
DLN_GDP_G(-1)	5.269195	2.383431	-0.363304	10.49889
	(7.46971)	(11.6278)	(0.37998)	(6.30462)
	[0.70541]	[0.20498]	[-0.95612]	[1.66527]
DLN_GDP_G(-2)	-3.971194	11.02305	-0.396811	4.640056
	(6.32969)	(9.85318)	(0.32199)	(5.34242)
	[-0.62739]	[1.11873]	[-1.23239]	[0.86853]
DLN_SP_G(-1)	0.441145	1.676269	-0.005183	-0.055170
	(0.44607)	(0.69438)	(0.02269)	(0.37649)
	[0.98896]	[2.41405]	[-0.22841]	[-0.14654]
DLN_SP_G(-2)	-0.112950	1.089770	0.003371	-0.182586
	(0.44683)	(0.69556)	(0.02273)	(0.37713)
	[-0.25278]	[1.56676]	[0.14831]	[-0.48414]
C	-0.022074	-0.196189	0.006320	-0.017758
	(0.04728)	(0.07359)	(0.00240)	(0.03990)
	[-0.46690]	[-2.66581]	[2.62803]	[-0.44504]
R-squared	0.711569	0.644323	0.483481	0.587081
Adj. R-squared	0.326995	0.170086	-0.205212	0.036521
Sum sq. resids	0.038947	0.094377	0.000101	0.027745
S.E. equation	0.080568	0.125417	0.004098	0.068002
F-statistic	1.850276	1.358653	0.702027	1.066335
Log likelihood	23.36786	16.72972	68.04533	25.91146
Akaike AIC	-1.915714	-1.030629	-7.872710	-2.254861
Schwarz SC	-1.490884	-0.605799	-7.447880	-1.830031
Mean dependent	-0.058807	-0.079804	0.003222	0.025477
S.D. dependent	0.098210	0.137671	0.003733	0.069278

Determinant resid covariance (dof adj.)	5.29E-12
Determinant resid covariance	1.35E-13
Log likelihood	137.0912
Akaike information criterion	-13.47883
Schwarz criterion	-11.77951

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	IR_JAPAN	DLN_BRENT	DLN_GDP_J	DLN_SP_J
IR_JAPAN(-1)	1.819126	14.35835	-0.331026	1.967495
	(1.01121)	(9.46068)	(0.48245)	(7.23214)
	[1.79896]	[1.51769]	[-0.68614]	[0.27205]
IR_JAPAN(-2)	-0.614334	-10.94746	0.268082	-0.394097
	(1.06747)	(9.98710)	(0.50929)	(7.63455)
	[-0.57550]	[-1.09616]	[0.52638]	[-0.05162]
DLN_BRENT(-1)	-0.014556	-0.278534	-0.003879	0.007213
	(0.03197)	(0.29909)	(0.01525)	(0.22864)
	[-0.45532]	[-0.93126]	[-0.25431]	[0.03155]
DLN_BRENT(-2)	0.024137	0.111944	-0.002445	0.097833
	(0.03272)	(0.30616)	(0.01561)	(0.23404)
	[0.73760]	[0.36564]	[-0.15663]	[0.41802]
DLN_GDP_J(-1)	0.877196	13.89887	-0.336674	8.223474
	(0.71997)	(6.73586)	(0.34350)	(5.14917)
	[1.21839]	[2.06341]	[-0.98014]	[1.59705]
DLN_GDP_J(-2)	0.779994	7.538284	-0.264604	-0.556674
	(0.63976)	(5.98552)	(0.30523)	(4.57558)
	[1.21919]	[1.25942]	[-0.86690]	[-0.12166]
DLN_SP_J(-1)	0.015582	0.171581	0.061025	0.155020
	(0.08057)	(0.75380)	(0.03844)	(0.57624)
	[0.19339]	[0.22762]	[1.58754]	[0.26902]
DLN_SP_J(-2)	-0.007209	-0.646780	0.005254	-0.530237
	(0.07040)	(0.65867)	(0.03359)	(0.50351)
	[-0.10239]	[-0.98195]	[0.15641]	[-1.05307]
C	-0.042136	-0.548629	0.011107	-0.180502
	(0.02662)	(0.24907)	(0.01270)	(0.19040)
	[-1.58272]	[-2.20267]	[0.87447]	[-0.94800]
R-squared	0.968629	0.721979	0.728583	0.606131
Adj. R-squared	0.926800	0.351283	0.366693	0.080973
Sum sq. resids	0.000843	0.073772	0.000192	0.043110
S.E. equation	0.011852	0.110884	0.005655	0.084764
F-statistic	23.15719	1.947633	2.013273	1.154187
Log likelihood	52.11713	18.57716	63.21759	22.60630
Akaike AIC	-5.748950	-1.276954	-7.229011	-1.814174
Schwarz SC	-5.324120	-0.852124	-6.804181	-1.389344
Mean dependent	0.127307	-0.079804	0.005203	0.039224
S.D. dependent	0.043806	0.137671	0.007105	0.088420

Determinant resid covariance (dof adj.)	1.42E-13
Determinant resid covariance	3.64E-15
Log likelihood	164.2061
Akaike information criterion	-17.09415
Schwarz criterion	-15.39483

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	D_IR_N	DLN_BRENT	DLN_GDP_N	DLN_SP_N
D_IR_N(-1)	-0.259983	-0.756530	-0.228906	-0.041196
	(0.31405)	(0.50187)	(0.09658)	(0.28761)
	[-0.82785]	[-1.50743]	[-2.37019]	[-0.14324]
D_IR_N(-2)	0.302463	-0.042636	0.216076	-0.091090
	(0.19815)	(0.31666)	(0.06094)	(0.18147)
	[1.52642]	[-0.13464]	[3.54590]	[-0.50195]
DLN_BRENT(-1)	-0.136005	-0.232897	0.289799	-0.053968
	(0.31453)	(0.50264)	(0.09673)	(0.28806)
	[-0.43241]	[-0.46335]	[2.99607]	[-0.18735]
DLN_BRENT(-2)	-0.038847	0.041734	-0.001788	0.203322
	(0.21570)	(0.34470)	(0.06633)	(0.19754)
	[-0.18010]	[0.12107]	[-0.02695]	[1.02925]
DLN_GDP_N(-1)	0.889970	-0.572828	-0.664382	0.348575
	(0.66756)	(1.06681)	(0.20529)	(0.61137)
	[1.33316]	[-0.53695]	[-3.23626]	[0.57015]
DLN_GDP_N(-2)	1.725907	0.185462	-0.247772	0.596096
	(0.74114)	(1.18440)	(0.22792)	(0.67876)
	[2.32871]	[0.15659]	[-1.08710]	[0.87821]
DLN_SP_N(-1)	1.136321	1.925474	-0.181893	-0.000312
	(0.51836)	(0.82838)	(0.15941)	(0.47473)
	[2.19213]	[2.32438]	[-1.14104]	[-0.00066]
DLN_SP_N(-2)	0.805203	1.160360	-0.361275	0.103561
	(0.53943)	(0.86204)	(0.16589)	(0.49402)
	[1.49270]	[1.34606]	[-2.17782]	[0.20963]
C	-0.118818	-0.220370	0.041044	0.003453
	(0.05026)	(0.08031)	(0.01546)	(0.04603)
	[-2.36422]	[-2.74388]	[2.65569]	[0.07501]
R-squared	0.731672	0.625165	0.840653	0.383540
Adj. R-squared	0.373902	0.125386	0.628189	-0.438406
Sum sq. resids	0.038946	0.099461	0.003683	0.032665
S.E. equation	0.080567	0.128751	0.024776	0.073785
F-statistic	2.045091	1.250882	3.956697	0.466625
Log likelihood	23.36818	16.33626	41.05613	24.68710
Akaike AIC	-1.915758	-0.978168	-4.274151	-2.091613
Schwarz SC	-1.490928	-0.553338	-3.849321	-1.666783
Mean dependent	-0.082444	-0.079804	0.003915	0.015545
S.D. dependent	0.101820	0.137671	0.040633	0.061522

Determinant resid covariance (dof adj.)	8.73E-12
Determinant resid covariance	2.23E-13
Log likelihood	133.3350
Akaike information criterion	-12.97800
Schwarz criterion	-11.27868

Vector Autoregression Estimates
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Standard errors in ( ) & t-statistics in [ ]

	D_IR_UK	DLN_BRENT	DLN_GDP_UK	DLN_SP_UK
D_IR_UK(-1)	1.546564	-0.215315	0.037645	-0.714843
	(0.18664)	(0.89930)	(0.10576)	(0.25123)
	[8.28643]	[-0.23943]	[0.35596]	[-2.84542]
D_IR_UK(-2)	-0.652867	0.031306	0.113881	0.410461
	(0.17202)	(0.82888)	(0.09748)	(0.23155)
	[-3.79521]	[0.03777]	[1.16829]	[1.77263]
DLN_BRENT(-1)	0.173777	0.115837	0.078758	-0.149278
	(0.09403)	(0.45307)	(0.05328)	(0.12657)
	[1.84810]	[0.25567]	[1.47816]	[-1.17941]
DLN_BRENT(-2)	-0.047666	0.387843	0.070684	-0.096055
	(0.08955)	(0.43149)	(0.05074)	(0.12054)
	[-0.53227]	[0.89884]	[1.39296]	[-0.79687]
DLN_GDP_UK(-1)	0.690291	-4.727304	-0.714809	-0.415140
	(0.56611)	(2.72776)	(0.32079)	(0.76202)
	[1.21935]	[-1.73304]	[-2.22831]	[-0.54479]
DLN_GDP_UK(-2)	1.083917	-1.673874	-0.416954	-0.204080
	(0.56563)	(2.72541)	(0.32051)	(0.76137)
	[1.91631]	[-0.61417]	[-1.30091]	[-0.26804]
DLN_SP_UK(-1)	1.082026	0.827211	0.227346	-0.986658
	(0.31710)	(1.52790)	(0.17968)	(0.42683)
	[3.41227]	[0.54140]	[1.26527]	[-2.31158]
DLN_SP_UK(-2)	0.279129	0.696097	0.144663	-0.442100
	(0.25961)	(1.25092)	(0.14711)	(0.34945)
	[1.07517]	[0.55647]	[0.98338]	[-1.26512]
C	0.063526	0.051536	0.044453	-0.126358
	(0.03743)	(0.18036)	(0.02121)	(0.05039)
	[1.69712]	[0.28574]	[2.09582]	[-2.50783]
R-squared	0.945985	0.454357	0.698249	0.739104
Adj. R-squared	0.873966	-0.273168	0.295915	0.391242
Sum sq. resids	0.006236	0.144784	0.002002	0.011299
S.E. equation	0.032239	0.155340	0.018268	0.043396
F-statistic	13.13515	0.624524	1.735494	2.124704
Log likelihood	37.10675	13.52015	45.62712	32.64905
Akaike AIC	-3.747567	-0.602687	-4.883616	-3.153207
Schwarz SC	-3.322737	-0.177857	-4.458786	-2.728377
Mean dependent	-0.029776	-0.079804	0.006667	-0.039207
S.D. dependent	0.090811	0.137671	0.021771	0.055619

Determinant resid covariance (dof adj.)	8.96E-13
Determinant resid covariance	2.29E-14
Log likelihood	150.4124
Akaike information criterion	-15.25499
Schwarz criterion	-13.55567

Vector Autoregression Estimates
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	D_IR_US	DLN_BRENT	DLN_GDP_US	DLN_SP_US
D_IR_US(-1)	0.821712	0.298128	-0.144516	-0.457110
	(0.35938)	(1.89030)	(0.09338)	(0.28263)
	[2.28649]	[0.15771]	[-1.54768]	[-1.61736]
D_IR_US(-2)	0.011969	-0.910496	-0.050375	0.649114
	(0.38429)	(2.02134)	(0.09985)	(0.30222)
	[0.03115]	[-0.45044]	[-0.50451]	[2.14783]
DLN_BRENT(-1)	0.072434	0.073856	-0.049674	-0.021120
	(0.08641)	(0.45452)	(0.02245)	(0.06796)
	[0.83824]	[0.16249]	[-2.21242]	[-0.31078]
DLN_BRENT(-2)	-0.139168	-0.105349	-0.017675	0.327561
	(0.09399)	(0.49438)	(0.02442)	(0.07392)
	[-1.48068]	[-0.21310]	[-0.72375]	[4.43151]
DLN_GDP_US(-1)	-1.666098	3.291131	-0.025274	2.867976
	(1.54312)	(8.11672)	(0.40094)	(1.21356)
	[-1.07969]	[0.40548]	[-0.06304]	[2.36327]
DLN_GDP_US(-2)	-0.082894	1.258816	0.150242	-1.518151
	(1.21925)	(6.41317)	(0.31679)	(0.95886)
	[-0.06799]	[0.19629]	[0.47426]	[-1.58329]
DLN_SP_US(-1)	-0.572321	0.126023	-0.050305	-0.210368
	(0.25265)	(1.32894)	(0.06565)	(0.19870)
	[-2.26524]	[0.09483]	[-0.76630]	[-1.05875]
DLN_SP_US(-2)	-0.632243	2.052285	-0.183519	0.110431
	(0.37862)	(1.99150)	(0.09837)	(0.29776)
	[-1.66988]	[1.03052]	[-1.86551]	[0.37088]
C	0.055330	-0.187882	0.009808	0.029413
	(0.02107)	(0.11082)	(0.00547)	(0.01657)
	[2.62617]	[-1.69537]	[1.79164]	[1.77516]
R-squared	0.918837	0.462627	0.556913	0.838812
Adj. R-squared	0.810620	-0.253871	-0.033870	0.623895
Sum sq. resids	0.005154	0.142589	0.000348	0.003187
S.E. equation	0.029308	0.154159	0.007615	0.023049
F-statistic	8.490700	0.645678	0.942669	3.902959
Log likelihood	38.53650	13.63470	58.75258	42.14019
Akaike AIC	-3.938200	-0.617960	-6.633677	-4.418692
Schwarz SC	-3.513370	-0.193130	-6.208847	-3.993862
Mean dependent	0.016889	-0.079804	0.011870	0.016164
S.D. dependent	0.067347	0.137671	0.007489	0.037583

Determinant resid covariance (dof adj.)	3.27E-13
Determinant resid covariance	8.37E-15
Log likelihood	157.9727
Akaike information criterion	-16.26303
Schwarz criterion	-14.56371

Appendix C Unit Root Tests:

Null Hypothesis: LN_SP_C has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.400027	0.1447
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_C)
Method: Least Squares
Date: 02/23/17 Time: 12:20
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_C(-1)	-0.068621	0.028592	-2.400027	0.0186
D(LN_SP_C(-1))	0.263818	0.102336	2.577958	0.0117
C	0.644958	0.266157	2.423221	0.0175

R-squared	0.120851	Mean dependent var	0.008427
Adjusted R-squared	0.099919	S.D. dependent var	0.073995
S.E. of regression	0.070201	Akaike info criterion	-2.441032
Sum squared resid	0.413968	Schwarz criterion	-2.356001
Log likelihood	109.1849	Hannan-Quinn criter.	-2.406793
F-statistic	5.773456	Durbin-Watson stat	1.954097
Prob(F-statistic)	0.004473		

Null Hypothesis: LN_SP_C has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.068472	0.1205
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_C)
Method: Least Squares
Date: 02/23/17 Time: 12:21
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_C(-1)	-0.153913	0.050160	-3.068472	0.0029
D(LN_SP_C(-1))	0.317617	0.103803	3.059801	0.0030
C	1.389644	0.447217	3.107313	0.0026
@TREND("1994Q1")	0.001082	0.000528	2.051470	0.0434

R-squared	0.163277	Mean dependent var	0.008427
Adjusted R-squared	0.133034	S.D. dependent var	0.073995
S.E. of regression	0.068898	Akaike info criterion	-2.467505
Sum squared resid	0.393991	Schwarz criterion	-2.354130
Log likelihood	111.3365	Hannan-Quinn criter.	-2.421853
F-statistic	5.398832	Durbin-Watson stat	1.981326
Prob(F-statistic)	0.001919		

Null Hypothesis: D(LN_SP_C) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.194759	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_C,2)
Method: Least Squares
Date: 02/23/17 Time: 12:26
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_C(-1))	-0.754509	0.104869	-7.194759	0.0000
C	0.006432	0.007781	0.826582	0.4108

R-squared	0.378494	Mean dependent var	0.000299
Adjusted R-squared	0.371182	S.D. dependent var	0.090973
S.E. of regression	0.072140	Akaike info criterion	-2.397697
Sum squared resid	0.442355	Schwarz criterion	-2.341009
Log likelihood	106.2998	Hannan-Quinn criter.	-2.374870
F-statistic	51.76455	Durbin-Watson stat	1.929963
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_C) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.227238	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_C,2)
Method: Least Squares
Date: 02/23/17 Time: 12:27
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_C(-1))	-0.761947	0.105427	-7.227238	0.0000
C	0.018172	0.016028	1.133776	0.2601
@TREND("1994Q1")	-0.000260	0.000310	-0.838305	0.4042

R-squared	0.383650	Mean dependent var	0.000299
Adjusted R-squared	0.368975	S.D. dependent var	0.090973
S.E. of regression	0.072266	Akaike info criterion	-2.383040
Sum squared resid	0.438685	Schwarz criterion	-2.298008
Log likelihood	106.6622	Hannan-Quinn criter.	-2.348800
F-statistic	26.14314	Durbin-Watson stat	1.933105
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_F has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.290650	0.1773
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_F)
Method: Least Squares
Date: 02/23/17 Time: 12:28
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_F(-1)	-0.069845	0.030491	-2.290650	0.0245
D(LN_SP_F(-1))	0.314345	0.102199	3.075828	0.0028
C	0.587664	0.254998	2.304586	0.0237

R-squared	0.135397	Mean dependent var	0.005446
Adjusted R-squared	0.114811	S.D. dependent var	0.087494
S.E. of regression	0.082318	Akaike info criterion	-2.122580
Sum squared resid	0.569205	Schwarz criterion	-2.037548
Log likelihood	95.33222	Hannan-Quinn criter.	-2.088340
F-statistic	6.577222	Durbin-Watson stat	2.050117
Prob(F-statistic)	0.002220		

Null Hypothesis: LN_SP_F has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.174155	0.4975
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_F)
Method: Least Squares
Date: 02/23/17 Time: 12:29
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_F(-1)	-0.067563	0.031075	-2.174155	0.0325
D(LN_SP_F(-1))	0.311003	0.102973	3.020225	0.0034
C	0.575697	0.257671	2.234232	0.0282
@TREND("1994Q1")	-0.000158	0.000359	-0.439801	0.6612

R-squared	0.137407	Mean dependent var	0.005446
Adjusted R-squared	0.106229	S.D. dependent var	0.087494
S.E. of regression	0.082716	Akaike info criterion	-2.101919
Sum squared resid	0.567882	Schwarz criterion	-1.988544
Log likelihood	95.43347	Hannan-Quinn criter.	-2.056266
F-statistic	4.407186	Durbin-Watson stat	2.052166
Prob(F-statistic)	0.006302		

Null Hypothesis: D(LN_SP_F) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.880143	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_F,2)
Method: Least Squares
Date: 02/23/17 Time: 12:30
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_F(-1))	-0.714863	0.103902	-6.880143	0.0000
C	0.003905	0.009061	0.430981	0.6676

R-squared	0.357697	Mean dependent var	4.06E-05
Adjusted R-squared	0.350141	S.D. dependent var	0.104634
S.E. of regression	0.084349	Akaike info criterion	-2.084976
Sum squared resid	0.604761	Schwarz criterion	-2.028289
Log likelihood	92.69647	Hannan-Quinn criter.	-2.062150
F-statistic	47.33637	Durbin-Watson stat	2.003649
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_F) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.897703	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_F,2)
Method: Least Squares
Date: 02/23/17 Time: 12:30
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_F(-1))	-0.719221	0.104270	-6.897703	0.0000
C	0.016887	0.018651	0.905423	0.3678
@TREND("1994Q1")	-0.000288	0.000361	-0.796865	0.4278

R-squared	0.362516	Mean dependent var	4.06E-05
Adjusted R-squared	0.347338	S.D. dependent var	0.104634
S.E. of regression	0.084531	Akaike info criterion	-2.069519
Sum squared resid	0.600223	Schwarz criterion	-1.984488
Log likelihood	93.02407	Hannan-Quinn criter.	-2.035279
F-statistic	23.88405	Durbin-Watson stat	2.009748
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_G has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.050715	0.2651
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_G)
Method: Least Squares
Date: 02/23/17 Time: 12:32
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_G(-1)	-0.056160	0.027386	-2.050715	0.0434
D(LN_SP_G(-1))	0.289374	0.104421	2.771224	0.0069
C	0.497649	0.238023	2.090759	0.0396

R-squared	0.113478	Mean dependent var	0.014034
Adjusted R-squared	0.092371	S.D. dependent var	0.098258
S.E. of regression	0.093610	Akaike info criterion	-1.865480
Sum squared resid	0.736082	Schwarz criterion	-1.780448
Log likelihood	84.14837	Hannan-Quinn criter.	-1.831240
F-statistic	5.376172	Durbin-Watson stat	2.006635
Prob(F-statistic)	0.006353		

Null Hypothesis: LN_SP_G has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.460179	0.3469
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_G)
Method: Least Squares
Date: 02/23/17 Time: 12:32
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_G(-1)	-0.093894	0.038165	-2.460179	0.0160
D(LN_SP_G(-1))	0.309271	0.104764	2.952057	0.0041
C	0.789887	0.314489	2.511649	0.0140
@TREND("1994Q1")	0.000786	0.000557	1.410795	0.1620

R-squared	0.134239	Mean dependent var	0.014034
Adjusted R-squared	0.102947	S.D. dependent var	0.098258
S.E. of regression	0.093063	Akaike info criterion	-1.866188
Sum squared resid	0.718844	Schwarz criterion	-1.752813
Log likelihood	85.17919	Hannan-Quinn criter.	-1.820536
F-statistic	4.289818	Durbin-Watson stat	2.020884
Prob(F-statistic)	0.007264		

Null Hypothesis: D(LN_SP_G) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.948113	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_G,2)
Method: Least Squares
Date: 02/23/17 Time: 12:35
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_G(-1))	-0.734482	0.105710	-6.948113	0.0000
C	0.009976	0.010350	0.963853	0.3379

R-squared	0.362227	Mean dependent var	-0.001248
Adjusted R-squared	0.354724	S.D. dependent var	0.118710
S.E. of regression	0.095359	Akaike info criterion	-1.839616
Sum squared resid	0.772933	Schwarz criterion	-1.782929
Log likelihood	82.02332	Hannan-Quinn criter.	-1.816790
F-statistic	48.27628	Durbin-Watson stat	1.972678
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_G) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.921440	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_G,2)
Method: Least Squares
Date: 02/23/17 Time: 12:35
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_G(-1))	-0.735341	0.106241	-6.921440	0.0000
C	0.017843	0.021173	0.842705	0.4018
@TREND("1994Q1")	-0.000175	0.000409	-0.426534	0.6708

R-squared	0.363605	Mean dependent var	-0.001248
Adjusted R-squared	0.348453	S.D. dependent var	0.118710
S.E. of regression	0.095821	Akaike info criterion	-1.818791
Sum squared resid	0.771263	Schwarz criterion	-1.733760
Log likelihood	82.11743	Hannan-Quinn criter.	-1.784552
F-statistic	23.99679	Durbin-Watson stat	1.975238
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_J has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.474314	0.1252
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_J)
Method: Least Squares
Date: 02/23/17 Time: 12:38
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_J(-1)	-0.086769	0.035068	-2.474314	0.0154
D(LN_SP_J(-1))	0.332547	0.103351	3.217645	0.0018
C	0.825087	0.334536	2.466365	0.0157

R-squared	0.145236	Mean dependent var	-0.002486
Adjusted R-squared	0.124885	S.D. dependent var	0.096025
S.E. of regression	0.089829	Akaike info criterion	-1.947946
Sum squared resid	0.677815	Schwarz criterion	-1.862915
Log likelihood	87.73564	Hannan-Quinn criter.	-1.913706
F-statistic	7.136383	Durbin-Watson stat	1.944558
Prob(F-statistic)	0.001373		

Null Hypothesis: LN_SP_J has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.334390	0.4110
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_J)
Method: Least Squares
Date: 02/23/17 Time: 12:39
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_J(-1)	-0.091426	0.039165	-2.334390	0.0220
D(LN_SP_J(-1))	0.339457	0.106957	3.173770	0.0021
C	0.874822	0.382475	2.287267	0.0247
@TREND("1994Q1")	-0.000118	0.000433	-0.273257	0.7853

R-squared	0.146005	Mean dependent var	-0.002486
Adjusted R-squared	0.115137	S.D. dependent var	0.096025
S.E. of regression	0.090328	Akaike info criterion	-1.925857
Sum squared resid	0.677206	Schwarz criterion	-1.812481
Log likelihood	87.77476	Hannan-Quinn criter.	-1.880204
F-statistic	4.730070	Durbin-Watson stat	1.949848
Prob(F-statistic)	0.004268		

Null Hypothesis: D(LN_SP_J) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.749640	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_J,2)
Method: Least Squares
Date: 02/23/17 Time: 12:40
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_J(-1))	-0.708829	0.105017	-6.749640	0.0000
C	-0.002316	0.009917	-0.233555	0.8159

R-squared	0.348947	Mean dependent var	-0.001902
Adjusted R-squared	0.341287	S.D. dependent var	0.113966
S.E. of regression	0.092496	Akaike info criterion	-1.900584
Sum squared resid	0.727217	Schwarz criterion	-1.843897
Log likelihood	84.67542	Hannan-Quinn criter.	-1.877758
F-statistic	45.55765	Durbin-Watson stat	1.905330
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_J) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.780131	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_J,2)
Method: Least Squares
Date: 02/23/17 Time: 12:41
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_J(-1))	-0.721570	0.106424	-6.780131	0.0000
C	-0.016796	0.020576	-0.816279	0.4166
@TREND("1994Q1")	0.000322	0.000400	0.803660	0.4239

R-squared	0.353914	Mean dependent var	-0.001902
Adjusted R-squared	0.338531	S.D. dependent var	0.113966
S.E. of regression	0.092689	Akaike info criterion	-1.885255
Sum squared resid	0.721668	Schwarz criterion	-1.800224
Log likelihood	85.00861	Hannan-Quinn criter.	-1.851016
F-statistic	23.00686	Durbin-Watson stat	1.898377
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_N has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.229511	0.6587
Test critical values:	1% level	-3.506484	
	5% level	-2.894716	
	10% level	-2.584529	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_N)
Method: Least Squares
Date: 02/23/17 Time: 12:43
Sample (adjusted): 1994Q2 2016Q1
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_N(-1)	-0.029097	0.023665	-1.229511	0.2222
C	0.184854	0.137246	1.346875	0.1816

R-squared	0.017274	Mean dependent var	0.016860
Adjusted R-squared	0.005847	S.D. dependent var	0.121778
S.E. of regression	0.121421	Akaike info criterion	-1.356640
Sum squared resid	1.267904	Schwarz criterion	-1.300337
Log likelihood	61.69217	Hannan-Quinn criter.	-1.333957
F-statistic	1.511698	Durbin-Watson stat	1.720058
Prob(F-statistic)	0.222233		

Null Hypothesis: LN_SP_N has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.259745	0.4509
Test critical values:	1% level	-4.065702	
	5% level	-3.461686	
	10% level	-3.157121	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_N)
Method: Least Squares
Date: 02/23/17 Time: 12:43
Sample (adjusted): 1994Q2 2016Q1
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_N(-1)	-0.116280	0.051457	-2.259745	0.0264
C	0.594511	0.254444	2.336511	0.0218
@TREND("1994Q1")	0.002106	0.001108	1.900550	0.0608

R-squared	0.057333	Mean dependent var	0.016860
Adjusted R-squared	0.035153	S.D. dependent var	0.121778
S.E. of regression	0.119618	Akaike info criterion	-1.375530
Sum squared resid	1.216220	Schwarz criterion	-1.291075
Log likelihood	63.52332	Hannan-Quinn criter.	-1.341505
F-statistic	2.584852	Durbin-Watson stat	1.645314
Prob(F-statistic)	0.081326		

Null Hypothesis: D(LN_SP_N) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.133698	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_N,2)
Method: Least Squares
Date: 02/23/17 Time: 12:46
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_N(-1))	-0.873918	0.107444	-8.133698	0.0000
C	0.015619	0.013201	1.183149	0.2400

R-squared	0.437671	Mean dependent var	0.000289
Adjusted R-squared	0.431055	S.D. dependent var	0.161575
S.E. of regression	0.121873	Akaike info criterion	-1.348947
Sum squared resid	1.262517	Schwarz criterion	-1.292259
Log likelihood	60.67919	Hannan-Quinn criter.	-1.326121
F-statistic	66.15704	Durbin-Watson stat	1.995473
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_N) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.096900	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_N,2)
Method: Least Squares
Date: 02/23/17 Time: 12:46
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_N(-1))	-0.874584	0.108015	-8.096900	0.0000
C	0.024091	0.027049	0.890646	0.3757
@TREND("1994Q1")	-0.000188	0.000523	-0.359419	0.7202

R-squared	0.438534	Mean dependent var	0.000289
Adjusted R-squared	0.425166	S.D. dependent var	0.161575
S.E. of regression	0.122503	Akaike info criterion	-1.327495
Sum squared resid	1.260578	Schwarz criterion	-1.242464
Log likelihood	60.74604	Hannan-Quinn criter.	-1.293256
F-statistic	32.80422	Durbin-Watson stat	1.997228
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_UK has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.465290	0.8919
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_UK)
Method: Least Squares
Date: 02/23/17 Time: 12:47
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_UK(-1)	-0.010211	0.021946	-0.465290	0.6429
D(LN_SP_UK(-1))	0.329163	0.105970	3.106200	0.0026
C	0.080406	0.193567	0.415389	0.6789

R-squared	0.103582	Mean dependent var	-0.014185
Adjusted R-squared	0.082239	S.D. dependent var	0.059641
S.E. of regression	0.057136	Akaike info criterion	-2.852896
Sum squared resid	0.274218	Schwarz criterion	-2.767864
Log likelihood	127.1010	Hannan-Quinn criter.	-2.818656
F-statistic	4.853152	Durbin-Watson stat	1.971720
Prob(F-statistic)	0.010126		

Null Hypothesis: LN_SP_UK has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.014525	0.5851
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_UK)
Method: Least Squares
Date: 02/23/17 Time: 12:48
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_UK(-1)	-0.080787	0.040102	-2.014525	0.0472
D(LN_SP_UK(-1))	0.367757	0.105552	3.484120	0.0008
C	0.744046	0.370508	2.008177	0.0479
@TREND("1994Q1")	-0.000934	0.000448	-2.085672	0.0401

R-squared	0.148224	Mean dependent var	-0.014185
Adjusted R-squared	0.117437	S.D. dependent var	0.059641
S.E. of regression	0.056030	Akaike info criterion	-2.880990
Sum squared resid	0.260562	Schwarz criterion	-2.767615
Log likelihood	129.3231	Hannan-Quinn criter.	-2.835337
F-statistic	4.814477	Durbin-Watson stat	2.008453
Prob(F-statistic)	0.003857		

Null Hypothesis: D(LN_SP_UK) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.635610	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_UK,2)
Method: Least Squares
Date: 02/23/17 Time: 12:48
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_UK(-1))	-0.681942	0.102770	-6.635610	0.0000
C	-0.009611	0.006274	-1.531983	0.1292

R-squared	0.341245	Mean dependent var	0.000195
Adjusted R-squared	0.333495	S.D. dependent var	0.069662
S.E. of regression	0.056872	Akaike info criterion	-2.873310
Sum squared resid	0.274925	Schwarz criterion	-2.816623
Log likelihood	126.9890	Hannan-Quinn criter.	-2.850484
F-statistic	44.03131	Durbin-Watson stat	1.965845
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_UK) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.653283	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_UK,2)
Method: Least Squares
Date: 02/23/17 Time: 12:49
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_UK(-1))	-0.689000	0.103558	-6.653283	0.0000
C	-0.001938	0.012556	-0.154368	0.8777
@TREND("1994Q1")	-0.000173	0.000245	-0.706178	0.4820

R-squared	0.345133	Mean dependent var	0.000195
Adjusted R-squared	0.329541	S.D. dependent var	0.069662
S.E. of regression	0.057040	Akaike info criterion	-2.856241
Sum squared resid	0.273303	Schwarz criterion	-2.771210
Log likelihood	127.2465	Hannan-Quinn criter.	-2.822001
F-statistic	22.13516	Durbin-Watson stat	1.964104
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_SP_US has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.836927	0.0573
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_US)
Method: Least Squares
Date: 02/23/17 Time: 12:50
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_US(-1)	-0.070793	0.024954	-2.836927	0.0057
D(LN_SP_US(-1))	0.238596	0.101254	2.356426	0.0208
C	0.675769	0.235064	2.874833	0.0051

R-squared	0.139305	Mean dependent var	0.012029
Adjusted R-squared	0.118812	S.D. dependent var	0.062195
S.E. of regression	0.058384	Akaike info criterion	-2.809679
Sum squared resid	0.286329	Schwarz criterion	-2.724648
Log likelihood	125.2211	Hannan-Quinn criter.	-2.775440
F-statistic	6.797769	Durbin-Watson stat	2.042327
Prob(F-statistic)	0.001835		

Null Hypothesis: LN_SP_US has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.738382	0.2243
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_US)
Method: Least Squares
Date: 02/23/17 Time: 12:51
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_SP_US(-1)	-0.087528	0.031963	-2.738382	0.0076
D(LN_SP_US(-1))	0.249775	0.102300	2.441587	0.0167
C	0.821078	0.292171	2.810267	0.0062
@TREND("1994Q1")	0.000270	0.000321	0.840139	0.4032

R-squared	0.146563	Mean dependent var	0.012029
Adjusted R-squared	0.115715	S.D. dependent var	0.062195
S.E. of regression	0.058486	Akaike info criterion	-2.795159
Sum squared resid	0.283915	Schwarz criterion	-2.681784
Log likelihood	125.5894	Hannan-Quinn criter.	-2.749506
F-statistic	4.751253	Durbin-Watson stat	2.050290
Prob(F-statistic)	0.004161		

Null Hypothesis: D(LN_SP_US) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.227239	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_US,2)
Method: Least Squares
Date: 02/23/17 Time: 12:51
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_US(-1))	-0.761519	0.105368	-7.227239	0.0000
C	0.009156	0.006636	1.379611	0.1713

R-squared	0.380615	Mean dependent var	-2.07E-05
Adjusted R-squared	0.373328	S.D. dependent var	0.076749
S.E. of regression	0.060756	Akaike info criterion	-2.741173
Sum squared resid	0.313763	Schwarz criterion	-2.684485
Log likelihood	121.2410	Hannan-Quinn criter.	-2.718346
F-statistic	52.23298	Durbin-Watson stat	1.997859
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_SP_US) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.304213	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_SP_US,2)
Method: Least Squares
Date: 02/23/17 Time: 12:52
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_SP_US(-1))	-0.773018	0.105832	-7.304213	0.0000
C	0.021806	0.013582	1.605487	0.1121
@TREND("1994Q1")	-0.000278	0.000261	-1.067219	0.2889

R-squared	0.388901	Mean dependent var	-2.07E-05
Adjusted R-squared	0.374351	S.D. dependent var	0.076749
S.E. of regression	0.060707	Akaike info criterion	-2.731652
Sum squared resid	0.309565	Schwarz criterion	-2.646621
Log likelihood	121.8269	Hannan-Quinn criter.	-2.697413
F-statistic	26.72866	Durbin-Watson stat	2.001060
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_BRENT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.656459	0.4497
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_BRENT)
Method: Least Squares
Date: 02/23/17 Time: 12:54
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_BRENT(-1)	-0.043363	0.026178	-1.656459	0.1014
D(LN_BRENT(-1))	0.304915	0.104529	2.917047	0.0045
C	0.171773	0.104315	1.646678	0.1034

R-squared	0.111379	Mean dependent var	0.003046
Adjusted R-squared	0.090222	S.D. dependent var	0.149962
S.E. of regression	0.143037	Akaike info criterion	-1.017546
Sum squared resid	1.718617	Schwarz criterion	-0.932514
Log likelihood	47.26324	Hannan-Quinn criter.	-0.983306
F-statistic	5.264257	Durbin-Watson stat	1.864458
Prob(F-statistic)	0.007016		

Null Hypothesis: LN_BRENT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.446668	0.8400
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_BRENT)
Method: Least Squares
Date: 02/23/17 Time: 12:56
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_BRENT(-1)	-0.076987	0.053217	-1.446668	0.1518
D(LN_BRENT(-1))	0.336697	0.113589	2.964163	0.0040
C	0.263203	0.163668	1.608156	0.1116
@TREND("1994Q1")	0.000910	0.001253	0.726367	0.4697

R-squared	0.116992	Mean dependent var	0.003046
Adjusted R-squared	0.085076	S.D. dependent var	0.149962
S.E. of regression	0.143441	Akaike info criterion	-1.000894
Sum squared resid	1.707761	Schwarz criterion	-0.887519
Log likelihood	47.53888	Hannan-Quinn criter.	-0.955241
F-statistic	3.665638	Durbin-Watson stat	1.864443
Prob(F-statistic)	0.015539		

Null Hypothesis: D(LN_BRENT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.740478	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_BRENT,2)
Method: Least Squares
Date: 02/23/17 Time: 13:00
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_BRENT(-1))	-0.709346	0.105237	-6.740478	0.0000
C	0.000862	0.015512	0.055570	0.9558

R-squared	0.348330	Mean dependent var	-0.004468
Adjusted R-squared	0.340663	S.D. dependent var	0.177953
S.E. of regression	0.144497	Akaike info criterion	-1.008391
Sum squared resid	1.774755	Schwarz criterion	-0.951704
Log likelihood	45.86503	Hannan-Quinn criter.	-0.985565
F-statistic	45.43405	Durbin-Watson stat	1.865398
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_BRENT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.829023	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_BRENT,2)
Method: Least Squares
Date: 02/23/17 Time: 13:01
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_BRENT(-1))	-0.724525	0.106095	-6.829023	0.0000
C	0.030965	0.032084	0.965116	0.3373
@TREND("1994Q1")	-0.000666	0.000622	-1.071564	0.2870

R-squared	0.357118	Mean dependent var	-0.004468
Adjusted R-squared	0.341811	S.D. dependent var	0.177953
S.E. of regression	0.144371	Akaike info criterion	-0.998980
Sum squared resid	1.750822	Schwarz criterion	-0.913949
Log likelihood	46.45563	Hannan-Quinn criter.	-0.964741
F-statistic	23.33077	Durbin-Watson stat	1.866488
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_C has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.602864	0.4768
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_C)
Method: Least Squares
Date: 02/23/17 Time: 13:07
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_C(-1)	-0.006076	0.003791	-1.602864	0.1127
D(LN_GDP_C(-1))	0.478879	0.094100	5.089016	0.0000
C	0.088289	0.053297	1.656544	0.1013

R-squared	0.298101	Mean dependent var	0.006083
Adjusted R-squared	0.281390	S.D. dependent var	0.006211
S.E. of regression	0.005265	Akaike info criterion	-7.621482
Sum squared resid	0.002329	Schwarz criterion	-7.536450
Log likelihood	334.5345	Hannan-Quinn criter.	-7.587242
F-statistic	17.83771	Durbin-Watson stat	1.866231
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_C has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.522978	0.8142
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_C)
Method: Least Squares
Date: 02/23/17 Time: 13:12
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_C(-1)	-0.026819	0.017610	-1.522978	0.1316
D(LN_GDP_C(-1))	0.493738	0.094652	5.216340	0.0000
C	0.372990	0.241971	1.541467	0.1270
@TREND("1994Q1")	0.000132	0.000109	1.206050	0.2312

R-squared	0.310190	Mean dependent var	0.006083
Adjusted R-squared	0.285257	S.D. dependent var	0.006211
S.E. of regression	0.005251	Akaike info criterion	-7.615866
Sum squared resid	0.002289	Schwarz criterion	-7.502491
Log likelihood	335.2902	Hannan-Quinn criter.	-7.570213
F-statistic	12.44101	Durbin-Watson stat	1.883071
Prob(F-statistic)	0.000001		

Null Hypothesis: D(LN_GDP_C) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.253218	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_C,2)
Method: Least Squares
Date: 02/23/17 Time: 13:12
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_C(-1))	-0.479543	0.091286	-5.253218	0.0000
C	0.002870	0.000801	3.582218	0.0006

R-squared	0.245091	Mean dependent var	-8.99E-05
Adjusted R-squared	0.236209	S.D. dependent var	0.006080
S.E. of regression	0.005314	Akaike info criterion	-7.614343
Sum squared resid	0.002400	Schwarz criterion	-7.557656
Log likelihood	333.2239	Hannan-Quinn criter.	-7.591517
F-statistic	27.59630	Durbin-Watson stat	1.894390
Prob(F-statistic)	0.000001		

Null Hypothesis: D(LN_GDP_C) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.423303	0.0001
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_C,2)
Method: Least Squares
Date: 02/23/17 Time: 13:13
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_C(-1))	-0.516130	0.095169	-5.423303	0.0000
C	0.004481	0.001473	3.042053	0.0031
@TREND("1994Q1")	-3.08E-05	2.36E-05	-1.300615	0.1969

R-squared	0.259993	Mean dependent var	-8.99E-05
Adjusted R-squared	0.242374	S.D. dependent var	0.006080
S.E. of regression	0.005292	Akaike info criterion	-7.611293
Sum squared resid	0.002353	Schwarz criterion	-7.526261
Log likelihood	334.0912	Hannan-Quinn criter.	-7.577053
F-statistic	14.75622	Durbin-Watson stat	1.867939
Prob(F-statistic)	0.000003		

Null Hypothesis: LN_GDP_F has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.806857	0.3750
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_F)
Method: Least Squares
Date: 02/23/17 Time: 13:13
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_F(-1)	-0.007637	0.004227	-1.806857	0.0744
D(LN_GDP_F(-1))	0.531953	0.090134	5.901797	0.0000
C	0.101450	0.055271	1.835507	0.0700

R-squared	0.382162	Mean dependent var	0.003966
Adjusted R-squared	0.367452	S.D. dependent var	0.004772
S.E. of regression	0.003795	Akaike info criterion	-8.276142
Sum squared resid	0.001210	Schwarz criterion	-8.191111
Log likelihood	363.0122	Hannan-Quinn criter.	-8.241903
F-statistic	25.97900	Durbin-Watson stat	2.087278
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_F has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.358949	0.8660
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_F)
Method: Least Squares
Date: 02/23/17 Time: 13:14
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_F(-1)	-0.018522	0.013629	-1.358949	0.1778
D(LN_GDP_F(-1))	0.544300	0.091480	5.949911	0.0000
C	0.241263	0.175377	1.375680	0.1726
@TREND("1994Q1")	4.74E-05	5.65E-05	0.840183	0.4032

R-squared	0.387372	Mean dependent var	0.003966
Adjusted R-squared	0.365229	S.D. dependent var	0.004772
S.E. of regression	0.003802	Akaike info criterion	-8.261623
Sum squared resid	0.001200	Schwarz criterion	-8.148248
Log likelihood	363.3806	Hannan-Quinn criter.	-8.215970
F-statistic	17.49400	Durbin-Watson stat	2.111291
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_F) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.804736	0.0001
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_F,2)
Method: Least Squares
Date: 02/23/17 Time: 13:15
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_F(-1))	-0.410955	0.085531	-4.804736	0.0000
C	0.001588	0.000538	2.952849	0.0041

R-squared	0.213585	Mean dependent var	-7.11E-05
Adjusted R-squared	0.204334	S.D. dependent var	0.004311
S.E. of regression	0.003846	Akaike info criterion	-8.261001
Sum squared resid	0.001257	Schwarz criterion	-8.204314
Log likelihood	361.3536	Hannan-Quinn criter.	-8.238175
F-statistic	23.08549	Durbin-Watson stat	2.149101
Prob(F-statistic)	0.000007		

Null Hypothesis: D(LN_GDP_F) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.022737	0.0005
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_F,2)
Method: Least Squares
Date: 02/23/17 Time: 13:15
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_F(-1))	-0.461320	0.091846	-5.022737	0.0000
C	0.002939	0.001076	2.731075	0.0077
@TREND("1994Q1")	-2.55E-05	1.76E-05	-1.446163	0.1519

R-squared	0.232690	Mean dependent var	-7.11E-05
Adjusted R-squared	0.214420	S.D. dependent var	0.004311
S.E. of regression	0.003821	Akaike info criterion	-8.262605
Sum squared resid	0.001227	Schwarz criterion	-8.177574
Log likelihood	362.4233	Hannan-Quinn criter.	-8.228366
F-statistic	12.73664	Durbin-Watson stat	2.088671
Prob(F-statistic)	0.000015		

Null Hypothesis: LN_GDP_G has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.891539	0.7866
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_G)
Method: Least Squares
Date: 02/23/17 Time: 13:16
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_G(-1)	-0.009350	0.010488	-0.891539	0.3752
D(LN_GDP_G(-1))	0.317283	0.103118	3.076882	0.0028
C	0.126938	0.139741	0.908383	0.3663

R-squared	0.108782	Mean dependent var	0.003432
Adjusted R-squared	0.087562	S.D. dependent var	0.008357
S.E. of regression	0.007983	Akaike info criterion	-6.789121
Sum squared resid	0.005353	Schwarz criterion	-6.704090
Log likelihood	298.3268	Hannan-Quinn criter.	-6.754882
F-statistic	5.126512	Durbin-Watson stat	2.022408
Prob(F-statistic)	0.007931		

Null Hypothesis: LN_GDP_G has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.282852	0.0760
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_G)
Method: Least Squares
Date: 02/23/17 Time: 13:17
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_G(-1)	-0.152398	0.046423	-3.282852	0.0015
D(LN_GDP_G(-1))	0.387597	0.100527	3.855639	0.0002
C	2.011236	0.611827	3.287266	0.0015
@TREND("1994Q1")	0.000476	0.000151	3.155055	0.0022

R-squared	0.204221	Mean dependent var	0.003432
Adjusted R-squared	0.175458	S.D. dependent var	0.008357
S.E. of regression	0.007589	Akaike info criterion	-6.879401
Sum squared resid	0.004780	Schwarz criterion	-6.766026
Log likelihood	303.2539	Hannan-Quinn criter.	-6.833748
F-statistic	7.100123	Durbin-Watson stat	2.126821
Prob(F-statistic)	0.000264		

Null Hypothesis: D(LN_GDP_G) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.630212	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_G,2)
Method: Least Squares
Date: 02/23/17 Time: 13:18
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_G(-1))	-0.682869	0.102994	-6.630212	0.0000
C	0.002357	0.000923	2.552017	0.0125

R-squared	0.340879	Mean dependent var	4.15E-05
Adjusted R-squared	0.333125	S.D. dependent var	0.009764
S.E. of regression	0.007973	Akaike info criterion	-6.802692
Sum squared resid	0.005404	Schwarz criterion	-6.746004
Log likelihood	297.9171	Hannan-Quinn criter.	-6.779865
F-statistic	43.95972	Durbin-Watson stat	2.021686
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_G) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.596397	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_G,2)
Method: Least Squares
Date: 02/23/17 Time: 13:19
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_G(-1))	-0.683972	0.103689	-6.596397	0.0000
C	0.002708	0.001814	1.492663	0.1393
@TREND("1994Q1")	-7.73E-06	3.43E-05	-0.225618	0.8220

R-squared	0.341279	Mean dependent var	4.15E-05
Adjusted R-squared	0.325595	S.D. dependent var	0.009764
S.E. of regression	0.008018	Akaike info criterion	-6.780309
Sum squared resid	0.005401	Schwarz criterion	-6.695278
Log likelihood	297.9434	Hannan-Quinn criter.	-6.746069
F-statistic	21.75989	Durbin-Watson stat	2.020615
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_J has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.669254	0.4432
Test critical values:	1% level	-3.506484	
	5% level	-2.894716	
	10% level	-2.584529	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_J)
Method: Least Squares
Date: 02/23/17 Time: 13:21
Sample (adjusted): 1994Q2 2016Q1
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_J(-1)	-0.066284	0.039709	-1.669254	0.0987
C	0.872638	0.522319	1.670698	0.0984

R-squared	0.031383	Mean dependent var	0.000756
Adjusted R-squared	0.020120	S.D. dependent var	0.009987
S.E. of regression	0.009886	Akaike info criterion	-6.372858
Sum squared resid	0.008406	Schwarz criterion	-6.316555
Log likelihood	282.4058	Hannan-Quinn criter.	-6.350175
F-statistic	2.786409	Durbin-Watson stat	1.805460
Prob(F-statistic)	0.098704		

Null Hypothesis: LN_GDP_J has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.717179	0.7355
Test critical values:	1% level	-4.065702	
	5% level	-3.461686	
	10% level	-3.157121	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_J)
Method: Least Squares
Date: 02/23/17 Time: 13:21
Sample (adjusted): 1994Q2 2016Q1
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_J(-1)	-0.072681	0.042326	-1.717179	0.0896
C	0.957667	0.557401	1.718094	0.0894
@TREND("1994Q1")	-2.00E-05	4.42E-05	-0.452363	0.6522

R-squared	0.033710	Mean dependent var	0.000756
Adjusted R-squared	0.010973	S.D. dependent var	0.009987
S.E. of regression	0.009932	Akaike info criterion	-6.352536
Sum squared resid	0.008385	Schwarz criterion	-6.268081
Log likelihood	282.5116	Hannan-Quinn criter.	-6.318511
F-statistic	1.482636	Durbin-Watson stat	1.798471
Prob(F-statistic)	0.232850		

Null Hypothesis: D(LN_GDP_J) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.658676	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_J,2)
Method: Least Squares
Date: 02/23/17 Time: 13:22
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_J(-1))	-0.938198	0.108354	-8.658676	0.0000
C	0.000780	0.001082	0.720723	0.4731

R-squared	0.468659	Mean dependent var	0.000145
Adjusted R-squared	0.462408	S.D. dependent var	0.013728
S.E. of regression	0.010066	Akaike info criterion	-6.336635
Sum squared resid	0.008612	Schwarz criterion	-6.279947
Log likelihood	277.6436	Hannan-Quinn criter.	-6.313808
F-statistic	74.97267	Durbin-Watson stat	1.985799
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_J) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.607620	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_J,2)
Method: Least Squares
Date: 02/23/17 Time: 13:22
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_J(-1))	-0.938198	0.108996	-8.607620	0.0000
C	0.000735	0.002229	0.329976	0.7422
@TREND("1994Q1")	9.80E-07	4.32E-05	0.022674	0.9820

R-squared	0.468662	Mean dependent var	0.000145
Adjusted R-squared	0.456012	S.D. dependent var	0.013728
S.E. of regression	0.010125	Akaike info criterion	-6.313652
Sum squared resid	0.008612	Schwarz criterion	-6.228621
Log likelihood	277.6439	Hannan-Quinn criter.	-6.279413
F-statistic	37.04580	Durbin-Watson stat	1.985812
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_N has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.059720	0.0019
Test critical values:	1% level	-3.509281	
	5% level	-2.895924	
	10% level	-2.585172	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_N)
Method: Least Squares
Date: 02/23/17 Time: 13:23
Sample (adjusted): 1995Q1 2016Q1
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_N(-1)	-0.076617	0.018873	-4.059720	0.0001
D(LN_GDP_N(-1))	-0.830191	0.064219	-12.92749	0.0000
D(LN_GDP_N(-2))	-0.868890	0.062685	-13.86123	0.0000
D(LN_GDP_N(-3))	-0.767626	0.064582	-11.88614	0.0000
C	1.037457	0.251019	4.132981	0.0001

R-squared	0.772449	Mean dependent var	0.004602
Adjusted R-squared	0.761071	S.D. dependent var	0.042975
S.E. of regression	0.021006	Akaike info criterion	-4.830955
Sum squared resid	0.035302	Schwarz criterion	-4.687270
Log likelihood	210.3156	Hannan-Quinn criter.	-4.773161
F-statistic	67.89220	Durbin-Watson stat	1.977661
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_N has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.485367	0.3345
Test critical values:	1% level	-4.069631	
	5% level	-3.463547	
	10% level	-3.158207	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_N)
Method: Least Squares
Date: 02/23/17 Time: 13:24
Sample (adjusted): 1995Q1 2016Q1
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_N(-1)	-0.185271	0.074545	-2.485367	0.0151
D(LN_GDP_N(-1))	-0.755526	0.080736	-9.358002	0.0000
D(LN_GDP_N(-2))	-0.818730	0.070553	-11.60452	0.0000
D(LN_GDP_N(-3))	-0.744948	0.065822	-11.31762	0.0000
C	2.455772	0.974245	2.520693	0.0137
@TREND("1994Q1")	0.000562	0.000373	1.505845	0.1361

R-squared	0.778798	Mean dependent var	0.004602
Adjusted R-squared	0.764798	S.D. dependent var	0.042975
S.E. of regression	0.020842	Akaike info criterion	-4.835725
Sum squared resid	0.034317	Schwarz criterion	-4.663303
Log likelihood	211.5183	Hannan-Quinn criter.	-4.766372
F-statistic	55.62785	Durbin-Watson stat	1.966744
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_N) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-20.33411	0.0001
Test critical values:	1% level	-3.509281	
	5% level	-2.895924	
	10% level	-2.585172	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_N,2)
Method: Least Squares
Date: 02/23/17 Time: 13:26
Sample (adjusted): 1995Q1 2016Q1
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_N(-1))	-3.450792	0.169705	-20.33411	0.0000
D(LN_GDP_N(-1),2)	1.608010	0.119223	13.48736	0.0000
D(LN_GDP_N(-2),2)	0.742561	0.070161	10.58371	0.0000
C	0.018438	0.002665	6.918972	0.0000

R-squared	0.897213	Mean dependent var	-0.001572
Adjusted R-squared	0.893406	S.D. dependent var	0.070221
S.E. of regression	0.022926	Akaike info criterion	-4.667162
Sum squared resid	0.042574	Schwarz criterion	-4.552213
Log likelihood	202.3544	Hannan-Quinn criter.	-4.620926
F-statistic	235.6781	Durbin-Watson stat	1.764176
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_N) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-21.94754	0.0000
Test critical values:	1% level	-4.069631	
	5% level	-3.463547	
	10% level	-3.158207	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_N,2)
Method: Least Squares
Date: 02/23/17 Time: 13:26
Sample (adjusted): 1995Q1 2016Q1
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_N(-1))	-3.552421	0.161860	-21.94754	0.0000
D(LN_GDP_N(-1),2)	1.675692	0.113523	14.76076	0.0000
D(LN_GDP_N(-2),2)	0.777353	0.066573	11.67678	0.0000
C	0.034449	0.005246	6.567164	0.0000
@TREND("1994Q1")	-0.000336	9.67E-05	-3.471743	0.0008

R-squared	0.910671	Mean dependent var	-0.001572
Adjusted R-squared	0.906205	S.D. dependent var	0.070221
S.E. of regression	0.021506	Akaike info criterion	-4.783970
Sum squared resid	0.037000	Schwarz criterion	-4.640285
Log likelihood	208.3187	Hannan-Quinn criter.	-4.726176
F-statistic	203.8917	Durbin-Watson stat	1.945476
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_UK has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.267402	0.6414
Test critical values:	1% level	-3.510259	
	5% level	-2.896346	
	10% level	-2.585396	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_UK)
Method: Least Squares
Date: 02/23/17 Time: 13:27
Sample (adjusted): 1995Q2 2016Q1
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_UK(-1)	-0.013613	0.010741	-1.267402	0.2088
D(LN_GDP_UK(-1))	-0.116580	0.085496	-1.363567	0.1766
D(LN_GDP_UK(-2))	-0.293739	0.086540	-3.394243	0.0011
D(LN_GDP_UK(-3))	-0.096960	0.085270	-1.137089	0.2590
D(LN_GDP_UK(-4))	0.606755	0.085974	7.057412	0.0000
C	0.178880	0.138087	1.295416	0.1990

R-squared	0.775090	Mean dependent var	0.005137
Adjusted R-squared	0.760672	S.D. dependent var	0.023008
S.E. of regression	0.011256	Akaike info criterion	-6.067096
Sum squared resid	0.009882	Schwarz criterion	-5.893466
Log likelihood	260.8180	Hannan-Quinn criter.	-5.997298
F-statistic	53.76096	Durbin-Watson stat	1.910603
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_UK has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.713502	0.7367
Test critical values:	1% level	-4.071006	
	5% level	-3.464198	
	10% level	-3.158586	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_UK)
Method: Least Squares
Date: 02/23/17 Time: 13:29
Sample (adjusted): 1995Q2 2016Q1
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_UK(-1)	-0.056520	0.032985	-1.713502	0.0906
D(LN_GDP_UK(-1))	-0.084596	0.088138	-0.959822	0.3401
D(LN_GDP_UK(-2))	-0.265431	0.088480	-2.999905	0.0036
D(LN_GDP_UK(-3))	-0.085265	0.085213	-1.000607	0.3202
D(LN_GDP_UK(-4))	0.615604	0.085730	7.180761	0.0000
C	0.717257	0.414960	1.728499	0.0879
@TREND("1994Q1")	0.000233	0.000169	1.374868	0.1732

R-squared	0.780479	Mean dependent var	0.005137
Adjusted R-squared	0.763373	S.D. dependent var	0.023008
S.E. of regression	0.011192	Akaike info criterion	-6.067539
Sum squared resid	0.009645	Schwarz criterion	-5.864971
Log likelihood	261.8366	Hannan-Quinn criter.	-5.986108
F-statistic	45.62718	Durbin-Watson stat	1.936169
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_UK) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.265414	0.0197
Test critical values:	1% level	-3.510259	
	5% level	-2.896346	
	10% level	-2.585396	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_UK,2)
Method: Least Squares
Date: 02/23/17 Time: 13:29
Sample (adjusted): 1995Q2 2016Q1
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_UK(-1))	-0.788679	0.241525	-3.265414	0.0016
D(LN_GDP_UK(-1),2)	-0.306755	0.189500	-1.618754	0.1095
D(LN_GDP_UK(-2),2)	-0.573859	0.125589	-4.569354	0.0000
D(LN_GDP_UK(-3),2)	-0.640094	0.082164	-7.790405	0.0000
C	0.003883	0.001809	2.146398	0.0349

R-squared	0.888869	Mean dependent var	-0.000116
Adjusted R-squared	0.883243	S.D. dependent var	0.033067
S.E. of regression	0.011299	Akaike info criterion	-6.070521
Sum squared resid	0.010086	Schwarz criterion	-5.925830
Log likelihood	259.9619	Hannan-Quinn criter.	-6.012356
F-statistic	157.9689	Durbin-Watson stat	1.937713
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_UK) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.290142	0.0750
Test critical values:	1% level	-4.071006	
	5% level	-3.464198	
	10% level	-3.158586	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_UK,2)
Method: Least Squares
Date: 02/23/17 Time: 13:30
Sample (adjusted): 1995Q2 2016Q1
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_UK(-1))	-0.866324	0.263309	-3.290142	0.0015
D(LN_GDP_UK(-1),2)	-0.246782	0.206101	-1.197384	0.2348
D(LN_GDP_UK(-2),2)	-0.533999	0.136649	-3.907821	0.0002
D(LN_GDP_UK(-3),2)	-0.619681	0.086754	-7.143000	0.0000
C	0.006250	0.003634	1.719739	0.0894
@TREND("1994Q1")	-4.17E-05	5.55E-05	-0.751528	0.4546

R-squared	0.889668	Mean dependent var	-0.000116
Adjusted R-squared	0.882596	S.D. dependent var	0.033067
S.E. of regression	0.011330	Akaike info criterion	-6.053926
Sum squared resid	0.010013	Schwarz criterion	-5.880297
Log likelihood	260.2649	Hannan-Quinn criter.	-5.984129
F-statistic	125.7919	Durbin-Watson stat	1.917834
Prob(F-statistic)	0.000000		

Null Hypothesis: LN_GDP_US has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.040304	0.9591
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_US)
Method: Least Squares
Date: 02/23/17 Time: 13:31
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_US(-1)	0.000190	0.004718	0.040304	0.9679
D(LN_GDP_US(-1))	0.389456	0.100464	3.876577	0.0002
C	0.004781	0.037612	0.127104	0.8992

R-squared	0.153281	Mean dependent var	0.010196
Adjusted R-squared	0.133121	S.D. dependent var	0.011635
S.E. of regression	0.010833	Akaike info criterion	-6.178656
Sum squared resid	0.009857	Schwarz criterion	-6.093625
Log likelihood	271.7715	Hannan-Quinn criter.	-6.144417
F-statistic	7.603238	Durbin-Watson stat	1.996531
Prob(F-statistic)	0.000923		

Null Hypothesis: LN_GDP_US has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.421489	0.3661
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_US)
Method: Least Squares
Date: 02/23/17 Time: 13:31
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_GDP_US(-1)	-0.085747	0.035411	-2.421489	0.0176
D(LN_GDP_US(-1))	0.433705	0.099267	4.369084	0.0000
C	0.652339	0.267096	2.442335	0.0167
@TREND("1994Q1")	0.000852	0.000348	2.447451	0.0165

R-squared	0.210275	Mean dependent var	0.010196
Adjusted R-squared	0.181730	S.D. dependent var	0.011635
S.E. of regression	0.010524	Akaike info criterion	-6.225351
Sum squared resid	0.009193	Schwarz criterion	-6.111976
Log likelihood	274.8028	Hannan-Quinn criter.	-6.179699
F-statistic	7.366610	Durbin-Watson stat	2.055985
Prob(F-statistic)	0.000195		

Null Hypothesis: D(LN_GDP_US) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.138899	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_US,2)
Method: Least Squares
Date: 02/23/17 Time: 13:32
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_US(-1))	-0.610147	0.099390	-6.138899	0.0000
C	0.006295	0.001524	4.131389	0.0001

R-squared	0.307175	Mean dependent var	0.000190
Adjusted R-squared	0.299024	S.D. dependent var	0.012862
S.E. of regression	0.010769	Akaike info criterion	-6.201625
Sum squared resid	0.009857	Schwarz criterion	-6.144938
Log likelihood	271.7707	Hannan-Quinn criter.	-6.178799
F-statistic	37.68608	Durbin-Watson stat	1.996901
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LN_GDP_US) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.116144	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LN_GDP_US,2)
Method: Least Squares
Date: 02/23/17 Time: 13:33
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_GDP_US(-1))	-0.612708	0.100179	-6.116144	0.0000
C	0.005595	0.002528	2.213011	0.0296
@TREND("1994Q1")	1.61E-05	4.63E-05	0.348013	0.7287

R-squared	0.308172	Mean dependent var	0.000190
Adjusted R-squared	0.291700	S.D. dependent var	0.012862
S.E. of regression	0.010825	Akaike info criterion	-6.180078
Sum squared resid	0.009843	Schwarz criterion	-6.095046
Log likelihood	271.8334	Hannan-Quinn criter.	-6.145838
F-statistic	18.70876	Durbin-Watson stat	1.994675
Prob(F-statistic)	0.000000		

Null Hypothesis: IR_CANADA has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.042326	0.2686
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_CANADA)
Method: Least Squares
Date: 02/23/17 Time: 13:34
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_CANADA(-1)	-0.053264	0.026080	-2.042326	0.0443
D(IR_CANADA(-1))	0.308231	0.091685	3.361836	0.0012
C	0.118599	0.096674	1.226795	0.2233

R-squared	0.138543	Mean dependent var	-0.061958
Adjusted R-squared	0.118032	S.D. dependent var	0.483763
S.E. of regression	0.454317	Akaike info criterion	1.293832
Sum squared resid	17.33795	Schwarz criterion	1.378864
Log likelihood	-53.28171	Hannan-Quinn criter.	1.328072
F-statistic	6.754595	Durbin-Watson stat	1.775271
Prob(F-statistic)	0.001905		

Null Hypothesis: IR_CANADA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.077217	0.1183
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_CANADA)
Method: Least Squares
Date: 02/23/17 Time: 13:35
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_CANADA(-1)	-0.142618	0.046347	-3.077217	0.0028
D(IR_CANADA(-1))	0.339501	0.090437	3.753984	0.0003
C	0.762029	0.294490	2.587620	0.0114
@TREND("1994Q1")	-0.007964	0.003453	-2.306280	0.0236

R-squared	0.190423	Mean dependent var	-0.061958
Adjusted R-squared	0.161161	S.D. dependent var	0.483763
S.E. of regression	0.443070	Akaike info criterion	1.254707
Sum squared resid	16.29379	Schwarz criterion	1.368082
Log likelihood	-50.57976	Hannan-Quinn criter.	1.300360
F-statistic	6.507567	Durbin-Watson stat	1.787257
Prob(F-statistic)	0.000523		

Null Hypothesis: D(IR_CANADA) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.870934	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_CANADA,2)
Method: Least Squares
Date: 02/23/17 Time: 13:35
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR_CANADA(-1))	-0.724010	0.091985	-7.870934	0.0000
C	-0.051814	0.049723	-1.042043	0.3003

R-squared	0.421578	Mean dependent var	-0.025203
Adjusted R-squared	0.414773	S.D. dependent var	0.604854
S.E. of regression	0.462714	Akaike info criterion	1.319306
Sum squared resid	18.19889	Schwarz criterion	1.375994
Log likelihood	-55.38983	Hannan-Quinn criter.	1.342133
F-statistic	61.95160	Durbin-Watson stat	1.728342
Prob(F-statistic)	0.000000		

Null Hypothesis: D(IR_CANADA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.791165	0.0000
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_CANADA,2)
Method: Least Squares
Date: 02/23/17 Time: 13:36
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR_CANADA(-1))	-0.721377	0.092589	-7.791165	0.0000
C	-0.093077	0.102294	-0.909897	0.3655
@TREND("1994Q1")	0.000919	0.001988	0.462246	0.6451

R-squared	0.423046	Mean dependent var	-0.025203
Adjusted R-squared	0.409309	S.D. dependent var	0.604854
S.E. of regression	0.464870	Akaike info criterion	1.339754
Sum squared resid	18.15271	Schwarz criterion	1.424786
Log likelihood	-55.27932	Hannan-Quinn criter.	1.373994
F-statistic	30.79608	Durbin-Watson stat	1.737230
Prob(F-statistic)	0.000000		

Null Hypothesis: IR_FRANCE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.643339	0.4563
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_FRANCE)
Method: Least Squares
Date: 02/23/17 Time: 13:37
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_FRANCE(-1)	-0.040422	0.024597	-1.643339	0.1041
D(IR_FRANCE(-1))	0.383263	0.099564	3.849419	0.0002
C	0.071065	0.081719	0.869627	0.3870

R-squared	0.163891	Mean dependent var	-0.068118
Adjusted R-squared	0.143984	S.D. dependent var	0.446474
S.E. of regression	0.413083	Akaike info criterion	1.103537
Sum squared resid	14.33355	Schwarz criterion	1.188568
Log likelihood	-45.00386	Hannan-Quinn criter.	1.137777
F-statistic	8.232702	Durbin-Watson stat	2.063729
Prob(F-statistic)	0.000543		

Null Hypothesis: IR_FRANCE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.043542	0.1267
Test critical values:	1% level	-4.066981	
	5% level	-3.462292	
	10% level	-3.157475	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_FRANCE)
Method: Least Squares
Date: 02/23/17 Time: 13:38
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_FRANCE(-1)	-0.127266	0.041815	-3.043542	0.0031
D(IR_FRANCE(-1))	0.428602	0.098166	4.366069	0.0000
C	0.654257	0.243900	2.682478	0.0088
@TREND("1994Q1")	-0.007582	0.002999	-2.528170	0.0134

R-squared	0.223674	Mean dependent var	-0.068118
Adjusted R-squared	0.195614	S.D. dependent var	0.446474
S.E. of regression	0.400432	Akaike info criterion	1.052339
Sum squared resid	13.30867	Schwarz criterion	1.165714
Log likelihood	-41.77675	Hannan-Quinn criter.	1.097992
F-statistic	7.971300	Durbin-Watson stat	2.151056
Prob(F-statistic)	0.000099		

Null Hypothesis: D(IR_FRANCE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.316457	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_FRANCE,2)
Method: Least Squares
Date: 02/23/17 Time: 13:40
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR_FRANCE(-1))	-0.632279	0.100100	-6.316457	0.0000
C	-0.041163	0.045326	-0.908152	0.3664

R-squared	0.319443	Mean dependent var	0.005185
Adjusted R-squared	0.311436	S.D. dependent var	0.502767
S.E. of regression	0.417195	Akaike info criterion	1.112192
Sum squared resid	14.79436	Schwarz criterion	1.168880
Log likelihood	-46.38036	Hannan-Quinn criter.	1.135019
F-statistic	39.89763	Durbin-Watson stat	2.045260
Prob(F-statistic)	0.000000		

Null Hypothesis: IR_GERMANY has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.746515	0.4045
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_GERMANY)
Method: Least Squares
Date: 02/23/17 Time: 13:40
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_GERMANY(-1)	-0.036910	0.021133	-1.746515	0.0844
D(IR_GERMANY(-1))	0.531993	0.090557	5.874667	0.0000
C	0.069587	0.065206	1.067184	0.2889

R-squared	0.300311	Mean dependent var	-0.062905
Adjusted R-squared	0.283652	S.D. dependent var	0.370986
S.E. of regression	0.313993	Akaike info criterion	0.554982
Sum squared resid	8.281692	Schwarz criterion	0.640013
Log likelihood	-21.14171	Hannan-Quinn criter.	0.589221
F-statistic	18.02667	Durbin-Watson stat	1.901569
Prob(F-statistic)	0.000000		

Null Hypothesis: D(IR_GERMANY) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.276437	0.0000
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_GERMANY,2)
Method: Least Squares
Date: 02/23/17 Time: 13:41
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR_GERMANY(-1))	-0.481725	0.091297	-5.276437	0.0000
C	-0.027346	0.034638	-0.789462	0.4320

R-squared	0.246726	Mean dependent var	0.005706
Adjusted R-squared	0.237864	S.D. dependent var	0.363982
S.E. of regression	0.317757	Akaike info criterion	0.567663
Sum squared resid	8.582427	Schwarz criterion	0.624350
Log likelihood	-22.69333	Hannan-Quinn criter.	0.590489
F-statistic	27.84079	Durbin-Watson stat	1.882444
Prob(F-statistic)	0.000001		

Null Hypothesis: IR_JAPAN has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.916811	0.0029
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_JAPAN)
Method: Least Squares
Date: 02/23/17 Time: 13:42
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_JAPAN(-1)	-0.106643	0.027227	-3.916811	0.0002
D(IR_JAPAN(-1))	0.405299	0.090545	4.476244	0.0000
C	0.029301	0.017703	1.655134	0.1016

R-squared	0.318123	Mean dependent var	-0.025352
Adjusted R-squared	0.301888	S.D. dependent var	0.151641
S.E. of regression	0.126701	Akaike info criterion	-1.260098
Sum squared resid	1.348466	Schwarz criterion	-1.175067
Log likelihood	57.81427	Hannan-Quinn criter.	-1.225859
F-statistic	19.59471	Durbin-Watson stat	1.904149
Prob(F-statistic)	0.000000		

Null Hypothesis: IR_NORWAY has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.188133	0.2121
Test critical values:	1% level	-3.507394	
	5% level	-2.895109	
	10% level	-2.584738	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_NORWAY)
Method: Least Squares
Date: 02/23/17 Time: 13:43
Sample (adjusted): 1994Q3 2016Q1
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR_NORWAY(-1)	-0.060527	0.027662	-2.188133	0.0314
D(IR_NORWAY(-1))	0.521017	0.094475	5.514853	0.0000
C	0.224019	0.126949	1.764638	0.0813

R-squared	0.274891	Mean dependent var	-0.048927
Adjusted R-squared	0.257626	S.D. dependent var	0.595339
S.E. of regression	0.512951	Akaike info criterion	1.536602
Sum squared resid	22.10198	Schwarz criterion	1.621633
Log likelihood	-63.84218	Hannan-Quinn criter.	1.570841
F-statistic	15.92229	Durbin-Watson stat	1.869454
Prob(F-statistic)	0.000001		

Null Hypothesis: D(IR_NORWAY) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.591569	0.0000
Test critical values:	1% level	-3.508326	
	5% level	-2.895512	
	10% level	-2.584952	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IR_NORWAY,2)
Method: Least Squares
Date: 02/23/17 Time: 13:43
Sample (adjusted): 1994Q4 2016Q1
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IR_NORWAY(-1))	-0.608795	0.108877	-5.591569	0.0000
D(IR_NORWAY(-1),2)	0.171185	0.107081	1.598655	0.1137
C	-0.037820	0.056076	-0.674442	0.5019

R-squared	0.286598	Mean dependent var	-0.008372
Adjusted R-squared	0.269408	S.D. dependent var	0.605762
S.E. of regression	0.517773	Akaike info criterion	1.555701
Sum squared resid	22.25137	Schwarz criterion	1.641317
Log likelihood	-63.89513	Hannan-Quinn criter.	1.590157
F-statistic	16.67197	Durbin-Watson stat	2.038247
Prob(F-statistic)	0.000001		