Effects of Oil Price Shocks on the Norwegian Economy

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Nora Bucher Holm
Sigrid Holte Igesund

Supervisor: Søren Plesner

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Executive Summary

In this thesis, we assess the underlying causes of changes in the price of oil and the effect of these changes on the Norwegian economy. By the use of a structural vector autoregression, we are able to identify the underlying supply and demand shocks in the global crude oil market. This allows us to decompose the price of oil into three components; oil supply shocks, aggregate demand shocks and oil-specific demand shocks. The analysis indicates that the effects of changes in the price of oil are highly dependent on the underlying causes of the oil price shock. Our results provide an historical evolution identifying the causes of oil price shocks from 1990 to 2015, and impulse response functions show that demand, rather that supply, have the largest and most significant effect on changes in the price of oil. The estimated structural shocks also allow us to assess the effects of a change in the price of oil on both Norwegian macroeconomic aggregates and industry-level stock indices, and identify how the effects differ depending on the cause of the oil price fluctuations. We find that there are large differences in how different variables in the Norwegian macroeconomic environment respond to a change in the price of oil, depending on the underlying cause. An aggregate demand shock generally affects the Norwegian economy positively, while uncertainties relating to the global geopolitical situation underlying an oil supply shock tend to decrease the overall performance of the variables, despite the associated increase in the price of oil. The effects of an oil-specific demand shock varies to a greater extent across both country- and industry-level variables, indicating that oil-specific demand shocks capture the largest differences in how the Norwegian economy respond to a change in the price of oil.

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1. Motivation and Problem Statement

For many years, the most common way of examining the effects of oil price shocks to macroeconomic aggregates has been based on an assumption that the price of oil is exogenous in the analysis. Kilian (2009) argues that this assumption is not well defined and as a response, introduces a method with the aim of modeling different causes of oil price shocks, to better understand how the effects of these shocks may differ depending on the cause. Many researchers have later built on this method to examine how net oil importers are affected by oil price shocks. However, how net oil exporters are affected by fluctuations in the price of oil is an area that has been less researched.

Norway is a net oil exporter and 15 percent of Norway's GDP is directly related to the petroleum industry (Norwegian Petroleum, 2016d). Currently, the Norwegian economy is going through a challenging phase characterized by increasing unemployment, decreasing stock market indices, a depreciating currency and concerns for future economic prospects; all seemingly caused by the recent sharp decreases in the price of oil. Earlier research (Bjørnland, 2009) has indicated that the Norwegian stock market is highly affected by shocks in the price of oil. However, to our knowledge, the extent to which the cause of the change affects the broader economic environment has not yet been thoroughly examined. We therefore believe that an analysis inspired by Kilian (2009) of the Norwegian economy will uncover interesting aspects of the effects of changes in the price of oil. By doing this, we hope to be able to estimate the country-specific effects of oil price shocks, as well as the effects on different industries of the country's economy. We will examine data on both the country and industry level, and the quantitative analysis will be based on historical data. Based on this, we have formulated the following problem statement:

> *How do changes in the price of oil affect the macroeconomic situation in Norway, and are the effects of oil price shocks different depending on the cause?*

2. Method

To better understand the extent to which fluctuations in the price of oil have affected the macroeconomic situation in Norway, we will conduct a thorough analysis of the causes of these fluctuations. Causes and effects will be examined through the use of econometric methods. Inspired by the method of Kilian (2009), we will use a structural vector autoregression (hereafter referred to as a structural VAR) to estimate the structural shocks to the price of oil. In addition to allowing us to estimate different causes of oil price shocks, this method deals with issues of causality and interdependence of variables in a satisfactory manner. The subsequent step will be to analyze the consequences of these separate shocks on different Norwegian macroeconomic aggregates, by linear regressions. The presentation of the two models will be followed by a description of the data used in the modeling. All data analyses has been done using Stata version 14.0.

2.1 Modeling the Causes of Oil Price Shocks

The structural VAR model allows for an estimation of the causes of oil price fluctuations in terms of changes in supply, demand and precautionary demand. This is done by structurally decomposing the real price of oil into three components: crude oil supply shocks, shocks to the global demand for all industrial commodities and demand shocks that are specific to the global crude oil market. These are included to indicate oil supply shocks, aggregate demand shocks and precautionary demand shocks, respectively.

The theory behind this method will be further discussed in *Section 5.2.1 Structural VAR Method*.

2.2 Modeling the Effects of Oil Price Shocks

In the second stage of the analysis, we analyze the effects of oil price fluctuations on the Norwegian economy and how they may differ depending on the underlying shocks identified through the structural VAR analysis. This is done by estimating the impact of the demand and supply shocks on a selection of macroeconomic Norwegian variables. For the country-level analysis, regression models are developed to measure the effects on

Norwegian GDP, the unemployment rate, total exports, the Oslo Stock Exchange Benchmark, the Norwegian CPI, the Norwegian Krone Trade Weighted Index and the interbank 3 month offered rate. We then break the analysis down to an industry-level focus, and use total return indices from the Oslo Stock Exchange to analyze how the effects of changes in the price of oil, depending on the cause, differ between Norwegian industries.

The modeling of these regressions will be further discussed in *Section 5.2.2 Linear Regression Method.*

2.3 Data

In the following section we will present our quantitative data material. The data is categorized to reflect the inputs of the three following analyses. *Section 2.3.1 World Oil Market and Global Indicators* discuss the input data to the structural VAR analysis, which estimates the three individual structural shocks, and their contribution to historical fluctuations in the price of oil. *Section 2.3.2 Macro Data for Norway - Country Level* presents the macro data used to measure the effects of oil price shocks at the country level, and *Section 2.3.3 Macro Data for Norway - Industry Level* presents the data used to examine the effects at industry level. All seasonality tests conducted can be found in *Appendix A5 Seasonality Tests*.

2.3.1 World Oil Market and Global Indicators

The price of oil is measured by the "Crude Oil-Brent Current Month Free on Board United Stated Dollar per Barrel", which is a nominal measure, retrieved from Datastream. We have therefore deflated the data by U.S. CPI .The CPI data are collected from the U.S. Bureau of Labor Statistics. We have chosen the Brent crude oil price, as this is the major price benchmark for oil from the North Sea and thus the oil price that is most relevant when examining effects on the Norwegian economy. In addition to this, it is the most widely used global crude oil benchmark (EIA, 2014). "Free on Board" indicates that the seller pays for transportation. The price is given in USD, which is the norm for oil prices. We have kept it this way in our analysis because we believe that exchanging it to NOK would only add an endogenous variable and further complicate the analyses without adding considerable value. We also believe the price in USD to be more relevant as we are looking at how global oil price shocks affect the Norwegian economy, and the global oil price is quoted in USD.

Although differences due to temporary storage of oil or transportation may cause delays or lags between production and actual supply, global oil production is considered to be the most relevant indicator of oil supply. The U.S. Energy Information Administration provides monthly statistics of global oil production. The figures are reported in thousand tons. The data has been collected from their website and downloaded in an excel document.

To measure global aggregate demand, we need a measure of world economic activity. The theory behind this and its application will be further discussed in the theoretical framework *Section 5.2.1 Structural VAR Method*. Crude steel is used as an important input across several industries, including transport, machinery, construction and packaging. The steel industry is the second largest in the world and plays a critical role in the global economy (World Steel Association, 2016b). It should therefore be able to reflect global economic activity, and will serve as a good indicator of global aggregate demand for industrial commodities (Ravazzolo and Vespignani, 2015). An additional advantage of using world steel production as an indicator of aggregate global demand is the availability of monthly data. The World Steel Association has published statistics of monthly global steel production since January 1990. The World Steel Association's data is collected from various sources, including national and regional statistics offices (World Steel Association, 2016a). The data is in thousand tons, and include figures from 65 countries that report numbers on a monthly basis. We have seasonally adjusted the data.

2.3.2 Macro Data for Norway - Country Level

Having identified the oil price shocks, we wish to include the variables that reflect the theoretical setup of a New-Keynesian small open economy model, such as described in Svensson (2000), Clarida et. al (2001) and applied by Bjørnland (2009). Although

Bjørnland (2009) used the variables to conduct a VAR analysis with a slightly different goal, we believe the argumentation for which variables to include is relevant for our OLS regressions as well. The theory behind this and its application will be further discussed in *Section 7 Analysis of Oil Price Shocks to Country-Level Variables*. The following variables have been included in our analysis of the effects of oil price changes on the Norwegian economy on a country level.

The unemployment rate is based on all people registered in the systems of the Norwegian Labor and Welfare Administration (NAV) as unemployed, seeking work or reduced capability to work. The data is collected from Statistics Norway via Datastream and is seasonally adjusted.

The Consumer Price Index (CPI) is collected from Statistics Norway via Datastream, and reflects the Norwegian CPI. The figures are monthly, and we have tested and adjusted for seasonality. This variable is used to indicate inflation by using the differenced variable.

The Norwegian Krone Trade Weighted Index is calculated on the basis of the NOK exchange rate against the currencies of Norway's 25 main trading partners (Norges Bank, 2016). Monthly data has been collected from Norges Bank via Datastream and we have tested and adjusted for seasonality.

Total exports provide information about the commodity flow between Norway and foreign countries and is an important indicator of economic changes and trends (Statistics Norway, 2015b). Norway is an important provider of oil and gas to the global market, as almost all oil and gas produced on the Norwegian shelf is exported (Norwegian Petroleum, 2016a). The figures of Total Exports are collected from Statistics Norway via Datastream as current prices and are not seasonally adjusted. Thus, we have tested and adjusted data for seasonality and deflated with the Norwegian CPI. The figures are monthly and in million NOK.

The Norwegian interbank 3 month offered rate (hereafter referred to as the interbank rate) is collected from Norges Bank via Datastream. The interbank rate reflects the interest rates banks require for lending in NOK and should be regarded as the best possible estimate of market rates (Finans Norge, 2016). The interest rate is included to capture the effect of oil price shocks on the monetary policy instrument.

To indicate the general development of the Norwegian stock market, we use the Oslo Stock Exchange Benchmark Index (OSEBX), which is an indicator of the overall performance of the most traded shares listed on the Oslo Stock Exchange. The price index is measured in NOK and we have tested and consequently adjusted the figures for seasonality. The data are collected from Oslo Stock Exchange via Datastream.

We have included three different measures of GDP. Since the petroleum sector constitute a significant share of Norway's GDP, it is interesting to separate between GDP in mainland Norway and GDP related to oil activities and ocean transport. Therefore, we have included both of these measures of GDP, in addition to total GDP. Both GDP mainland and GDP from oil activities and ocean transport are reported in current prices and are seasonally adjusted, however total GDP is not. Therefore, GDP has been deflated with Norwegian CPI and tested and adjusted for seasonality. All figures are in million NOK.

2.3.3 Macro Data for Norway - Industry Level

To examine the effects of oil price changes on an industry level in Norway, we use the total return indices based on the Global Industry Classification Standards (GICS), which is a global standard developed by Standard and Poor's. Each of the indices includes all shares listed on the Oslo Stock Exchange in its respective industry group. Bjørnland (2009) emphasizes that in contrast to the significant volume of analysis of the relationship between oil price shocks and the economic effects, few analyses focus on the effect on the financial markets in oil exporting countries. Yet, financial markets are highly affected by the price of oil and are important channels of wealth in oil abundant countries such as Norway. Although the effect of oil price shocks on variables such as GDP for individual industries might be equally interesting to analyze, an industry-level analysis would be restricted by the unavailability and frequency of such data. Total return indices from Oslo Stock Exchange, however, provide an opportunity to differentiate between the effects on different industries as well as providing data on a monthly basis.

In the GICS system, companies are categorized on a sector, industry-group, industry and sub-industry level. In our analysis, we have chosen to focus on the industry group level and have thus included the following 20 groups: Food, Beverage and Tobacco, Banks, Technology Hardware and Equipment, Media, Retailing, Software and Services, Transport, Real Estate, Insurance, Pharmaceuticals and Biotechnology, Utilities, Telecommunication Services, Diversified Financials, Health Care Equipment and Services, Consumer Services, Consumer Durables and Apparel, Commercial and Professional Services, Capital Goods, Materials and Energy. The data is monthly and we have tested and consequently adjusted for seasonality.

2.4 Time Frame

Our goal is to better understand the effects of oil price shocks on the Norwegian economy today, and we are basing this understanding on an analysis of historical data. To make the analysis as relevant as possible, it is important to consider the fact that time periods might be fundamentally different due to differences in economic cycles, paradigms, politics and other externalities. Assuming that more recent time periods are the most similar to the current situation, worries regarding fundamentally different data increases with age. On the other hand, and as always in time series analyses, the isolated effect of additional length to the data material is the production of more statistically robust results. We therefore need to balance these two concerns against each other. A third and crucial factor to consider is the availability of credible data in the chosen time span.

An argument for including material dating back to the 1970s is the inclusion of the fluctuations and related effects from the oil crisis in 1973 and the energy crisis in 1979 in the analysis. Kilian (2009) uses data that includes this time period, emphasizing that this would be a reasonable choice when conducting a similar analysis. However, there have been significant changes in the oil and energy market since the 1970s. For example, many alternative and renewable energy sources have been introduced in recent decades. Another factor differentiating the recent decades from each other is the quite rapid globalization that is assumed to have affected all global markets.

In addition to consider the factors affecting Kilian's (2009) choice of time period, we need to consider the Norwegian economy in particular. Looking at the Norwegian economy, the monetary policy has not been conducted in a consistent manner since the 1970s, making current data less comparable to those from this period. Bjørnland (2009) emphasizes the relevance of using monthly data from a period associated with a relatively stable monetary policy regime. Having argued for this, she chooses to use a time period in her econometric analysis from 1993 to 2005, because the Norwegian monetary policy regime is relatively stable in this period. The central bank of Norway has not intervened in the currency market since 1999, and we further assume that the changes made before this do not significantly impact our analysis. Based on this, we believe it to be reasonable in terms of the monetary policy to add the recent years to Bjørnland's time period, and use a time span from January 1993 to the most current data available for all variables, which is October 2015.

An advantage of using a relatively short time period is the availability of more data material, especially with regards to stock market indices. However, we have not been able to find stock market indices dating as far back as 1993. We have therefore analyzed data from the beginning of 1994, as this is when the largest amount of our data is available from. Some data are only available from as late as in 1996; however this only applies to variables that are not the main focus of analysis. The results for these variables will be available in *Appendix A6. Impulse Response Functions from Structural VAR 2 lags, Variables Not Analyzed,* and it will be clear which variables have a shorter time span in the data material.

2.5 Validity and Reliability

In the following section we discuss the validity and reliability of our thesis, which relates to the topic of research philosophy. Validity refers to the accuracy of measures used, the accuracy of the analysis of the results as well as the generalization of the findings. Reliability covers the terms replication and consistency, which relates to whether it is possible for another researcher to replicate the research and find the same results (Saunders et al., 2016).

Our analysis is mainly based on quantitative research, data and methodology. This kind of research is usually associated with a deductive approach, using data to test theory. Quantitative research can also be used for a more inductive approach, using data to develop theory (Saunders et al., 2016). In this thesis, the data analysis is of the deductive kind, as we are using an already developed and tested method in a new scenario, namely on the Norwegian economy and on both the country and industry level. Quantitative research examines statistical and numerical relationships between variables. These methods often incorporate validity controls such as significance tests, to secure validity of the results (Saunders et al., 2016). However, these are strictly statistical measures, and only measure the statistical validity given that the other assumptions regarding the analysis hold.

We have relied on external sources for data. This means that the validity of our data, and thus the analyses in which the data is used, are dependent on the quality of sampling techniques used by these sources. Aware of this, we have used official and well-known sources such as Statistics Norway, the Norwegian Central bank and the World Bank, as well as Datastream. This does not, however, exclude the possibility of errors in the collected data material. We have therefore been conscious of whether or not the data material seems reasonable. However, although official and well-known sources may decrease this risk, it does not exclude the possibility of errors entirely. On the other hand, these are data sources and data series that are extensively used in econometric analysis, and we therefore consider the chance of possible significant errors having been detected and corrected as reasonably high.

The choice of empirical data as well as the models used to answer the problem statement is well discussed and applied by several researchers such as Kilian (2009), Bjørnland (2009) and Lorusso and Pierone (2015). We believe this strengthens the validity of the data selection and the methods applied in this thesis. However, not all parameters that we ideally would have wanted are measurable or available. It would for example be ideal to have a specific measure of economic growth in Norway and Norwegian industries as well as a measure of global precautionary crude oil demand. As this is not available, we have had to use proxies. Thus, the validity and reliability of our results relies on whether the argumentation for the use of these proxies holds. Our argumentation for why we believe this is the case can be found in *Section 2.3.1 World Oil Market and Global Indicators*.

As our research is, to a large extent, a replication of other researchers' methods through well-known statistical procedures, we believe this illustrates that the methods used in our thesis are reliable. The reliability of the interpretations made in our thesis may not be as certain as the methods, as these are mainly based on our own knowledge and perceptions. Thus, other researchers could come to different conclusions. However, where comparable, our results and interpretations do not differ significantly from similar research such as Kilian's (2009).

The credibility of our results relies on factors such as the validity and reliability of the data, assumptions and methods for analyses used as well as the quality of the work. The quality of the work is a combination of several factors; however the most important factor that has not yet been discussed is the possibility of calculation errors. In addition to misinterpretations, this could potentially lead to misleading results and thus lower the credibility, reliability and validity of our work. The fact that we have crosschecked our results with previous and similar research and found that the results are not considerably different is regarded as an indication that this is not the case.

2.6 Thesis Structure

The remainder of the thesis is organized as follows. In the next section we explain the delimitations associated with this paper, that is, we describe the boundaries set, any shortcomings and assumptions made. Section 4 is an introduction to the oil industry and the Norwegian petroleum market, while Section 5 provides the theoretical background for our thesis. This includes a review of previous literature and relevant research, and a discussion of the specification and identification of the theoretical framework used, including the technical aspects, choices and assumptions. Section 6 presents the specification of our structural VAR model, the output from the analysis as well as analysis of the results. Section 7 and Section 8 presents the specification, results and analysis of our econometric analysis of the effect of oil price shocks on Norwegian macroeconomic variables on a country level and industry level, respectively. We subsequently provide a thorough discussion of the total results of our analysis, including argumentation, interpretation and perspectives in Section 9. Finally, Section 10 concludes our paper, and Section 11 is a perspectivation that provides a wider perspective and determines possible future developments or unanswered questions.

3. Delimitations

As expressed in the problem statement, we wish to examine how changes in the price of oil affect the macroeconomic situation in Norway, depending on the causes of the oil price shocks. This does not include a forecast of the future effects of oil price changes on the Norwegian economy, as our focus is on historical data and using this to understand the current situation. However, the possible use of our results in a forecast situation will be discussed shortly in the perspectivation.

As already discussed in *Section 2.4 Time Frame*, our time frame does not include the oil crisis of the 1970s. To better understand the current macroeconomic situation in Norway, we have chosen a shorter time span that we believe reflect the current macroeconomic situation more accurately.

The reader of this thesis is assumed to be familiar with basic statistical theory. Consequently, our focus in the theoretical section is to explain the most important features of the statistical models used in this thesis. We explain the most relevant aspects in order to understand the specific methodology applied. We do not, however, explain detailed theory behind all tests used throughout the statistical analysis, as this is considered to be redundant. This applies to tests for stationarity, autocorrelation in residuals, the eigenvalues test for stability, different information criteria such as AIC and BIC, as well as other similar tests. We do not consider it to be problematic if the reader should not perfectly understand the underlying theory behind the tests, as the results will be discussed in the text.

Another statistical feature that will not be discussed is the bootstrapping method used to deal with serial correlation in the residuals of the structural VAR. The underlying theory behind this method is considered to be out of scope for our thesis. However, we have still made use of the method to control for the presence of serial correlation in the error term of the structural VAR. This choice is based on the method of Kilian (2009).

Basic micro- and macroeconomic theory is also assumed to be understood by the reader. Some of the most relevant aspects of the analysis will be presented for convenience and overall coherence. Consequently, we will present these aspects without going into depth with the underlying theories as they are assumed to be known.

Asymmetric effects of oil price changes is a research field of its own, and results have shown that effects can differ depending on whether the oil price shock is positive or negative. On the other hand, new research using state-of-the-art techniques has found very little support for the hypothesis of asymmetric effects (Herrera et al., 2015). We assume symmetric effects of oil price increases and decreases, as this topic is not the focus of our study.

4. Introduction to the Oil Industry and the Norwegian Petroleum Market

4.1 The History of Oil

Oil is an important commodity in the world economy, both as an input for industrial and economic growth as well as a financial trading commodity. In our thesis, we seek to explain aspects of the current situation of the oil market. However, to understand the position of oil as a commodity today, we believe it is important to understand its history. We will therefore present and discuss certain historical events in the history of crude oil in the following section.

After the first modern process of crude oil drilling was invented in the 19th century, crude oil rapidly became a commodity produced and used across the globe. The real boost to the demand for crude oil was the invention and entry into society of the automobile and engines using oil products. Enabling ships to travel faster and longer at a lower cost made oil a strategically important commodity, a perception that would only be reinforced by World War I. Due to the new strategical importance of oil, the U.S. senate began to worry about the certainty of future oil supply. Forecasts of nearly empty U.S. oil reserves caused hysteria. When at the same time the Bolshevik Revolution constrained the oil supply in Russia, this resulted in a significant increase in the price of oil. At this point, the U.S. still stood for approximately 70 percent of world oil production, however oil was being found in more places and in larger amounts, and oil from the Middle East was becoming increasingly important. In retrospect, it is apparent that the unsubstantiated worry for future oil supply has followed both them and others since, leaving its marks on the oil supply and price as well as the international geopolitical situation (Maugeri, 2006).

The countries that first realized the importance of oil, such as the U.S. and Great Britain, were also those who secured themselves positions in many of the new oil fields that were found. This provided them with secure supply of oil as well as profits from the oil extraction while simultaneously leaving the world’s main oil producing areas outside of the U.S. and the Soviet Union in the hands of a few Western companies. For many of the countries in which oil was found, however, the rapid development of the oil sector discouraged participation in other sectors, and provoked an inflationary spiral that impoverished all that was not part of the oil or oil-related industry. This phenomenon was later named "The Dutch Disease" (Maugeri, 2006).

Contrary to the pessimistic forecasts of crude oil reserves, oil production continued to increase as science improved techniques regarding finding, collecting and refining oil. Combined with the increasing amount of discovered crude oil fields, oil production increased rapidly. To prevent diminishing oil price levels, oil companies agreed on a system reminiscing of a cartel, limiting supply and fixing prices at higher levels than market prices. However, the Wall Street crash of 1929 caused an abrupt decrease of both the U.S. and world demand for oil, resulting in as sharp fall in crude oil prices. Efforts from the American oil-producing states to control this failed, and additionally resulted in a black market for oil. It took until 1935 before a common effort and centralized control managed to stabilize oil prices (Maugeri, 2006).

This chain of events regarding oil supply, demand, speculations and their effect on price fluctuations would later turn out not to be unique for the early 1900s. Always affected by and related to current events, however, the rise and fall of oil prices and the fear and speculations related to them has often been regarded as both unique and surprising.

At the end of World War II, oil had again proven its role as strategically important, and a common belief was that no war could be won without a secure supply of oil. The U.S. was still the definite center of production, yet they were also the first to be concerned for their domestic crude oil production. As a result, the U.S. entered a long-term oil-based alliance with Saudi Arabia, producing the first estimates of great amounts of oil in the Middle East. For the first time, the center of gravity for world oil production was changing from the Gulf-Caribbean area to the Middle East (Maugeri, 2006).
As supply increased, large corporations had to cut their prices. This threatened both American and Venezuelan oil production; both remarkably more expensive than the

Middle Eastern. The U.S. reacted by limiting their oil imports to protect domestic production. This negatively affected the Middle Eastern countries, as lower prices and a smaller exporting market lead to lower profits than anticipated. This was a contributing factor to the establishment of the Organization for Petroleum Exporting Countries (OPEC) by Venezuela, Saudi Arabia, Iraq, Iran and Kuwait in 1960, as an instrument for collective bargaining and self-defense (Maugeri, 2006).

However, the establishment of OPEC did not immediately have the effect the member countries may have hoped for. Selfish mindsets of many of the countries lead to internal rivalry, and they did not succeed in limiting the oil production to raise oil prices. When major oil reserves were discovered in several African countries, it only amplified the decreasing tendency of the oil prices (Maugeri, 2006).

In the early 1970s, the period of overproduction and declining prices was suddenly over. The triggering factor of the oil crisis of 1973 was the political situation in the Middle East when war broke out between the Arabs and the Israelis and again, oil was used as an important part of wartime strategy. However, total world oil supply was not severely damaged by this, as other oil producers increased supply in this period. Therefore, it must have been the fear for an oil shortage which through precautionary demand caused the first oil crisis of 1973. Due to the importance of oil as a commodity, this caused a stagflation in both oil and non-oil rich countries (Maugeri, 2006).

In the 1970s, OPEC emerged as an important player in the market, controlling the official price of oil. At the same time, a spot-market was slowly emerging and a fear of oil shortages increased prices in the spot market, indicating to OPEC countries that the market was willing to pay more than the official prices. Several macroeconomic events caused oil prices to reach a historic peak of $42 per barrel (Maugeri, 2006). The high prices made most economies decrease their consumption by turning away from oil where possible. In addition to competition from new sources of energy, more oil started to flood the market. This was due to new oil fields that had become profitable due to the high prices in the 70s, such as Alaska, Mexico and the North Sea. OPEC was not capable of dealing with the following oil oversupply, as the new and additional production came from areas out of their control. Moreover, OPEC member countries were still overproducing compared to their quotas. In 1986, prices collapsed to below $10 per barrel, contrary to all forecasts and expectations. Although OPEC more successfully than before implemented a new and more flexible quota and price-system, oil prices stayed relatively low and there was still some overproduction compared with quotas. Additionally, the new and better quality Brent oil pushed prices of OPEC oil down (Maugeri, 2006).

The world oil supply kept growing more than demand, partly due to the increasing supply of oil from the North Sea. The world was once again facing an oversupply compared to demand, lowering prices and putting pressure on OPEC to cut production. Frustrated from being the only producers to make an effort to stabilize prices, many OPEC countries started disobeying the quotas set by the organization, leading the oil prices to drop 1998. The crisis continued until OPEC and a group of other oil producing countries successfully agreed to cut production in 1999. Despite the effort to control and stabilize the prices, oil production capacity was booming, as uncontrolled production in Asia and non-OPEC Middle Eastern countries were diluting the effects of cuts in production. Additionally, environmental issues had become a top priority, resulting in restrictions being placed on the consumption of oil products in most countries (Maugeri, 2006). It is interesting to see this in relation to the situation in 2016, where OPEC once again does not want to be the stabilizers on behalf of all oil producers. Additionally, it is apparent that OPEC, not even on the height of their power, was able to fully control the many factors affecting the price of oil. The current role of OPEC will be further discussed in *Section 5.2.3 Oil Market Dynamics and Microeconomic Theory*.

Years of low oil prices lead to low investments, less excess production and limited exploration and development of new oil fields. Together with a growing Chinese economy demanding more oil, this changed the balance of the market. Although these were the underlying factors, Maugeri (2006) argues that the next big increase in the oil prices was, although delayed, triggered by the terrorist attacks of September 11th 2001 and the postchain reaction of "war on terror" in Afghanistan and Iraq. At this point, oil had a smaller impact on the world economy than during the previous oil crisis of the 1970s. However, fear of future oil shortage was this time substantiated by war, as well as slower growth of the world oil supply and a decrease in the findings of new oil fields (Maugeri, 2006).

However difficult it is to estimate the "fear factor" in the price of oil, Saudi Arabia's oil minister estimated this to be about $15 per barrel in November 2004, when the oil price was $45 per barrel. At the same time, analysts conformingly calculated that overall findings, development and production costs together nor supply and demand could explain an oil price above $30-32 per barrel for even the most expensive oil in the world (Maugeri, 2006).

Further events such as the storm Katrina that hit the Gulf of Mexico in 2005, the turmoil in Nigeria in 2006-2008 as well as the conflict in Iraq contributed to rising oil prices as well. There was a stagnation in supply between 2006 and 2007, where world production of oil barely increased. At the same time, global demand was growing strongly, much due to a rapid growth in China. However, it has been argued that the record high prices of 2008 cannot be explained by supply and demand alone. It has further been argued that the financialization of commodities contributed to a speculative bubble in the price of oil (Hamilton, 2009).

The last two quarters of 2007 and the first two quarters of 2008 were comparable to earlier oil crises such as the one in 1990 and 1991 in terms of several economic characteristics. In the U.S., both the contribution to GDP and employment in the automobile sector was weakened. Hence, even before the financial crisis in 2008, the U.S. economy was showing signs of a recession in line with the increasing oil prices. In fact, Hamilton (2009) argues that if it had not been for the oil price shock of 2007-2008, the financial crisis of 2008 had resulted in slow growth rather than a recession.

Following years of high oil prices as well as years of research and development, the shale oil revolution significantly increased U.S. production of crude oil especially rapidly from the start of 2009. This increased global demand, and most likely cushioned the oil price spike following the sanctions on Iran as well as other geopolitical factors limiting the world oil supply. It has been discussed whether the shale oil revolution has been one of the driving factors of the large fall in oil prices since 2014 (Stevens, 2015). Although it may be too soon to fully understand the current oil crisis, this is part of what we seek to analyze in this thesis.

Apparent from the historical events discussed, oil has been an important commodity in the world economy for many decades. The price of oil is affected by macroeconomic events, while simultaneously affecting both the geopolitical and economic situation. Both actual and unsubstantiated worries of oil shortages and oil under- or oversupply are important factors in determining the price of oil. At the same time, the price of oil is important for economic development in both oil importing and oil exporting countries. The events discussed emphasize the issue of defining oil as exogenous to economic development. Additionally, they illustrate the importance of precautionary demand's influence on the development of the price of oil as well as the world economic development. The importance of oil as a commodity has somewhat decreased in line with the increased focus on environmental changes and the evolution of alternative and renewable sources of energy. However, oil is still an important factor in the world economy today. This is especially apparent from the current situation of low oil prices, the economic effects of this as well as the turmoil this has caused in the media.

4.2 The Norwegian Oil Market

The first discovery of oil in Norway was in 1967, and production started in 1971. Since then, petroleum activities have had a significant impact on the Norwegian economy. The oil and gas sector is Norway's largest in terms of value added, and the petroleum sector's share of GDP, government revenues, investments and export value are 15%, 20%, 26% and 39%, respectively (Norwegian Petroleum, 2016d). Due to its importance to the Norwegian welfare state, there are extensive legal frameworks associated with the country's petroleum industry to ensure that the society as a whole can benefit from the revenues and value created by it. Additionally, it is intended to serve future generations, which is ensured by transferring the government revenues from Norway's oil and gas activities to the Government Pension Fund Global. The fund had, by year-end 2015, a market value of more than 7,000 billion NOK (Norges Bank, 2015). The Norwegian economy is highly dependent on revenues generated by the petroleum industry, and is therefore naturally affected by significant fluctuations in the price of oil. The majority of oil and gas produced on the Norwegian shelf is exported, and 39 percent of all Norwegian exports are related to oil and gas activities. The export value of oil and gas constituted a total of 450 billion NOK in 2015, something that emphasizes the importance the industry has for the Norwegian economy.

Since the first oil was discovered in Norway, the petroleum sector has constituted a significant share of the country's employment. In addition to providing direct employment in the petroleum industry, continuous expansion of exploration has provided increasing employment in both supplier industries and other industries in the economy where demand is increased by petroleum activities. Today, people employed directly in the oil or oil related industries are found in all parts of the country, although the majority is located in the southwest region (Statistics Norway, 2015a).

Norway is one of the main locations for both national and international suppliers to the oil industry. Due to strict legislation and extreme weather conditions, the supply industry in Norway has had to develop efficient and advanced technology and processes, and has thereby become competitive on a global basis (Norwegian Petroleum, 2016c). Consequently, both the petroleum sector as well as related industries has for many years benefited significantly from oil activities.

There has, since production began in the 1970s, been a high level of activity on the Norwegian shelf in terms of exploration and investments. However, there is currently a downward trend in field investments as several major projects are getting close to completion and the complexity of extracting less accessible resources results in higher costs. This reduces the profitability of Norway's petroleum sector. Although production is expected to remain at relatively stable levels for approximately 10 years to come, a continued growth in the petroleum sector is dependent on the discovery of new fields as well as the size of these (Norwegian Petroleum, 2016b).

Over the last years, the combination of higher costs, uncertainty of future investment levels and the significant decrease in the price of oil has provided several challenges for the petroleum sector and the Norwegian economy as a whole. Although the petroleum sector is still contributing to value creation and revenues for the Norwegian economy, adjustments and adaptation is needed in the sector (Norsk Olje og Gass, 2015). The low price of oil over the recent years could have significant implications for high cost oil producers such as Norway. Norwegian oil companies are forced to reduce production costs to be competitive next to oil producers like the Middle East where marginal costs and average breakeven points are significantly lower (Saltvedt, 2015b). Norway is already experiencing substantial downsizings as an attempt by oil companies to reduce costs. As a result of this, unemployment is currently rising, especially in the regions closest related to and mostly dependent on oil production.

However, analysts emphasize the importance of recognizing the opportunities the changing oil market dynamics and a low oil price can bring. Reduced costs, a changing demand pattern and technological innovations can generate new and motivate adjustment of existing employment, and thereby compensate for the damaging aspects of a falling oil price. Although the current economic environment might result in a belief that the prosperity Norway has experienced in recent years may have been temporary, it may also serve as an incentive to diversify the Norwegian economy.

There is no doubt that the Norwegian economy is sensitive to changes in the price of oil. The recent development has definitely caused challenges and concerns, as well as discussions of how the changing economic environment can be used to create new opportunities. Either way, the level of unemployment, the exchange rate and the stock market, among other macroeconomic aggregates, are affected by the current low price of oil. However, although it is interesting to analyze the effects on the Norwegian economy as a whole, there may exist differences across Norwegian industries in terms of how these are affected and the magnitude of these effects.

Due to the importance of the petroleum industry to the Norwegian economy, the effects on industries may differ depending on the relation the respective industry has to petroleum activities and the significance of this relationship. Industries that supply relatively insignificant quantities of their total output to the petroleum industry may experience increased profitability, and lower energy costs may contribute to an increase in spending in other areas of the economy by individual households. As a consequence of a weakened Norwegian currency, companies within industries associated with non-oil related exports could possibly experience improved premises and increased competitiveness.

While companies within supplying industries are expected to be affected negatively by a fall in the price of oil, companies within industries such as such as retail and consumer services may experience a different, and possibly even positive, development. Industries may also respond differently to oil price shocks if they are driven by changes in demand compared to if they are driven by supply, particularly emphasized by Cappelen et al. (2014). Cappelen et al. (2014) argue that companies associated with exports may respond negatively to a decrease in global demand and increased international competition, while a supply-driven oil price shock may result in growth in non-oil producing countries and thus increase demand for other Norwegian products and services. Either way, these factors yet again emphasize the importance of understanding the different causes of fluctuations in the price of oil to fully comprehend the subsequent effects.

Although there is no doubt that the Norwegian economy both has been and still is dependent on income from the oil industry, it is important to note the difference between Norway and most other oil-exporting countries in terms of how the income from oil activities is distributed. As already mentioned, a large part of the Norwegian oil related income is saved in the Government Pension Fund. The government is restricted to use only four percent of the capital, corresponding to the expected return from the fund, to finance social goods (Bjørnland and Thorsrud, 2013). This may contribute to cushioning the direct effects from fluctuations in the performance of the oil industry on the economy. Additionally, effects reminiscent of the "Dutch disease" experienced in many other natural resource abundant countries, or a rapid emergence of a wealthy elite, may have been avoided because of this policy.

5. Theory

5.1 Literature Review

Since the oil crisis in the 1970s, various researchers have attempted to understand the effects of oil price shocks on different economies. Hamilton (1983) suggests that the U.S. economic performance was better before the oil price shock of 1972 with GDP growth averaging at four percent in the period 1960 to 1972 while dropping to 2.4 percent in the period 1973 to 1981. After conducting a Granger-causality test, he concluded that the majority of the economic downturns in the U.S. occurred as a result of oil price decreases in the period examined. Mory (1993) finds that an increase in the price of oil is more closely related to macroeconomic variables than a decrease in the price of oil. Papapetrou (2001) examines the effect of oil price fluctuations on the Greek economy, and finds that oil price changes affect real economic activity and employment, and are important in explaining stock price movements. Gogineni (2010) investigates the impact of oil price changes on stock returns of different U.S. industries, and finds that both industries that depend heavily on oil and less oil-dependent industries are sensitive to changes in the price of oil.

Divergent from the large amount of research that has been conducted on how net oil importers react to oil price shocks, Mendoza and Vera (2010) estimate the effects of unexpected changes in the price of oil on output in Venezuela, an oil-exporting economy. By the use of a GARCH model they find, in line with previous research, that the economy is more responsive to unexpected increases than decreases in the oil price.

Historically, the majority of research regarding the effect of oil price shocks on economies has been conducted under a ceteris paribus assumption of the effect of oil price shocks. That is, researchers have treated the oil price as exogenous, assuming that they could vary the price of oil while holding other variables constant. Kilian (2009) points to two reasons why the assumption of an exogenous price of oil is not appropriate. Firstly, there exists reverse causality between macroeconomic factors and the price of oil. Secondly, the demand and supply that drives fluctuations in the price of oil cannot be considered independent of macroeconomic factors, rather the opposite. He presents a structural VAR model in which the issue of dependence between oil and macroeconomic variables is addressed by identifying the underlying supply and demand shocks that affect oil price fluctuations. This method has been widely used since when examining the effects of oil price shocks.

Building on this method, Lorusso and Pieroni (2015) analyze the impact of oil price changes on the UK economy, the largest producer of oil in the European Union. Their results confirm those of Kilian (2009) with regard to the causes of oil price shocks, suggesting that most large and persistent oil price fluctuations in recent years have been driven by demand rather than supply. They find that oil supply disruptions underlying the price of oil are associated with an immediate fall in UK domestic GDP growth as well as a sustained increase in domestic inflation. Increases in aggregate demand have a negligible effect on the growth in output; however in the long term tend to depress it. Although the overall performance of the UK economy deteriorates after an oil price increase, UK public finances improve.

In summary, many researchers have examined the effects of oil price fluctuations on different economies since the oil crisis in the 1970s; however a great amount of this research is related the U.S. economy or other net oil importers. Before Kilian (2009), the majority also built on an assumption of oil prices as being exogenous. More recent research has, however, put more focus on oil exporters as well as taken into account the endogeneity of oil prices.

In terms of research on the effects of oil price fluctuations on the Norwegian economy, Sørensen (2009) examines possible trading strategies in the stock market related to oil price shocks. Bjørnland (2009) analyzes the effects of oil price shocks on stock returns. She adopts the structural VAR model to capture the interaction between different macroeconomic variables, and finds that an increase in the price of oil causes an increase in stock returns. She emphasizes the importance of recognizing the stimulating effect a high price of oil has on the Norwegian economy, and its overall responsiveness to changes in the price of oil. Although Bjørnland (2009) extends her analysis by testing for nonlinear transformations of oil prices, she emphasize the need for a more thorough analysis of how the effects may differ depending on the cause of the change in the price of oil.

Our contribution to previous research is an analysis of Norway, an oil exporting and oil abundant country. We will not only focus on the stock market effects of oil price fluctuations; we will perform an analysis inspired by Kilian (2009) which also corresponds to the analysis conducted by Lorusso and Pierone (2015). We have shortened the time frame with a goal of encountering a better understanding of the current situation. Consequently, we conduct a structural VAR analysis to understand how different causes of fluctuations in the price of oil have affected various macroeconomic aggregates in the Norwegian economy over the last two decades. The exact period of time for each analysis depends on the respective data material available. Through this analysis, we hope to better understand the dynamics of oil price fluctuations and Norwegian macroeconomic variables. In addition to the variables analyzed by Kilian (2009) and Lorusso and Pieroni (2015), we increase the number of variables analyzed at the country level, and add variables at the industry level. By doing this, we hope to gain a broader understanding of the effects to the economy. The theoretical framework for our analysis will be thoroughly discussed in the following section.

5.2 Theoretical Framework

As previously mentioned, we will divide our empirical analysis in two steps: the modeling of the causes of oil price shocks through a structural VAR, and the modeling of the effects of oil price shocks through OLS regressions. In this section we will go through the theory behind both of these models, as well as the underlying theoretical micro- and macroeconomic aspects of oil market dynamics affecting the world oil market and the Norwegian economy.

5.2.1 Structural VAR Method

As introduced in the literature review, Kilian (2009) presents a structural VAR model where the issue of dependence between oil and macroeconomic variables is addressed by identifying the underlying supply and demand shocks that affect oil price fluctuations. By doing this, one can not only cope with the ceteris paribus issue more accurately; the results are furthermore given in terms of the causes of oil price fluctuations by changes in supply as well as aggregate and oil-specific demand. This is done by structurally decomposing the real price of oil into three components: crude oil supply shocks, shocks to the global demand for all industrial commodities and demand shocks that are specific to the global crude oil market. The model is designed to capture the effects of these shocks on the price of oil and the three components are referred to as oil supply shocks, aggregate demand shocks and oil-specific demand shocks, respectively.

Technically, the structural decomposition is based on two indices of crude oil supply and aggregate demand; global crude oil production for supply, and a monthly index of world real economic activity to measure global demand for industrial commodities. Assuming that the three main drivers of the price of oil are supply, aggregate demand and precautionary demand, Kilian (2009) presents a structural dynamic simultaneous-equations model to identify the oil market-specific part of demand as the residual after having controlled for the two other aggregate drivers. This way, he avoids the problem of modeling expectations directly.

To measure aggregate demand, Kilian (2009) creates an index of global economic activity based on dry cargo single ocean freight rates, and this approach has been widely used since. He argues that this index explicitly captures shifts in demand for industrial commodities and that increases in freight rates should function as a good indicator of strong global demand pressures. His index has led to reasonable, accurate and interesting results. However, more recent research has focused on developing new indices that are argued to be more accurate indicators of global real economic activity. One of these is world steel production, which has been shown to provide even better statistical predictions of world economic activity than Kilian’s index (Ravazzolo and Vespignani 2015). Based on this, as well as the argumentation in *Section 2.3.1 World Oil Market and Global Indicators*, this is the index we will use in our structural VAR analysis.

The structural VAR model by Kilian (2009) is based on the data and indices representing the three individual shocks, $z_t = (\Delta prod_t, rea_t, rpo_t)'$. $\Delta prod_t$ denotes the percentage change in crude oil production, rea_t denotes the index of real economic activity, which in Kilian's (2009) model is based on dry cargo single ocean freight rates, and rpo_t denotes

$$A_0 z_t = \alpha + \sum_{i=1}^{24} A_i z_{t-i} + \varepsilon_t \qquad \text{(Eq. 1)}$$

the real price of oil. Kilian expresses the latter two series are in log levels so that a unit change can be interpreted as a percentage. The analysis is structured around a sample consisting of monthly data, and the following model is estimated:

where z_t represents the three variables introduced above and ε_t is the 3x1 vector of serially and mutually uncorrelated structural innovations, also referred to as structural

shocks. Furthermore, Kilian (2009) explains that A_0^{-1} has a recursive structure so that the reduced-form errors e_t can be decomposed according to $e_t = A_0^{-1}\varepsilon_t$:

$$e_t = \begin{pmatrix} e_t^{\Delta prod} \\ e_t^{rea} \\ e_t^{rpo} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{oil-specific\ demand\ shock} \end{pmatrix} \qquad \text{(Eq. 2)}$$

A feature of the structural VAR model is that the errors are constructed to be uncorrelated by orthogonalizing the reduced-form errors mechanically by a Cholesky decomposition, and thus create a causal chain based on identified economic assumptions rather than identifying the causal relationships from the data itself (Kilian 2011). The imposed solution is then able to explain which shocks cause the variation in ε_t. Kilian (2011) emphasizes the need for an economic reasoning for the recursive ordering for this mechanical solution to make sense. Kilian's (2009) orthogonalization of the shocks in this particular model, and thus the choice of oil supply shocks as the first of the three, is based on the assertion that oil supply shocks do not respond to changes in oil demand within the same month. Secondly, shocks specific to the oil market should not affect global real economic activity immediately, but with at least a one-month delay. Kilian (2009) justifies these two assumptions by emphasizing the significant cost associated with an immediate adjustment of production to a change in demand, and the slow response of global real economic activity to major oil price increases.

The oil-specific demand shocks are interpreted as shocks in precautionary demand. These shocks are defined to reflect the uncertainty of future oil supply shortfalls and capture the oil price fluctuations that cannot be explained by oil supply shocks or aggregate demand shocks. Although it is reasonable to assume that this third shock could potentially reflect unrelated changes such as weather shocks or changed consumer preferences, Kilian (2009) argues that there is no evidence of this due to the timing of such exogenous events. He therefore argues that it can be interpreted to only reflect oil market-specific demand.

Kilian's (2009) results from the structural VAR includes a historical evolution of the structural shocks based on the structural residuals implied by the defined structural VAR model. Subsequently, he analyzes how global oil production, real economic activity and the real price of oil respond to one-standard-deviation demand and supply shocks through impulse response functions. He then uses the historical decomposition of the structural shocks to estimate the cumulative contribution of the shocks through which he provides a measure of the contribution of each shock to the development of the real price of oil over time. The focus of the corresponding analysis in this thesis will be on the historical evolution of the structural shocks as well as the impulse response functions of the three determinants of the oil price when responding to one-standard-deviation demand and supply shocks.

5.2.2 Linear Regression Method

Kilian (2009) uses the already estimated structural shocks to measure their effects on U.S. macroeconomic aggregates by constructing two regression models. Kilian's structural VAR is estimated using monthly data, and he argues that the results from the analysis rely heavily on restrictions that only make economic sense on a monthly frequency (Kilian, 2009). The data for the selected macroeconomic variables used in the following regressions are however only provided on a quarterly basis. Thus, the shocks estimated in the structural VAR analysis are represented on a quarterly basis by averaging the monthly structural shocks for each quarter:

$$\hat{\zeta}_{jt} = \frac{1}{3}\sum_{i=1}^{3} \hat{\varepsilon}_{j,t,i}, \quad j = 1,2,3 \qquad \textit{(Eq. 3)}$$

where j denotes the structural shocks in the ith month of the tth quarter. $\hat{\varepsilon}_{j,t,i}$ is the estimated residual for each of the structural shocks.

The model is based on quarterly data for the selected variables CPI inflation (π_t) and real GDP growth (Δy_t). The effects of the structural shocks on the U.S. macroeconomic variables are then estimated based on the following regressions:

$$\Delta y_t = \alpha_j + \sum_{i=0}^{12} \phi_{ji} \hat{\zeta}_{jt-i} + u_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 4)}$$

$$\pi_t = \delta_j + \sum_{i=0}^{12} \psi_{ji} \hat{\zeta}_{jt-i} + v_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 5)}$$

The number of lags is determined by the maximum horizon of the impulse response functions, which is 12 quarters. ϕ and ψ refer to the regressions' impulse response coefficients and u and v potentially serially correlated errors. Kilian (2009) summarizes the responses of the macroeconomic variables to each of the three structural shocks by plotting the cumulated impulse response functions with one- and two-standard error bands and subsequently analyzes the differences in how the demand and supply shocks underlying the real price of oil affect U.S. CPI and GDP.

When conducting OLS regressions, standard OLS assumptions are assumed to hold. However, an issue with time series data in particular is the possibility of autocorrelation in the error terms, and the violation of strict exogeneity. To deal with possible serial correlation in the error term, Kilian (2009) uses block bootstrap methods in his regressions when conducting inference on the estimation of the responses. Lorusso and Pieroni (2015) further emphasize the importance of recognizing heteroscedasticity in the residuals of regressions involving monthly data and argue that the bootstrap method is successful in dealing with this issue.

5.2.3 Oil Market Dynamics and Microeconomic Theory

Having presented the underlying theoretical framework for the structural VAR, we move on to present the theoretical framework for the further analysis. The following section will serve as an introduction to the oil market dynamics as well as a basic microeconomic framework which is used to understand the characteristics of and interactions in the market. However, as expressed in the delimitations section, we assume that the reader understands the basics of the theory. Consequently, this section serves to refresh and clarify the terms used as well as a discussion of the current market dynamics.

According to microeconomic theory, a market is in equilibrium when supply and demand are equal. At the equilibrium level, there exists an equilibrium price for each unit of the equilibrium quantity sold and bought. Market equilibriums can be stable or unstable, depending on whether market disruptions cause short or long term changes in the equilibrium (Bade and Parkin, 2004).

Another factor describing a market in microeconomic theory is the elasticity of supply and demand. When the percentage change in the quantity demanded exceeds the percentage change in price, demand is elastic. Thus, if demand is entirely inelastic, price does affect the quantity demanded (Bade and Parkin, 2004).

In the short term, it may be reasonable to expect demand to be more elastic than supply in the oil market. Adjustment of supply is associated with large costs, something that should cause a delayed reaction to changes in the price of oil. However, the demand for oil is dependent on several factors that decrease the short-term elasticity. When machines are built using oil as fuel, the users of these are dependent on oil in the short term. A low elasticity for supply and demand indicates that the percentage change in supply and demand is smaller than the corresponding percentage change in price. In the long term, the elasticity is dependent on the alternatives of producing and using oil. Thus, alternative energy sources contribute to decreasing the long-term demand for oil, increasing its elasticity. The actual supply and demand curves as well as their elasticities are not easy to model, as only the equilibrium price and quantity is actually observed.

The dynamics of the global oil market depend on the fundamentals of, and changes in, crude oil supply and demand patterns. As crude oil is a global commodity and activities relating to it occurs in the global marketplace, the dynamics and prices of the petroleum market is determined by demand and supply on a worldwide basis. As discussed in the previous section, the history of oil indicates that the oil market may have some characteristics that distinguish it from other commodity markets. This is partly due to its importance as a commodity, as well as players such as OPEC that act to fix the price at levels higher than supply and demand forces would have alone.

Global oil production can be divided between three groups: OPEC countries, OECD countries and countries that do not belong to either of the two. OPEC is often in economic literature treated as a cartel. This is due to their restrictions on output in order to keep oil prices at a high level. According to themselves, one of their main objectives is to secure an efficient and regular supply of oil to consuming nations (OPEC, 2016). Regardless of their motives, OPEC has been important to the dynamics of the global oil market since their establishment in 1960, although the persistence of their power in recent years has been questioned.

In microeconomic theory there exist various models to explain the dynamics in different markets due to differences in market characteristics. Although we do not directly model the microeconomic market dynamics, an understanding of these helps to comprehend the factors underlying the analysis of the oil market dynamics. Which model is preferred usually depends on the amount of suppliers, consumers and the division of power between the players. The two extremes in this theory are free competition and monopoly. Historically, the oil market should be considered to have lied in-between these two extremes, as competition cannot be considered as being free due to the continuous fixing of supply to control prices. Consequently, both monopolistic competition and oligopoly could be considered to model this particular market.

In the oil market, OPEC has often been regarded to act as an oligopolist, which is a market form with only a small number of firms competing while natural or legal barriers prevent the entry of new firms (Bade and Parkin, 2004). However, when considering the entire oil market, it can be argued that it has too many participants to be regarded as an oligopoly. On the other hand, the oil market may still be better explained by the oligopoly-model than the monopolistic competition-model if one assumes that OPEC's role is affecting the market dynamics. Another possibility would be to model the market as a price-leader and follower model, as for example the Cournot model with OPEC as the leader.

When modeling an oligopoly or a price-leader and follower model, one takes into account the responses of other market actors before making a decision regarding, for example, prices. If one supplier lowers prices, this firm is likely to immediately increase their market share, followed by higher profits. However, other firms are likely to follow, lowering the profits for all as a result of the lower prices.

Many argue that due to the major changes in the oil market since the 1960s, such as the increasing amount of alternative energy sources and players in the market, OPEC's role and significance has decreased. Rather than continuing a focus on maximizing return, OPEC is now attempting to simply maintain its market share, signaled by its recent refusal to cut production and thus an apparent change in strategy (Ramady and Mahdi, 2015). Without OPEC, its restrictions to supply and its overall power to influence oil prices, the oil market will function as any other commodity market (Custard, 2015). Doubt concerning OPEC's current influence on the oil market has resulted in the belief that prices are now determined by market supply and demand dynamics and that the only power that may exist is driven by Saudi Arabia alone (Ramady and Mahdi, 2015).

OPEC's changing role in shaping the global oil market became particularly evident in the oil price collapse in 2014. The subsequent decision by OPEC to hold current production levels instead of conducting an expected cut in output indicated an increasing desire to let market forces influence the price. Though it may not be unreasonable of OPEC to pressure others into contributing to market balance, it has been more than 25 years since they made a similar move. Some analysts speculate on whether OPEC's strategy involves letting prices fall even further than it already has, hope for non-OPEC countries producing at high costs to exit the market, and this way intend to regain some of their market share (Ramady and Mahdi, 2015). The lack of action by OPEC during times of turmoil could potentially be catastrophic for producing countries that depend on high oil prices to meet economic targets and to avoid extra pressure on their economy. Either way, the sharp fall in oil prices is an indication to the global oil market that the dynamics has changed.

Despite OPEC's decision not to cut production in 2014, the continued low oil prices recently resulted in OPEC and Russia taking initiative to freeze production levels in 2016. This is the first sign of cooperation between two of the world's largest producers in many years (Sergie et al., 2016). However, the freeze was contingent on the participation of other nations, and the negotiations had a breakdown in April 2016 when, among other things, Iran did not attend a negotiation meeting in Doha. The end result of this situation is yet to be determined. Moreover, analysts disagree on whether or not a production freeze will have any significant effects as the production freeze is not nearly as drastic or effective as a production cut, and the production would be frozen at a level so high that it would not relieve the current oil oversupply (Kleppe, 2016). Shortly after the announcement of a potential freeze in oil production, the oil price fell, indicating an effect of the agreement in favor of the skeptics. Though it may contribute to a rebalancing of the market in a long term perspective, the absence of an immediate positive effect on the price of oil can be interpreted as yet another indication of OPEC's decreasing influence and the issue of global oil suppliers not coping with the current state of demand for oil. Furthermore, analysts speculate on whether the slight increase in the price of oil since the first announcement in February is associated with expectations of an agreement to freeze production (Riley and Defterios, 2016), emphasizing the importance of recognizing the effects of the market's expectations and uncertainties of future oil supply levels on the price of oil.

If OPEC's power actually is diminishing, then oil prices will continue to fluctuate in an attempt to align demand and supply. An increasingly competitive market and a continued mismatch between supply and demand will therefore keep oil prices at a low level as long as there is an oversupply of oil in relation to demand in the market. Currently, the oil market is seemingly facing both supply and demand trends causing low oil prices. Fuel efficiency as a result of times of high oil prices and climate change concerns that put pressure on energy policies are factors that have contributed to a significant reduction in the demand for oil. Furthermore, despite an expectation of a gradual recovery of advanced economies, imbalance in economies like China results in a slowdown in overall global growth (Norsk Olje og Gass, 2015). Technological improvements reducing extraction costs, increasing non-OPEC supply as well as the rapid growth of emerging oil producing markets results in a rising global oil inventory, which is clearly not offset by an equivalent increase in demand.

In our analysis, we model the supply and demand shocks, and furthermore differentiate between aggregate and precautionary demand. This will be further discussed in *Section 6 Structural VAR Estimation*.

5.2.4 Macroeconomic Dynamics

Macroeconomic theory can help explain the dynamics in the economy when it is affected by different shocks. Although the reader is assumed to be familiar with basic macroeconomic theory, we present a short discussion of some relevant principles of macroeconomic theory in the following section. These are used as a fundament for the analysis in *Section 7.4 Analysis of Results at Country Level* and *Section 8.4 Analysis of Results at Industry Level,* as well as *Section 9 Aggregate Analysis of IRF results* where we examine the effects of oil price shocks on the Norwegian economy.

Economic growth can be measured as growth in the GDP of a country, which is often used as a measure of how well an economy is performing. GDP growth that rises faster than the population is assumed to increase the average standard of living because output per person increases. However, GDP is not the only indicator of a well-performing economy. If the unemployment rate is high, it affects how the wealth is distributed in the population. Therefore, the unemployment rate is another important indicator of the performance of an economy. Third, the state of an economy can be indicated by the inflation rate. A high inflation rate is costly to society because the purchasing power of the country's currency declines when inflation rises. Economists argue that a certain level of inflation is good for the economy, as long as it is kept reasonably low (Hall and Lieberman, 2013).

If governments wish to increase investments or boost the economy, they typically act through decreasing the interest rate. Similarly, if they wish to cushion positive shocks, they can increase the interest rate, as the interest rate is one of the key costs of any investment project. Although there are many interest rates in the banking system, they all relate to the interest rate controlled by the central bank, from which the banks can borrow money (Hall and Lieberman, 2013). In Norway, the interest rate is set with a goal to retain the inflation rate in the long run at 2,5% (Lovdata, 2016).

An important macroeconomic model is the Aggregate Demand (AD) curve. The dynamics of this model could be explained as follows. If the price level increases, the money demand, and thereby the interest rate, increases. This leads to decreased consumption and investment spending, which consequently decreases GDP. The entire curve shifts rightwards by positive demand shocks, if for example investment spending increases.

The corresponding Aggregate Supply (AS) curve can be explained as follows. If real GDP increases, it raises the prices of raw materials and other inputs, which leads to increased input costs per unit produced. To keep their markup stable, firms have to raise their prices, and this leads to a generally increased price level. Changes to other variables than GDP that increase unit costs shift the AS curve upwards. Equilibrium between the price level and the GDP is reached when the AD and AS curve intercepts (Hall and Lieberman, 2013).

Cyclical unemployment is unemployment related to economic downturns, and is regarded as a macroeconomic problem. The term "full employment" in macroeconomic theory does not mean that the whole population is employed, but rather an absence of cyclical employment. This is often called the natural rate of unemployment, and is related to GDP in the following way: When the unemployment rate is lower than the natural rate, GDP is higher than potential output, and the economy will consequently correct itself by increasing inflation. The relationship between the inflation and the unemployment rate is often modeled as the Phillips curve. This curve illustrates that in the short run, there is a tradeoff between low inflation and low unemployment (Hall and Lieberman, 2013).

The stock market is also affected by macroeconomic variables. Macroeconomic theory says that if the interest rates increases and all other variables stay the same, stock prices will fall in order to become as attractive to hold as bonds. However, financial markets are not only affected by actual changes to the interest rate. Due to the stock market dynamics, they are also affected by expected changes in the interest rate, even though they may not occur (Hall and Lieberman, 2013). Thus, the stock market can easily be affected by perceptions of the macroeconomic situation. This extends to all variables that could possibly affect stock markets and the general economic situation. Positive news relating to the economic situation can result in beliefs of higher stock returns and thus higher stock prices. However, it could also result in fear of inflation and a consequent response by the central bank to increase the interest rate, which in turn will cause lower stock prices (Hall and Lieberman, 2013).

The currency is affected by the macroeconomic variables discussed as well. If the economy in country A performs better than in country B, the prices increase relatively more in country A. This increases the relative price level in country A compared to B, resulting in more attractive goods in country B. This increases the demand for country B's currency, which leads to an appreciation of currency B relative to A; assuming free floating exchange rates. At the same time, the interest rate is likely to increase in country A to cushion the economic upturn. If so, the interest rate becomes relatively higher in country B, something that makes it relatively more attractive to invest there and further increases demand for their currency (Hall and Lieberman, 2013). Moreover, the currency is an important factor to explain the variables already discussed as well.

As is evident from the above discussion, macroeconomic variables are highly dependent on each other's development: multiple variables find a way to stabilize each other in a complex equilibrium. Therefore, seemingly similar disruptions in the market can turn out to be stabilized in different ways and by different variables.

6. Structural VAR Estimation

6.1 Setup

In the following analysis, we use a structural VAR to model the causes of oil price fluctuations in terms of changes in oil supply, aggregate demand and precautionary demand. The subsequent results will be used in the following sections to model the effects on Norwegian macroeconomic variables and stock price indices of oil price changes, depending on the cause of the oil price change.

The setup of the structural VAR estimation is similar to that of Kilian (2009), which was theoretically presented in *Section 5.2.1 Structural VAR Method*. However, not all of the choices made in our analysis are identical to his. In this section we present the modeling and analyze the results of our structural VAR.

The data used in the structural VAR is the Brent crude oil price, the world steel production as a proxy for world economic activity and the crude oil production as a proxy for crude oil supply. They are all included as log first difference, as this is necessary to make them stationary.

Kilian (2009) included the Brent crude oil price, an index for real economic activity based on dry cargo bulk freight rates and crude oil production. He included all variables as logs, and only crude oil production in first differenced form. Another difference in our data is that, compared to Kilian (2009), it covers a different time span. His analysis examines the period 1973 to 2007, while we examine the period from 1990 to 2015. Thus, in addition to answering our problem statement, this analysis will also be a test of the robustness of Kilian's (2009) method when applied to different data.

Supply and aggregate demand forces that affect the price of oil are included in the model by crude oil production and steel production, respectively. The oil production ($\Delta prod$) is the first variable in the Cholesky ordering, indicating that this variable will not be allowed to respond to the other variables within the same month, which further indicates a vertical short-run supply curve of crude oil. In line with Kilian (2009), this is believed to be reasonable because of the large costs related to adjusting oil production immediately as a response to changes in demand, as well as the uncertainties in the crude oil market. The second variable in the Cholesky ordering is real economic activity (Δrea_t). Thus, the model will allow for this variable to be affected immediately by oil production, but not by the real price of oil. Like Kilian (2009), we justify this with the slow response of global real economic activity to major oil price changes. Included as the last variable, the crude oil price (Δrpo_t) will be allowed to be affected simultaneously by both of the other variables in the model. The idea behind the setup of the structural VAR is that as supply and aggregate demand shocks have already been explained by the two first variables in the model, the last shock reflects oil-specific demand shocks, which is assumed to capture shocks in precautionary demand. As previously mentioned, this relies on the assumption that these three are the true explanatory variables of the price of oil, which in line with Kilian (2009) is considered to be reasonable. He argues that there are no other plausible explanations for other exogenous oil market-specific demand shocks.

Our estimated structural VAR model can be expressed as follows:

$$A_0 z_t = \alpha + \sum_{i=1}^{n} A_i z_{t-i} + \varepsilon_t \qquad \textit{(Eq. 6)}$$

where ε_t represents the vector of serially and mutually uncorrelated structural innovations. A_0^{-1} has a recursive structure, and thus the reduced-form errors e_t can be decomposed according to $e_t = A_0^{-1}\varepsilon_t$:

$$e_t = \begin{pmatrix} e_t^{\Delta prod} \\ e_t^{\Delta rea} \\ e_t^{\Delta rpo} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{oil-specific\ demand\ shock} \end{pmatrix} \qquad \textit{(Eq. 7)}$$

The zeros in the matrix represent the restrictions previously introduced, as they restrict the immediate response of the applicable variables in the respective time period. The letter n expresses the amount of lags included in the structural VAR model. In our estimations we have considered two different lag lengths, and this section will therefore include a discussion of our choice.

Based on the choice of Kilian (2009), we consider up to 24 lags for this model. Also based on his method, we only consider symmetric lag lengths. Looking at the selection-order criteria, FPE, AIC and HQIC all recommend 2 lags in the estimation of the structural VAR, while 24 lags is recommended by the LR information criterion. A model of 2 lags is substantially different from Kilian's (2009) choice of 24. However, we still consider both alternatives because an unnecessary large lag length can reduce the precision of the model. On the other hand, we do not want to lose valuable information to explain our model, or to create larger problems with autocorrelation in the residuals than necessary.

When testing for autocorrelation in the residuals for the structural VAR with 2 lags, we find significant results at lags 10, 11 and 24. Increasing the model by only a few lags does not remove, or even worsens this problem, and running the model with 10 or 11 lags also produces several autocorrelated lags in the residuals. Running the model with 24 lags results is the least problematic model in terms of autocorrelation in the residuals, however there still is a significant problem at the 11th lag. The selection-order criteria can be viewed in *Appendix A1.1 Selection Order Criteria*, and the Lagrange-multiplier tests as well as the Durbin-Watson d-statistic for a structural VAR of 2 and 24 lags in *Appendix A1.2 Tests for Autocorrelation in Residuals*.

The estimated historical evolution of the structural shocks of both models is graphed together in Figure 1. As these shocks will be used for further statistical analyses in the next sections, the results in the subsequent analysis depend on our choice of lags here. It is therefore considered to be reassuring that the results are relatively similar. The largest difference is that the 24 lag-model produces a smoother line for the years 1999 to 2003 for the oil-specific demand shock, while the 2-lag model seem to better capture the shocks in this period. Additionally, there is a difference in the years 2009 and 2010 for the oil supply shocks. As the historical evolution of the structural shocks is of crucial importance to our further analyses, we wish to use the model that best captures the actual fluctuations. Although we cannot be certain as to which model is the most efficient, we will discuss our reflections regarding which of the two models capture the actual effects best.

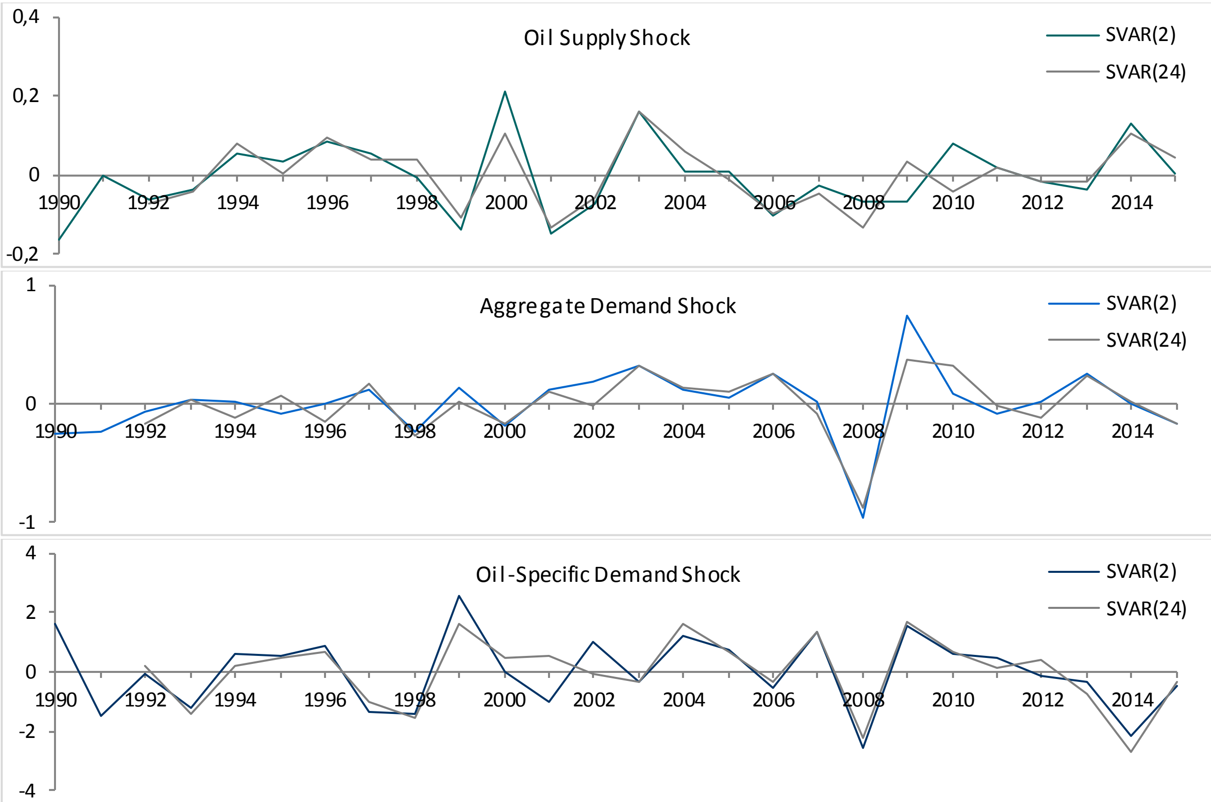

Figure 1: Comparison of structural shocks from structural VAR (2) and structural VAR (24) (Averaged to annual frequency)

In terms of precautionary demand in the years 1999 to 2003, it would be reasonable to expect a reaction to the terrorist attacks of September 11th 2001 and the subsequent invasion of Afghanistan. Intuitively, we would therefore expect precautionary demand to show a positive shock in 2001. However, the terrorist attacks occurred in September and the invasion in October, which is late in the year. We believe the months that followed must have held uncertainties regarding the effect on the oil market. Thus, it would also be reasonable if the shock is first indicated in 2002, such as reflected in the structural VAR with 2 lags. This is consistent with Maugeri's (2006) assertion that the oil marked in fact had a delayed reaction to this event. The model based on the structural VAR with 24 lags does not show a change in precautionary demand from 2000 to 2001. Furthermore, only a small negative shock is reflected in 2002, indicating that the shock is either not captured by the model, or suggesting that there was no shock in precautionary demand. Our opinion is that the structural VAR with 2 lags is most likely providing the most accurate picture of the situation.

The oil supply shocks in 2009 and 2010 are assumed to reflect the shale oil revolution in the U.S. at this time. As discussed in *Section 4.1 The History of Oil*, the rapid increase in oil production from the beginning of 2009, caused by the shale oil revolution, suggests that our model should show a oil production shock in this period. It seems like the model with 24 lags reflects this situation more accurately. However, the model with 2 lags also captures a corresponding shock, although delayed by one year.

Based on the fluctuations in the structural shocks, we believe the arguments are in favor of the structural VAR with 2 lags. Although the structural VAR with 24 lags is less problematic in terms of autocorrelation in the residuals, none of the models are perfect in this regard. In relation to the impulse response functions, the main conclusions are the same from both models, however the results are clearer and easier to interpret when the model is run with 2 lags. This is assumed to be an indication of a more precise model of the structural shocks.

Autocorrelation in the residuals should not affect the estimates, however it could produce standard errors and confidence intervals that are biased downward and therefore indicate significant results when they are not. We therefore make use of bootstrapping when calculating the confidence intervals for the impulse response functions, in line with Kilian (2009). We have obtained standard errors from bootstrapping with 2000 replications.

Both models are stable when run with differenced and logged variables. However, it is interesting to note that the structural VAR model with 2 lags is also stable when running it with the same level variables as Kilian (2009), differenced log crude oil production, and log oil price and real activity index. This is not the case for the corresponding model with 24 lags. The results from the eigenvalues test for stability for our structural VAR model can be viewed in *Appendix A2.2 Stability Test for Structural VAR 2 lags*.

Based on the discussion above, we have chosen to model our structural VAR with 2 lags. Consequently, we can express our model as follows:

$$A_0 z_t = \alpha + \sum_{i=1}^{2} A_i z_{t-i} + \varepsilon_t \qquad \textit{(Eq. 8)}$$

Apart from this, the characteristics of the model are the same as presented for Equation 6.

6.2 Analysis of Results from Structural VAR

Results from structural VARs are usually interpreted from structural shocks, impulse response functions, forward error decompositions and historical decompositions. However, we consider an analysis of the historical evolution of the structural shocks and the impulse responses to be sufficient for this thesis, as the main focus is to use these shocks in the further analyses. As a result, this section will include an analysis of the shocks estimated based on the historical evolution of the structural shocks and the impulse responses.

The structural shocks are obtained by predicting the residuals of the structural VAR model described in *Section 6.1 Setup*. We have chosen to annually average the structural shocks to make graphical interpretation easier. The shocks are illustrated in Figure 2 below.

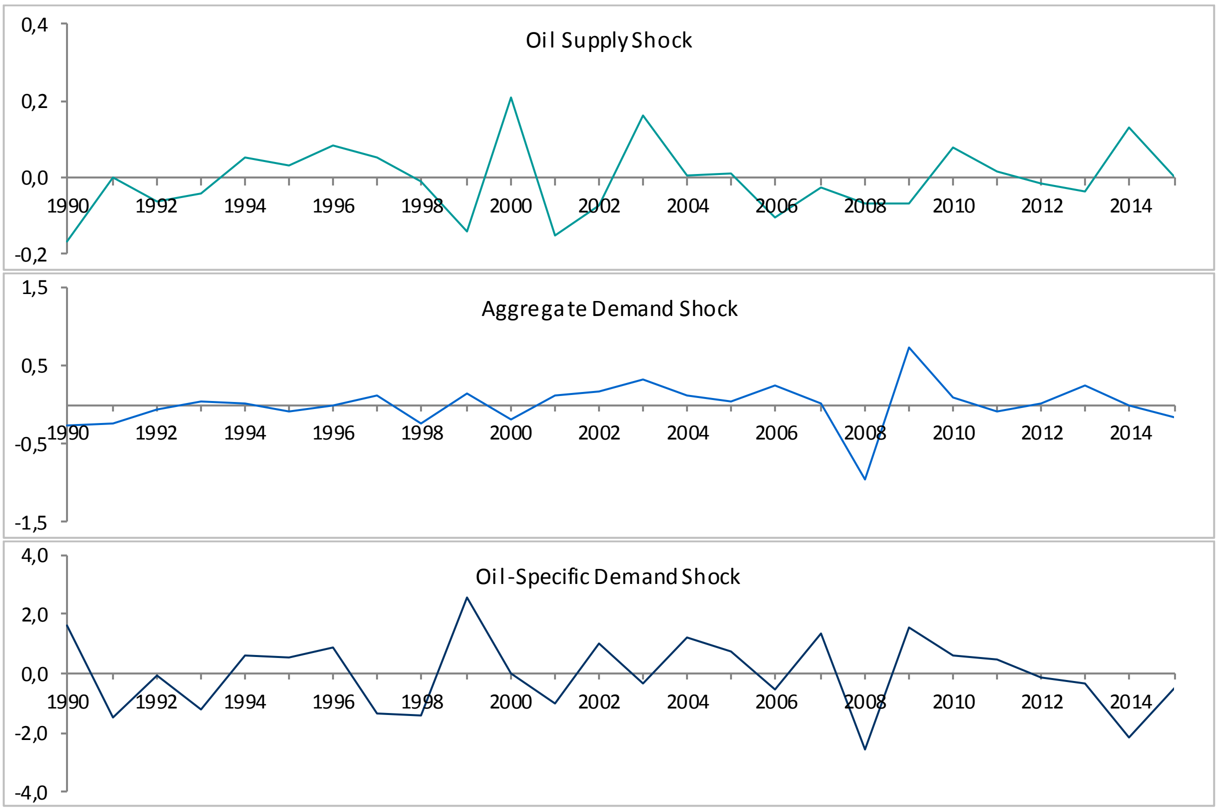

Figure 2: Historical evolution of the structural shocks, 1990-2015

(Averaged to annual frequency)

As can be seen from the structural shocks in Figure 2, 1990 was a year characterized by a negative shock in oil supply and a positive shock in oil-specific demand. This was the year that Iraq invaded Kuwait and gained control over more than half of the world's known oil reserves at the time. Knowing this, it seems reasonable that reduced oil supply and precautionary demand together caused this year's increases in the price of oil.

The price drop in 1998 can be attributed to earlier years of oversupply compared to demand, which is confirmed by the positive supply shocks in the years 1993 to 1998 held together with almost zero aggregate demand shocks and a fluctuating but low precautionary demand in the same period. The negative supply shock in 1999 can be attributed to this year's production cut by OPEC and a group of western oil producing countries, intended to keep oil prices from dropping. As described in *Section 4.1 The History of Oil*, a booming oil production in Asia and Middle Eastern countries was considered to be swelling these effects. It is, however, considered somewhat surprising that the year 2000 proves to be modeled as having the largest oil supply shock in the time period analyzed. It is worth noting that the structural VAR model with 24 lags considered also modeled this shock as large, however relatively smaller compared to other shocks.

As discussed when determining the lag length of the structural VAR model in *Section 6.1 Setup*, the peak in precautionary demand in 2002 could be considered to be a result of the terrorist attacks of September 11th 2001 and the following war in Afghanistan. The peak of precautionary demand in 2004 also confirms the estimate of a high "fear factor" affecting the price at this point. The small and negative shocks to supply held together with mostly positive shocks in aggregate as well as precautionary demand reflects the trend of increasing oil prices up until 2008. The impact of the financial crisis has a considerable negative impact on both aggregate and precautionary demand in 2008. As already discussed, it may be the shale oil revolution in the U.S. that shows as a positive supply shock in 2010. A significant supply shock is evident in 2014 as well, together with no aggregate demand shock and a negative shock in precautionary demand. This is in line with our impression of the oil market in the last years. A belief that there is excess supply compared to demand leads to expectations of low oil prices also in the time to come.

The structural shocks estimated seem to fit the historical events in the oil market relatively well. As a result, we believe that further analysis based on these shocks can yield interesting results.

The impulse response functions from the structural VAR model are graphed in Figure 3. Impulse response functions involve inducing a one-standard deviation shock in one variable to analyze how the response variable reacts to this shock. The solid lines represent the response of a variable from a positive shock in itself or another variable. The inner and outer dotted gray lines represent one- and two-standard error bands for the estimates, respectively. The graphs are normalized so that all innovations are expected to increase the price of oil. Therefore, the oil supply shocks, which are expected to decrease the price of oil, are presented as oil supply disruptions.

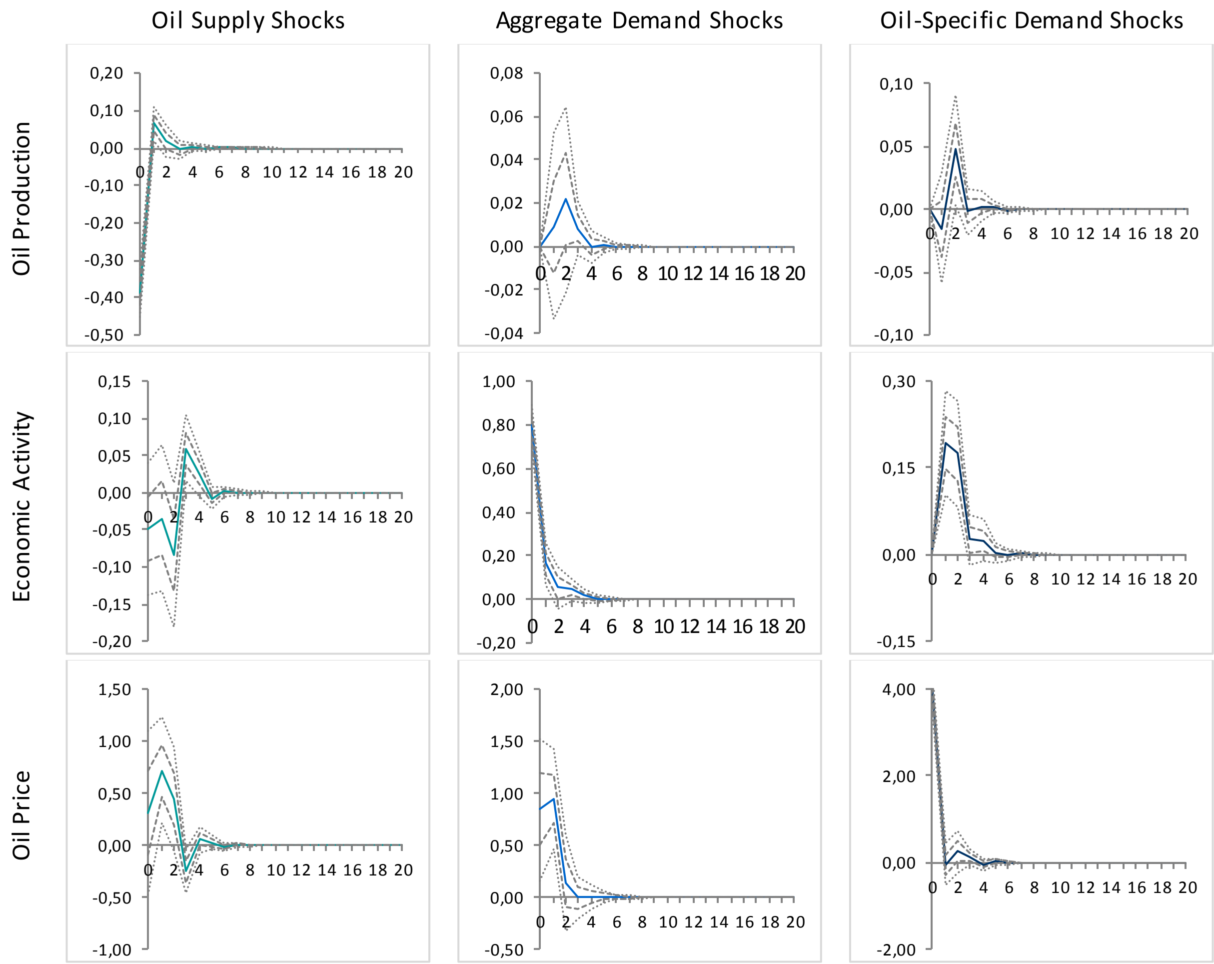

Figure 3: Impulse responses based on the structural VAR estimates
(Point estimates with one- and two-standard error bands)

The left column of Figure 3 represents the response of oil production, economic activity and the price of oil to a one-standard deviation oil supply shock, respectively. In the analysis, we refer to results that are significant at the one standard-error level as significant, and at the two standard-error level as highly significant. This terminology is in accordance with how Kilian (2009) reviews his results.

An oil supply disruption causes a statistically significant and immediate decrease in oil production. This is followed by a partially reversal of this effect, and after two months, the effect dies out and becomes statistically insignificant. The immediate decrease in oil production could potentially be explained by the traditional OPEC reaction to cut or freeze production as an attempt to maintain or increase the price of oil. However, as discussed earlier, the role and power of OPEC is seemingly decreasing, and their decision not to cut production in 2014 despite the apparent oversupply of oil in the global market is conflicting with this explanation. It could, though, indicate that changes in the level of supply in some regions tend to be neutralized by a consequent change in production levels elsewhere (Kilian 2009).

An oil supply disruption causes an immediate and partially statistically significant decrease in economic activity, which lasts for two months. Subsequently, it causes economic activity to increase in the third month, after which it is reversed, becomes statistically insignificant and dies out five months after the shock.

An oil supply disruption causes an immediate increase in the real price of oil, however this initial effect is insignificant and of a relatively small extent. The price of oil continues to increase in the first month, and at this point the effect becomes statistically significant. After this, the effect reverses and causes a partially significant decrease in the price of oil for the next two months. Although our results indicate that the shock has only a momentary effect on the price of oil while Kilian's (2009) indicate a more persistent increase for almost a year, the magnitude and insignificance of the results coincide. Kilian (2009) speculates on whether the small and only partially significant effect is due to the fact that fluctuations in oil production in some regions tend to be offset by consequent changes in the level of oil production elsewhere. He also argues that these results could possibly substantiate the opinion that oil supply shocks have little predictive power for changes in the real price of oil. Kilian (2009) emphasizes the interesting aspect of what, if not oil supply shocks, then results in the large fluctuations if the real price of oil. Consistent with his findings, our results indicate that the answer lies in the two remaining shocks that will be discussed next.

The second column in Figure 3 represents the responses of oil production, economic activity and the price of oil to a one-standard-deviation shock in aggregate demand. A positive shock in aggregate demand has no immediate effect on oil production; however it induces a delayed increase in the following two months. After this, oil production is subsequently offset by an oil production decrease. The delayed response is in line with the findings of Kilian (2009); however his results indicate an increase in oil production only after about six months. Kilian's (2009) results show a significant increase of an aggregate demand shock on oil production, while our results indicate only a marginally significant decrease in oil production after the second month. It is considered to be surprising that our results are mostly insignificant throughout the entire impulse response horizon.

An aggregate demand shock causes an immediate and highly significant increase in economic activity, which lasts for about four months. These results are different from those of Kilian (2009). The immediate and highly significant increase we find is consistent with Kilian's (2009) results, however his results indicate that economic activity begins to decline only after 14 months, and the effect is highly significant throughout the impulse response horizon.

An aggregate demand expansion causes a large and significant increase in the price of oil. The effect is immediate and continues to increase in the first month after the shock is induced. Contrary to Kilian (2009), the increase in oil price is not delayed and it is not persistent. The increase in the price of oil caused by an aggregate demand shock found by Kilian (2009) is delayed by six months, consistent with his view that aggregate demand shocks causes long swings in the real price of oil. Although it causes an increase until the second month after the shock in our impulse response, it subsequently becomes insignificant and dies out after the third. A contributing factor to the difference between our and other researcher's results, especially Kilian's (2009), can be the additional years included in our analysis characterized by significant fluctuations in economic activity. The sharp fall in the price of oil late in 2008 following the oil price spike earlier the same year, and the associated simultaneous economic collapse, could possibly explain why our results indicate a more immediate effect of aggregate demand shocks on the price of oil. The last year of data included in Kilian's (2009) analysis is 2007 and thus his analysis does not capture the events of 2008.

The third column in Figure 3 represents the response of oil production, economic activity and the price of oil to a one-standard-deviation shock in oil-specific demand. Kilian (2009) finds that an increase in oil-specific demand causes no increase in oil production and that only a small and temporary decline is associated with an oil-specific demand shock. Our results differ slightly from this. Although the shock causes a small and insignificant decrease in oil production, in line with the findings of Kilian (2009), this effect is reversed after the first month. After two months, oil production increases. The increase is significant, which indicates that oil production does in fact respond somewhat to increased oil-specific demand. The effect is however only temporarily, and reverses immediately after this. After the third month, the effect is insignificant.

An oil-specific demand shock is associated with increased economic activity with a delay of one month. The effect is partially reversed after two months; however the effect of increased economic activity is statistically significant for almost half a year. This effect is less persistent than the effect Kilian (2009) finds, as increased economic activity is significant and increasing for more than a year after the shock is introduced.

A positive oil-specific demand shock has the largest and most statistically significant effect on the price of oil. The immediate and sharp increase reflects the instantaneous effect an oil-specific demand shock driven by expectations about future oil supply has to this variable. Even though the effect of an aggregate demand shock is large as well as more significant and of greater magnitude than that of an oil supply shock, these results indicate that oil-specific demand shocks are in fact the main driver of fluctuations in the price of oil.

Compared to the results from the impulse response functions from the structural VAR with 24 lags, we find that the main conclusions are the same. The impulse response functions can be viewed in *Appendix A2.1 Impulse Response Functions from Structural VAR 24 lags*. Because of the similarities, we have decided to proceed with the 2-lag model without further comparison to the 24-lag model.

7. Analysis of Oil Price Shocks to Country-Level Variables

7.1 Data

To examine how the estimated structural shocks relate to the Norwegian economy, OLS regressions are used to analyze the effect of each of the three structural shocks on a chosen set of variables reflecting the Norwegian macroeconomic environment. The setup is similar to that of Kilian (2009), and Lorusso and Pieroni (2015), who measure the effects on two U.S. and four UK macroeconomic aggregates, respectively. However, we have chosen to analyze a greater number of variables, and macroeconomic variables related only to the Norwegian economy. Furthermore, in addition to conducting the structural VAR discussed earlier with a different time frame, which consequently produces different results in terms of the structural shocks, the time frame of the macroeconomic variables differs as well. Thus, our results and interpretation will naturally differ from those of Kilian (2009) and Lorusso and Pieroni (2015).

The variables used in our regressions include three GDP measures with data provided on a quarterly basis; total GDP (GDP), GDP mainland (GDP_mainland) and GDP for oil activities and ocean transport (GDP_oilocean). These three variables are estimated from the second quarter of 1994 to the third quarter of 2015. Furthermore, the data include five variables with data provided on a monthly basis; the Unemployment Rate (UR), the 3 Month Interbank Offered Rate (Interbank), Total Exports (TotExp), the Oslo Stock Exchange Benchmark Index (OSEBX) and the Norwegian Krone Trade Weighted Index (KRONE_TWI). The variables UR, Interbank, TotExp, and KRONE_TWI are all estimated from February 1994 to October 2015, while the variable OSEBX is estimated from January 1996. All the time series are expressed in log levels and first differenced.

7.2 Model

The data for the majority of the included variables is provided on a monthly basis. Thus, the following regressions can be estimated, using the series for the monthly macroeconomic aggregates and the previously estimated structural shocks:

$$UR_t = \rho_j + \sum_{i=0}^{24} \delta_{ji} \hat{\zeta}_{jt-i} + s_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 9)}$$

$$CPI_t = \alpha_j + \sum_{i=0}^{24} \Phi_{ji} \hat{\zeta}_{jt-i} + u_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 10)}$$

$$Interbank_t = \theta_j + \sum_{i=0}^{24} \gamma_{ji} \hat{\zeta}_{jt-i} + v_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 11)}$$

$$TotExp_t = \delta_j + \sum_{i=0}^{24} \psi_{ji} \hat{\zeta}_{jt-i} + w_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 12)}$$

$$OSEBX_t = \iota_j + \sum_{i=0}^{24} \varkappa_{ji} \hat{\zeta}_{jt-i} + o_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 13)}$$

$$KRONE\_TWI_t = \varphi_j + \sum_{i=0}^{24} \eta_{ji} \hat{\zeta}_{jt-i} + m_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 14)}$$

$\hat{\zeta}$ represents the previously estimated structural shocks, $\delta, \Phi, \gamma, \psi, \varkappa$ and η correspond to the impulse response coefficients for each of the variables, and s, u, v, w, o and m are the potentially serially correlated errors, respectively.

For the regressions involving quarterly data of total GDP, GDP mainland and GDP oil activities and ocean transport, the monthly structural shocks need to be modified so that their frequency correspond to the data series of the three macroeconomic variables. Adopting the approach of Kilian (2009), we average the monthly structural shocks for each quarter in the sample to create quarterly shocks, where $\hat{\varepsilon}$ corresponds to the residuals estimated for the jth structural shock in the ith month of the jth quarter:

$$\hat{\zeta}_{jt} = \frac{1}{3}\sum_{i=1}^{3} \hat{\varepsilon}_{j,t,i}, \qquad j = 1,2,3 \qquad \textit{(Eq. 15)}$$

Having constructed quarterly shocks, the following regressions can be estimated in the same procedure as the other variables:

$$GDP_t = \emptyset_j + \sum_{i=0}^{8} \tau_{ji}\hat{\zeta}_{jt-i} + n_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 16)}$$

$$GDP\_mainland_t = \vartheta_j + \sum_{i=0}^{8} \beta_{ji}\hat{\zeta}_{jt-i} + p_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 17)}$$

$$GDP\_oilocean_t = \pi_j + \sum_{i=0}^{8} \omega_{ji}\hat{\zeta}_{jt-i} + q_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 18)}$$

τ, β and ω correspond to the impulse response coefficients for each of the variables, and n, p and q are the potentially serially correlated errors, respectively.

7.3 Setup

Unit root tests have been carried out for all the included variables, and each indicates that the series are non-stationary. The Augmented Dickey-Fuller tests indicate that the logged variables are integrated of order one I(1). Thus, all variables in the model are expressed as log first difference to make them stationary.

The lag length of the structural shocks in the regressions are selected based on an evaluation of different models using the information criteria AIC and BIC. Kilian (2009) uses a total of 12 quarters in his regression model, which corresponds to an impulse response horizon of three years. The information criteria for the regressions indicate a lag length of 24 months relatively consistently across all monthly variables, and a lag length of 8 quarters for the quarterly data. Although one could consider a different lag length for all variables based on the best possible selection criteria, we consider it more valuable to choose the same lag length to make the results as comparable as possible across the estimated variables. Consequently, the lag length is set to 24 months for the variables with monthly data and 8 quarters for the GDP variables. The results from the information criteria tests can be found in *Appendix A3.1 Country-Level Variables.*

Autocorrelation often occurs in time series data where an observation at a given point in time is dependent on observations from previous time periods, and causes inefficient estimators and incorrect standard errors (Ajmani, 2009). We have used the Durbin Watson statistic to detect autocorrelation in our regressions, as this is one of the most commonly used statistics for autocorrelation detection (Ajmani, 2009). All of our regressions show presence of autocorrelations and this is dealt with by obtaining standard errors based on the robust Huber-White variance estimator. The output of the tests for autocorrelation is provided in *Appendix A4.1 Country-Level Variables.*

7.4 Analysis of Results at Country Level

Impulse response functions representing the effects of the three shocks to the price of oil on different Norwegian macroeconomic variables will be presented and analyzed in the following section. Due to the large amount of variables, we have divided the analysis into three groups for convenience. Total GDP and GDP for respectively the mainland and the oil-related economy will be examined first. Subsequently, the variables CPI, Norwegian Krone Trade Weighted Index and Interbank Rate will be examined together as these are expected to be closely related. Lastly, the variables Unemployment Rate, Total Exports and the OSEBX index will be analyzed. As previously discussed in *Section 7.3 Setup,* all impulse response functions indicate the response over a period of two years. The responses to the GDP variables are presented in quarters while the responses of the remaining variables are presented in months. The impulse response functions are graphed cumulatively, with one- and two standard error bands.

7.4.1 IRF Analysis of Norwegian GDP

The responses of the three Norwegian macroeconomic variables related to GDP to each of the three defined shocks are summarized in Figure 4 below.

Figure 4 identifies the differences in how the demand and supply shocks underlying the price of oil affect Norwegian GDP. A positive change in the price of oil driven by any of the three shocks is expected to have a positive effect on total GDP. Even though the effect is expected to be somewhat reduced over time due to a reversed effect of higher commodity and export prices, it is not expected to be completely neutralized.

The actual responses partially confirm these expectations. An oil-specific demand shock causes an immediate and persistent increase in total GDP, which is significant throughout the entire impulse horizon. Additionally, an aggregate demand shock causes a delayed, though mostly significant, increase in total GDP. These findings emphasize the importance of the oil industry to the Norwegian economy, and the significant responsiveness of it to oil-related activity. An oil supply disruption, however, causes a reaction opposite to that of the other two shocks. The immediate response is positive; however the following quarters are characterized by a decrease in total GDP. The response is only significant from the first through the third quarter, as well as from the eighth quarter in the impulse horizon. The negative response of Norwegian GDP to an oil supply disruption could potentially reflect decreased demand for oil as a result of higher oil prices caused by an oil supply disruption. However, we find it more likely that the negative response reflects uncertainties related to the geopolitical situation elsewhere in the world, which could have negative effects on the Norwegian economy despite the higher price of oil.

Figure 4: Cumulated responses of GDP, GDP mainland and GDP oilocean to structural shocks (Point estimates with one- and two-standard error bands)

Our expectations to the responses of GDP for mainland Norway is quite similar to those of total GDP. GDP mainland is expected to react positively to the three shocks, though the effect could be expected to be somewhat delayed as it should be reflecting a spillover effect from the oil sector. Also, a reverse effect as a response to higher commodity prices could be expected to occur sooner.

The actual response of GDP mainland differs slightly from the results of total GDP, as well as from our expectations. As with total GDP, an oil supply disruption causes a decrease in GDP mainland, though this is only partially significant in the first five quarters. After a year and a half, the decrease is large and significant. If an oil supply shock is caused by a Norwegian oil supply disruption, it would be reasonable for the mainland to experience a decrease in GDP, as this would imply lower activity, demand and spillover effects from the oil industry. However, as for total GDP, we find it more reasonable to interpret the results as an indication of a negative effect from an increased price of oil, caused by an external oil supply disruption. Higher oil prices may be profitable for the overall Norwegian economy, however it may be reasonable for GDP mainland to decrease when the price of oil increases due to an oil supply disruption as opposed to increased demand. GDP mainland follows a similar pattern as total GDP for the other two shocks. Both aggregate and oil-specific demand shocks results in increased GDP for mainland Norway, though the effect is immediate and significant for an aggregate demand shock while somewhat delayed for oil-specific demand.

The response of GDP oil activities and ocean transport is the opposite of what we would expect. The GDP for oil activities and ocean transport is expected to be highly responsive to increases in the price of oil caused by all of the three shocks. Although costs of transportation could increase significantly following an increased oil price due to the use of oil-related inputs such as fuel, we would at most expect this to have a relatively small effect on the GDP measure for oil activities and ocean transport. We therefore find it puzzling that the GDP measure for the oil industry is either insignificant or negatively affected by all three shocks examined.

The petroleum sector was 15 % of total Norwegian GDP in 2015, while it contributed to 20 % of the government income. It constituted 26 % of total investments and 39 % of total exports (Norwegian Petroleum, 2016d). A relevant question is therefore whether all of these sources of income are actually reflected in the GDP oil activity and ocean transport measure. Another question is how transfers to the Government Pension Fund Global are reflected in the GDP oil activity and ocean transport measure. Without being familiar with the exact dynamics of these calculations, a conclusion regarding the effect of GDP oil activities and ocean transport is difficult to reach. However, we find it more likely that there is a calculation technical matter rather than an actual insignificance of the effect of the oil price to the oil and oil-related industry that causes the results. This is supported by the overall positive responses of the other country-level variables to oil-specific demand shocks. Still, the effect on GDP oil activities and ocean transport would be an interesting area of further research.

GDP is one of the two variables also examined by Kilian (2009), and our results are therefore natural to compare to his for this variable. The effects on total GDP are of opposite sign compared to his findings when caused by demand shocks. As we are examining an oil exporting economy where an increased oil price is expected to have a positive rather than negative impact on Norway's value creation, these contradicting results are as expected. It is interesting, however, that the effect on Norwegian GDP of supply shocks underlying the price of oil is similar to Kilian's (2009) result for U.S. GDP. This could, as already discussed, be a result of the externality of these shocks to the Norwegian oil economy. Although the two countries differ in their relation to oil activities, shocks caused by global supply disruptions, and that therefore are external to both countries, may result in similar effects.

7.4.2 IRF Analysis of CPI, the Interbank Rate and the Norwegian Krone TWI

The responses of the three Norwegian macroeconomic variables related to CPI, the Norwegian Krone Trade Weighted Index (hereafter referred to as Krone TWI) and the Interbank 3 Month Offered Rate (hereafter referred to as the interbank rate) to each of the shocks examined are summarized in Figure 5. Shocks to the Krone TWI are normalized such that an increase in the variable reflects an appreciation of the Norwegian currency.

CPI is an indication of the price level in Norway, and is used to measure inflation. If all other variables were held constant, we would expect positive oil price shocks to increase inflation. However, since the central bank of Norway continuously attempts to maintain inflation at a constant level, the effect of any shock to inflation is expected to be neutralized over time. Since all variables are not held constant in our analysis, it is interesting to see how inflation relates the corresponding effects to other variables when responding to oil price shocks.

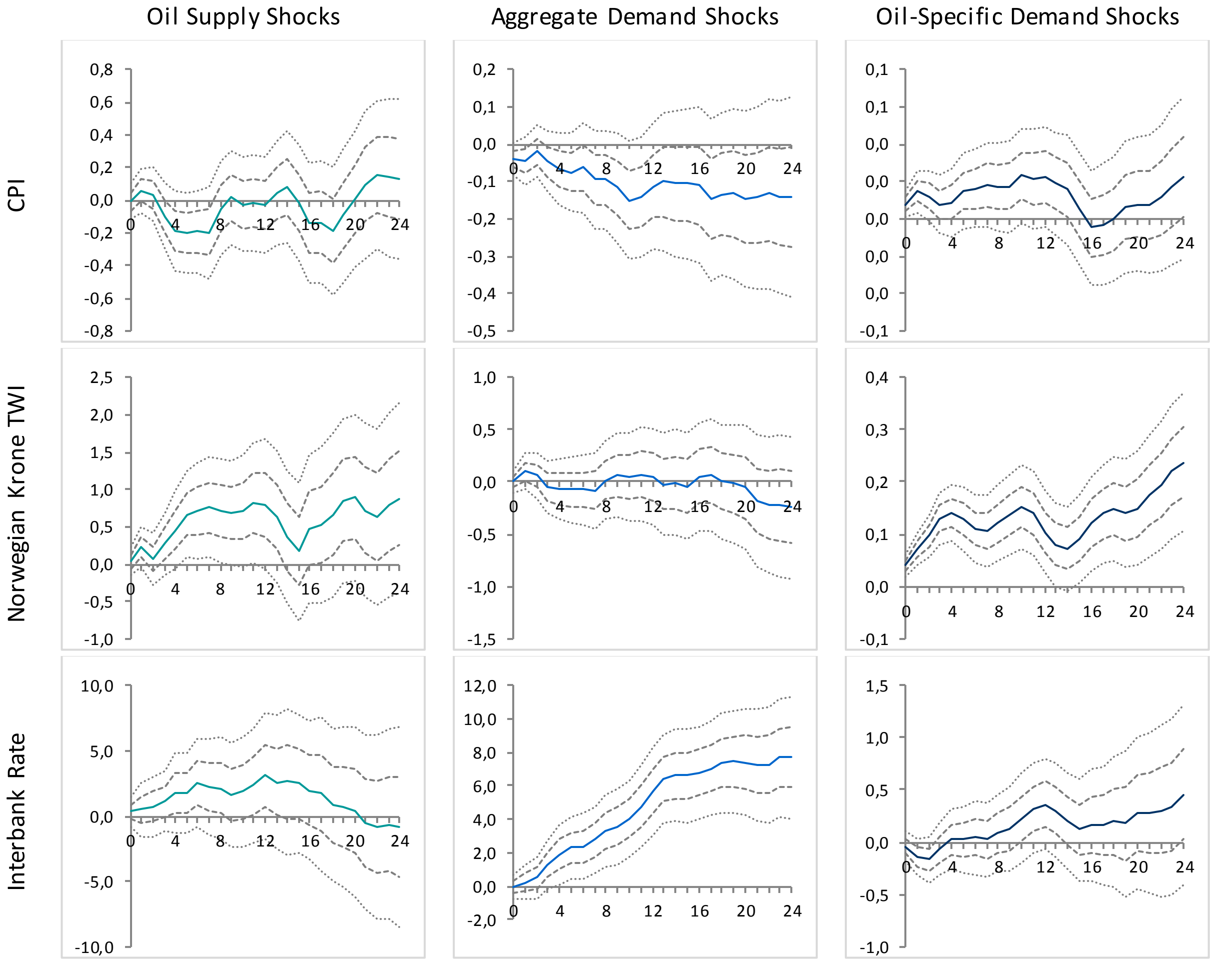

Figure 5: Cumulated responses of CPI, Interbank Rate and Krone TWI to structural shocks (Point estimates with one-and two-standard error bands)

As can be seen from Figure 5, inflation does not have an apparent response to oil supply shocks. Except from a short and significant decrease between the third and the seventh month, the overall reaction is not significantly different from zero. An aggregate demand shock, one the other hand, has a negative and significant effect on inflation throughout the two years we examine, although the effect stabilizes after 12 months. Both of these results are surprising. However, examining the corresponding impulse responses for the other variables in Figure 5, it appears as if the responses of inflation to the three structural shocks can be explained by the simultaneous reactions of the other two macroeconomic variables; Krone TWI and the Interbank Rate. An aggregate demand shock causes a significant increase in the interbank rate. A higher interest rate decreases inflation, which can explain the corresponding negative reaction of inflation.

An oil-specific demand shock increases inflation significantly for approximately a year before the effect is reversed. The reversed effect on inflation in this case appears to stem from a strengthening of the Norwegian Krone more than the interest rate. This makes sense, as an oil-specific demand shock would affect Norway more than many of Norway's trading partners, and thus increase the relative demand for Norwegian currency. This is confirmed by a more thorough analysis of the responses of the variable Krone TWI. The reaction is positive and significant when the change in the price of oil is driven by an oil-specific supply or demand shock. If the shock is driven by aggregate demand, however, increased activity in the world economy as a whole may neutralize the specific demand for the Norwegian Krone by a strengthening of the currencies of Norway's main trading partners.

The impulse responses of the above examined variables fit the responses of the Norwegian interbank rate to the three structural shocks. Isolated, the interbank rate is expected to increase with positive oil price shocks, especially if caused by an aggregate demand expansion. However, if the currency appreciates, the need for an increased interest rate to cushion the economy could be reduced. If the interbank rate increases, the demand for Norwegian currency can increase as well. Therefore, it is reasonable that the interbank rate increase more when the currency does not.

CPI is the second of the two variables examined by Kilian (2009). Compared to his results, inflation in Norway has a somewhat similar reaction to oil supply shocks and oil-market specific demand shocks. However, the response of Norwegian CPI to an aggregate demand shock is the opposite of the response of CPI for the U.S. Our results indicate interdependency between CPI and other macroeconomic aggregates not included in Kilian's (2009) analysis, which makes it challenging to further elaborate on the causes of the differences. It would have been interesting to see the corresponding reactions of other U.S macroeconomic variables, as these likely to better explain the different responses of inflation.

7.4.3 IRF Analysis of Unemployment Rate, Total Exports and the OSEBX Index

The responses of the three Norwegian macroeconomic variables Unemployment Rate, Total Exports and the OSEBX index to each of the three structural shocks are summarized in Figure 6 below.

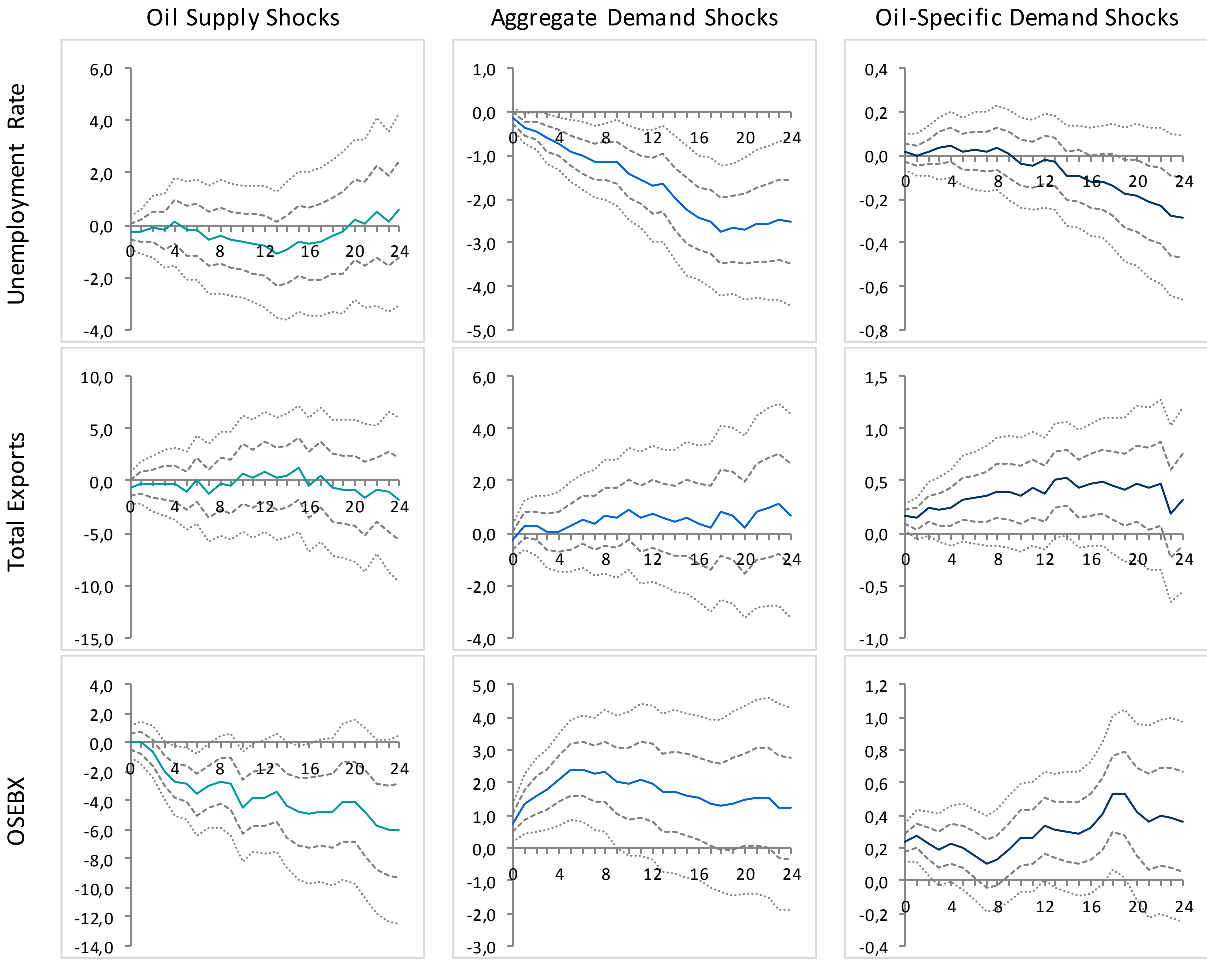

Figure 6: Cumulated responses of Unemployment Rate, Total Exports and OSEBX to structural shocks (Point estimates with one- and two-standard error bands)

The Norwegian unemployment rate is expected to be negatively related to an increase in the price of oil, and particularly those caused by aggregate demand shocks. A high price of oil should indicate lower Norwegian unemployment, and so should positive shocks to economic activity. However, Norwegian industries that may experience an opposite response to changes in the price of oil than the oil industry could partially relieve the effects on the unemployment rate.

Our results confirm these expectations. The response of the unemployment rate to an oil supply disruption is relatively small and insignificant throughout the impulse horizon. An aggregate demand expansion causes an immediate and persistent decrease in the unemployment rate. This is in line with the expectation that increased global activity and the associated high price of oil, is closely related to Norwegian economic activity. An oil-specific demand shock also results in a decreased unemployment rate, however the response is delayed. The response is significant only after the 18th month after the shock is introduced.

An explanation for the slower response of the unemployment rate to an oil-specific demand shock may be related to possible expansions in the oil industry as a response to this specific shock. A large share of the Norwegian workforce is employed in the oil industry and in industries related to it. An increased oil-specific demand shock underlying the price of oil may increase activity in the oil industry and thus create significant employment. However, expansions or adjustments in the industry will not necessarily occur immediately, and therefore result in a delayed response. Thus, an oil-specific demand shock underlying the price of oil will result in a significant response of Norwegian unemployment, although this response is slower than that caused by other oil price shocks.

Almost all oil produced in Norway is exported, and therefore positive shocks to the oil price are expected to increase total exports. However, this effect could be somewhat reduced or neutralized by higher commodity and export prices, which may lower the level of exports from other industries. A third factor that could affect the response of exports is that higher oil prices could decrease the global demand for oil. As can be seen from Figure 6, there is no significant effect on exports from oil supply shocks. One explanation is an appreciation of the Norwegian currency, which is the response of this variable to the same shock, evident from the previous analysis related to Figure 5. Another explanation is, as mentioned, that demand for oil might fall due to the increased price of oil caused by an oil supply shock. Alternatively, the oil supply shock could be related to an unfavorable geopolitical situation that lowers the general demand for goods. This could for example be unrest or uncertainties relating to war activities in the Middle East or natural disasters. An aggregate demand shock has a positive, but insignificant, effect while the effect of an oil-specific demand shock is both positive and significant. This emphasizes the importance of oil as a Norwegian export commodity. It also indicates that the positive effects on oil-related exports dominate possible negative effects on non-oil related exports when oil price shocks are caused by demand shocks, and especially when the demand shocks are oil-specific.

The expected response of the OSEBX index to the three shocks is somewhat uncertain due to the significant amount of factors influencing stock prices. Any shock that increases the price of oil, and particularly aggregate demand expansions, is likely to improve the economic situation for many Norwegian companies. On the other hand, increased economic activity can lead to a higher interest rate or expectations thereof, as well as appreciation of the currency or higher costs if oil is used as an input. All of this could potentially cause a decrease in stock prices.

The OSEBX index clearly responds negatively and significantly to oil supply disruptions, and the effect continues to decrease throughout the two years we examine. Although oil supply disruptions should increase the price of oil, OSEBX is an index that consists of many different Norwegian companies, and these are likely to also be affected by the world geopolitical situation. Therefore, an explanation for the negative response related to oil supply disruptions may be that this shock could be related to geopolitical uncertainties, as previously discussed in relation to other variables.

The effect of an aggregate demand shock underlying the price of oil on the OSEBX index is positive and mostly significant. The effect appears to wear off after six months, although it stays positive and significant for the two years examined. The effect of an oil-specific demand shock is somewhat similar, although the effect is more delayed and peaks after 18 months. The subsequent decrease could be an indication of higher commodity and export prices that are neutralizing the positive effect on the Norwegian economy of an increased oil price. This theory is supported by the previous discussion of inflation and the currency with regards to the oil-specific demand shocks, while the cushioning of aggregate demand shocks is better explained by an increase in the interest rate.

7.4.4 Summary of Country Level IRF Analyses

As we have analyzed a considerable amount of variables in this section, we find it convenient to summarize the main effects before moving on to the next section. This section will therefore include a short summary of the main effects and their most likely interpretations.

All of the three GDP variables were expected to react positively to all three shocks, and the largest effect was expected for GDP for oil activities and ocean transport. The responses of total GDP and GDP mainland are as expected except from the response to an oil supply shocks. The effects on GDP for oil activities and ocean transport were surprisingly small and insignificant, and even negative for the oil specific demand shocks. This is considered to be puzzling.

Inflation was expected to increase with economic activity. However, it proved to have a large and negative response to an aggregate demand shock. This is found to be explained by the interbank rate, which appreciates significantly as a result of the same shock. The Norwegian Krone TWI increases from oil-specific demand shocks, and appears to keep inflation low when the economy is affected by such a shock.

The unemployment rate was expected to react negatively to positive shocks to the price of oil, while the expected response of total exports and the OSEBX index were more uncertain. The actual effects on the unemployment rate turns out to match our overall expectations, while total exports appears to be affected by the currency effects from the corresponding shocks. The response of total exports to both an oil supply disruption and an aggregate demand expansion is insignificant, which could reflect a neutralizing effect of the most likely positive shock from oil exports from an opposite level of exports from other industries. The response from an oil-specific demand shock is positive and significant; indicating that when a higher price of oil is driven by oil-specific demand, the increased export from the oil industry is dominating a possible decreased level from other non-oil related industries. The OSEBX index reacts negatively to oil supply disruptions and positively to the demand related shocks. Surprisingly, OSEBX has the largest response to an oil supply disruption.

8. Analysis of Oil Price Shocks to Industry-Level Variables

8.1 Data

To examine how the estimated structural shocks relate to different Norwegian industries, the response of 20 Norwegian industry group indices to each of the three structural shocks is analyzed through OLS regressions. The majority of the variables are analyzed from January 1996 to October 2015. Due to unavailability of certain data, the remaining variables are analyzed from July 1996. It will be clear from the subsequent analysis if a variable has been estimated based on a shorter time period. Although the setup is similar to the regressions modeled in the previous section for Norwegian variables at country level, the industry-level setup will be presented in the following section.

The variables used in our regressions include Food, Beverage and Tobacco (Food), Banks (Banks), Technology Hardware and Equipment (Technology), Media (Media), Retailing (Retail), Software Services (SoftwServ), Transportation (Transport), Real Estate (RealEst), Insurance (Insurance), Pharmaceuticals and Biotechnology (PharmaBio), Utilities (Utilities), Telecommunication Services (Telecom), Diversified Financials (DivFin), Health Care Equipment and Services (Health), Consumer Durables and Apparel (ConsDur), Commercial and Professional Services (ProfServ), Consumer Services (ConsServ), Capital Goods (Capital), Materials (Materials) and Energy (Energy). The names included in parentheses are the abbreviations used.

8.2 Model

The total return indices for all industries are provided on a monthly basis. Thus, the following regressions can be estimated using the series for the monthly total return indices and the previously estimated structural shocks:

$$\partial_t = \kappa_j + \sum_{i=0}^{24} o_{ji} \hat{\zeta}_{jt-i} + \mu_{jt}, \qquad j = 1,2,3 \qquad \textit{(Eq. 19)}$$

∂ represents the respective industries analyzed, $\hat{\zeta}$ represents the previously estimated structural shocks, o corresponds to the impulse response coefficients for each of the variables, and μ are the potentially serially correlated errors.

8.3 Setup

Augmented Dickey-Fuller tests indicate that all variables are non-stationary and integrated of order one I(1). Therefore, all the variables in these regressions are included in log first difference to make them stationary.

The lag lengths of the structural shocks in the regressions are determined by a thorough evaluation of different models using the information criteria AIC and BIC. The information criteria indicate a lag length of 24 months relatively consistently across all industry-level variables. As for the structural shocks in the country-level analysis, we consider it to be valuable to choose the same lag length for all to make the results as comparable as possible across the estimated variables. A lag length equivalent to two years would correspond to the lag length chosen for the country-level data, ensuring that the effects of structural shocks are comparable across all variables in our analysis. Consequently, the lag length is set to 24 months. The information criteria output can be found in *Appendix A3.2 Industry-Level Variables*.

Equivalent to the country-level analysis, we have used Durbin Watson statistics to detect any presence of autocorrelation in the industry-level regressions. All of our regressions show presence of autocorrelation, and this is dealt with by obtaining standard errors based on the robust Huber-White variance estimator. The output of the tests is provided in *Appendix A4.2 Industry-Level Variables*.

8.4 Analysis of Results at Industry Level

Although regressions have been run for all 20 available industries, we have chosen to focus on some and exclude others from the analysis. This choice is based on an evaluation of whether the results add value to the analysis, as well as whether or not the actual results deviate significantly from our initial expectations. To ease the analysis for the reader, the industries have been grouped into six categories. The reasoning behind each group of industries is explained in the corresponding paragraphs. The impulse response functions of the variables included in the analysis are presented in the text, while the impulse response functions of the excluded variables can be found in *Appendix A6. Impulse Response Functions from Structural VAR 2 lags, Variables Not Analyzed.*

The following analysis is based on the effects of the three shocks to the oil price on different total return indices from Oslo Stock Exchange. As they are based on stock prices, these variables are different in nature from most of the variables discussed in the previous section. GDP, for example, is a representative measure of actual value creation. In contrast, a stock index will capture both actual performance as well as expectations in the market. As a result, stock market indices may fluctuate more rapidly compared to variables such as GDP, and are also affected by factors such as dividend payments. One should therefore be careful when comparing the results of this section with the ones in the previous, except from the OSEBX index. In addition to the nature of the data, a source of complexity is the content of each industry index. Fluctuations in each industry index depend on the composition of the actual stocks in the index, which may change over time.

Before providing a detailed analysis of each group of industries, we will discuss the most recurring trends and their most probable explanations. That way, we can focus on the unique characteristics of each industry group when we turn to the more detailed analysis.

In general, oil supply shocks cause the stock indices to decrease over the two-year period. For any industry involved in exports, an explanation of this trend could be an appreciation of the Norwegian Krone, which previous analyses have shown is the response by this variable to the corresponding shock. Alternatively, it could be related to the underlying cause of the supply shock, which could be driven by political unrest or natural disasters. This could cause uncertainties directly linked to these events, which could further affect expectations for economic growth. This interpretation of supply shocks should not be confused with changes in precautionary demand, which are changes in the price of oil that cannot be explained by actual supply or demand shocks. If the oil supply shock is caused by a shock in the Norwegian oil supply, it could result in a positive effect on oil and oil-related industries. However, we do not find evidence for this interpretation in our analysis.

Aggregate demand shocks have an overall positive effect on the included industries, and the effect is mostly significant. However, the effect generally stabilizes or decreases after approximately a year. In addition to capturing a positive aggregate demand shock to the oil price, the extensive effect indicates that the stock indices also capture the effect of a generally higher aggregate demand. This is not surprising; however it implies that the results need to be interpreted carefully. The recurrence of a neutralizing effect over time may be related to expectations of inflation and thereby an increased interest rate. It could also be an indication that the positive shock needs approximately one year to be fully absorbed by the companies, after which the effect persists or decreases depending on the industry.

The effects of oil-specific demand shocks on the stock indices differ from the effects caused by aggregate demand and oil supply shocks. The most apparent difference is the variation in responses across the industries. The responses to oil-specific demand shocks are generally of smaller magnitude than the other two shocks, however the responses are characterized by more rapid changes throughout the course of the impulse horizons. Additionally, the effects differ more in direction and impact. Thus, the results emphasize the immediate and significant effect precautionary demand can have on economic development. Expectations and uncertainties related to future oil supply do not only have a sharp and significant effect on the price of oil, they can quickly change expectations to and performance of different Norwegian industries. Due to the importance of the petroleum industry, a reasonable initial expectation for many industries in the Norwegian economy would be a positive reaction from this shock. However, our results indicate that the actual effects on different Norwegian industries are more complex than this. Thus, changes in precautionary demand seem to be the most revealing variable to indicate to how industries respond differently to changes in the price of oil. It should therefore be the most interesting shock of the three to analyze.

8.3.1 IRF Analysis of Utilities and Energy

The impulse response functions for the Utilities and Energy industries are illustrated in Figure 7 below. They are presented together as Energy mainly represents oil and oil-related companies, while Utilities represent alternative energy sources such as solar energy, hydroelectric power and district heating. As these industries could be viewed as both complements and substitutes to one another, is interesting to analyze whether or not they respond differently to each structural shock.

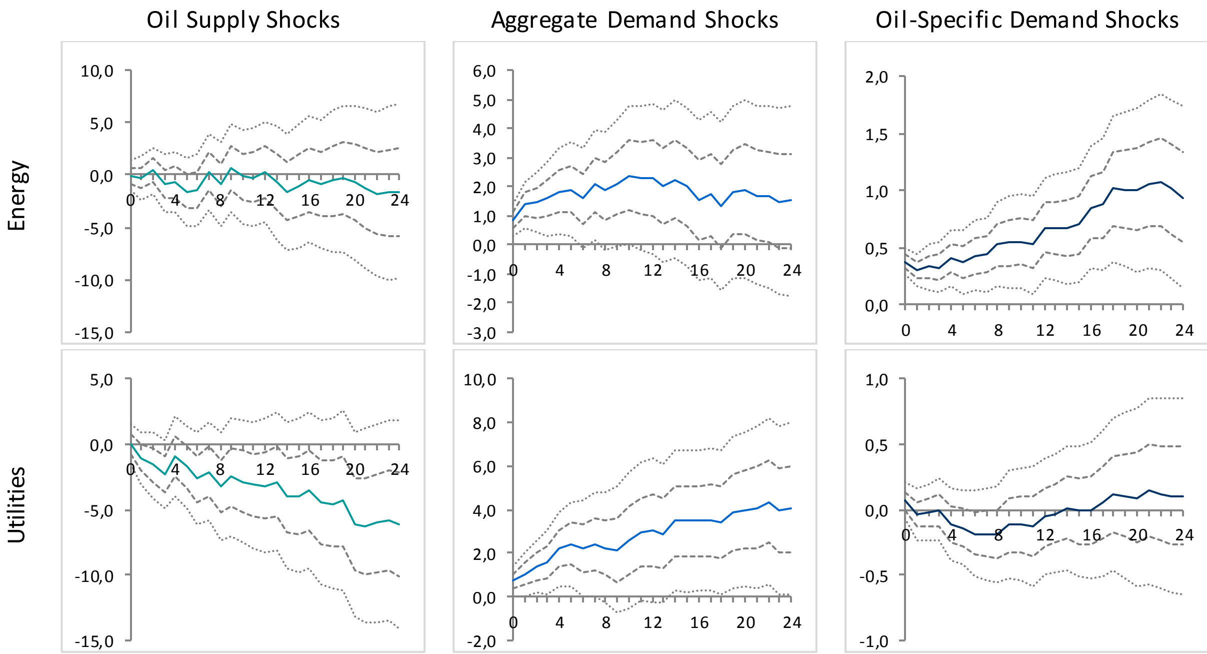

Figure 7: Cumulated responses of Utilities and Energy to structural shocks (point estimates with one- and two-standard error bands)

The energy industry is expected to react highly significant and positively to oil price shocks, especially if caused by changes in demand. The utilities industry, however, could possibly react differently to shocks in the oil price. On the one hand, utilities could be expected to increase performance when the price of oil increases due to its relatively higher attractiveness as a source for energy compared to oil. On the other hand, a high price of oil could make it relatively more attractive to invest in the oil industry, which could affect alternative energy sources negatively.

An oil supply shock does not affect the energy industry significantly, nor does it have an apparent trend. This indicates that the Norwegian oil and oil-related companies are unresponsive to a positive change in the price of oil driven by an oil supply disruption. This confirms what our earlier analysis indicated, that oil supply shocks are not mainly related to Norwegian oil supply shocks, but rather events abroad. Although we would have expected a positive effect from the oil price increase, oil supply shocks were found in the structural VAR analysis to have the smallest impact on the price of oil. Also, unrest affecting the world oil supply could be expected to have a positive effect on the relative amount of Norwegian oil sold. Apparently, the related negative effects caused by an oil supply shock are canceling these effects out, leaving the Norwegian oil and oil-related companies indifferent. This conclusion is interesting when interpreting the oil supply shocks' effects on other industries. As oil and oil-related companies are not affected by these shocks, this substantiates the interpretation that any evident effects on other industries are caused by direct effects to the respective industries, rather than spillover effects from oil activities.

The impulse responses for the utilities industry show a negative and significant reaction to oil supply shocks. Thus, an oil price increase driven by an oil supply disruption does not appear to trigger a reaction by investors to switch their demand to alternative energy sources. If looking at energy and utilities as competitors, a negative response in utilities should be expected to contribute to a positive response to energy. However, as the response of the energy industry indicates, the corresponding effect is not as expected. As already discussed, the fact that energy is not affected by this shock indicates that there are other effects than oil industry spillovers that cause the effects to other industries. In this case, we see that oil supply disruptions cause a generally lower belief in and performance of the utilities industry. An example of a sub industry of utilities is solar power producers, who typically operate power plants across the globe and thus deliver energy worldwide. These companies are therefore sensitive to the world geopolitical situation, and could consequently be negatively affected by the causes of oil supply disruptions.

Aggregate demand shocks have similar effects on both energy and utilities, which is not surprising. In this case, demand in general increases and therefore increased demand for one energy source need not go on the expense of increased demand for another. It does, however, appear to induce a more persistent increase in demand for and performance of utilities. This could be an indication of the growing trend of moving towards renewable energy and other cleaner energy sources. It is not surprising that times of high economic activity are boosting this trend.

Oil-specific demand shocks have, as expected, a highly significant and positive effect on the energy industry. It is interesting to see how large an effect precautionary demand can have on oil and oil-related companies through the price of oil. The corresponding effect on utilities is not as evident and mostly insignificant. This could serve as an indication that the attractiveness of alternative energy sources has made the utilities industry relatively independent to shocks in the price of oil when caused by changes in precautionary demand. This would not be surprising, as measures against climate changes and for a generally improved environment are becoming increasingly important. An additional factor is that, although the oil industry in Norway is large and important, the majority of direct use of energy in Norway is energy from renewable resources such as hydroelectric power. This is something that could increase the independence of this industry from oil-specific demand shocks to the price of oil (Olje- og Energidepartementet, 2014).

8.3.2 IRF Analysis of Food and Transportation

The impulse responses of the industries Food, Beverage & Tobacco (hereafter referred to as Food) and Transportation are graphed in Figure 8 below. The two industry indices are analyzed together as they are both highly exposed to changes in the Norwegian currency. This is due to the significant level of exports for the companies in both of these industry groups.

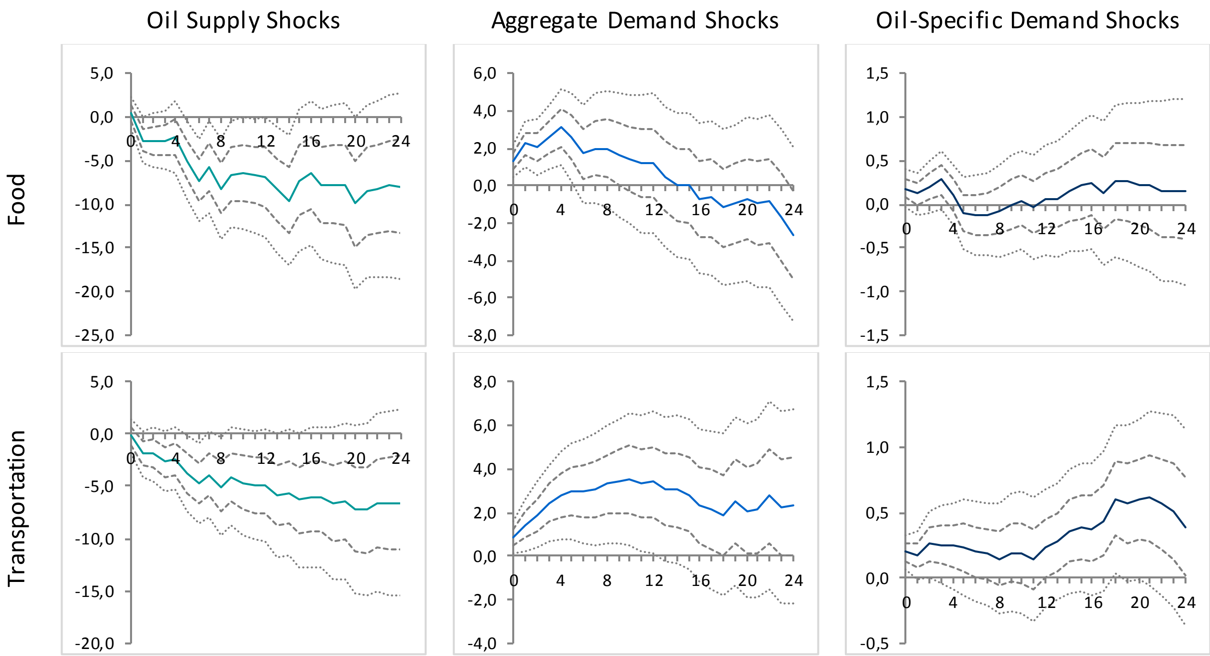

Figure 8: Cumulated responses of Food, Beverage & Tobacco and Transport to structural shocks (point estimates with one- and two-standard error bands)

The industry index Food mainly contains fisheries and seafood production and distribution companies. Norway is the world's leading exporter of salmon and the world's second largest exporter of seafood (Nærings- og Fiskeridepartementet, 2013). Thus, as the petroleum industry, it is of great importance to the Norwegian economy. Although a high price of oil could be expected to have a positive effect on this industry as a result of increased domestic demand and inland sales, it is considered equally likely to have an opposite effect. As companies in this industry are highly involved with exports, it is one of the Norwegian industries that may suffer from a high price of oil through the appreciation of the Norwegian Krone. On the other hand, it provides them with an opportunity to exploit an oil price decline, and leaves them with potential to grow in a generally challenging environment. A high price of oil generally results in an appreciation of the Norwegian Krone, which could result in a significant decrease in these companies' revenues. However, as these companies are dependent on international demand for Norwegian seafood, the response of a change in the price of oil could vary significantly depending on the cause. Thus, we expect to see different responses of this industry to each of the three shocks.

The majority of the companies in the transportation industry are airlines and shipping companies. Like companies involved with exports, these companies are highly affected by the Norwegian currency. Furthermore, the transportation industry is highly energy intensive and fuel is one of the most important inputs and constitutes a significant cost for companies in this industry. Therefore, they could experience decreased performance in times of high price levels of oil, and significant windfall gains from a low price of oil. Airlines, in particular, could additionally experience decreased demand as a consequence of high fuel prices and thereby less spending from individual consumers. Thus, there are reasons to believe that both of these industries could be negatively affected by a high price of oil, and benefit substantially from a low price level of oil even though this is generally challenging for the Norwegian economy as a whole.

The Food industry index increases as an immediate response to an oil supply shock, though it subsequently decreases and continues to decrease significantly throughout the impulse horizon. This response is interpreted to reflect the contrasting effect a change in the price of oil has on exporting companies. An oil supply shock, and the associated high price of oil, is clearly not advantageous which is interpreted to be caused by the associated appreciation of Norwegian currency. As long as the shock is driven by oil supply disruptions, as opposed to changes in international demand, a change in the Norwegian Krone will affect the revenues of exporting companies without necessarily changing the level of production and exported products. The reaction of the transportation industry to an oil supply shock is approximately equal to that of the food industry, substantiating the level of importance currency has to certain industries. For the transportation industry, it could also reflect the previously mentioned effect of a changing cost level associated with a change in the price of oil.

As expected, an aggregate demand shock has a significantly different effect on both industries compared to the effect of an oil supply disruption. Although the resulting higher price of oil will affect the revenues generated through the value of export and the level of costs in these two industries, increased economic activity and aggregate demand expansions offsets this effect and results in an overall increase. However, the increase is not persistent; it is reversed and turns insignificant after only nine months for food and after a year and a half for transportation. This reversed effect indicates that the positive effect is only temporarily outweighing the negative, and that the higher costs associated with a high price of oil dominate over time.

An oil-specific demand shock results in an immediate and significant effect on the Food industry index. In line with the response to aggregate demand expansions, and our expectations that increased demand might outweigh the negative effect of an appreciated currency, the response is positive and significant. However, both the increase and the significance are small and temporary. After three months, the increase is reversed and becomes insignificant. The response of transportation is similar, though characterized by a more fluctuating course of the response throughout the impulse horizon. The initial positive response is followed by a reversed and insignificant negative effect for six months, after which it increases significantly for the remaining months. Although the responses are not persistent, the initial increases substantiate the importance of the petroleum industry. It emphasizes that, depending on the cause of a change in the price of oil, growth in the petroleum industry can have a positive effect on the overall economy.

8.3.3 IRF Analysis of Consumer Services, Retail and Media

Consumer Services, Retail and Media are all linked to the consumption of private consumers. It is interesting to analyze the effects of shocks to the oil price to these industries, as they can give an indication of the effects on the individual households and how their consumption is affected by changes in the price of oil. The impulse response functions for the three industries are illustrated in Figure 9 below.

The consumer services industry includes hotels, restaurants, cruise ships and other similar companies. These are services that are usually regarded as luxury goods and thereby as having a high elasticity of demand. If the price of oil affects the personal finances of Norwegian consumers, it would therefore be reasonable to expect this industry to react to shocks through changes in consumers' demand. Retail is also expected to be highly affected by demand. However, as this industry includes companies selling necessary household products such as food, clothes and furniture, the industry is expected to be somewhat more resilient to changes in the price of oil than the consumer services industry. Media consists mainly of companies selling books and newspapers. This industry is also associated with relatively redundant goods. However, subscriptions are expected to be more resilient to changes in the price of oil than luxury services such as restaurants and hotels.

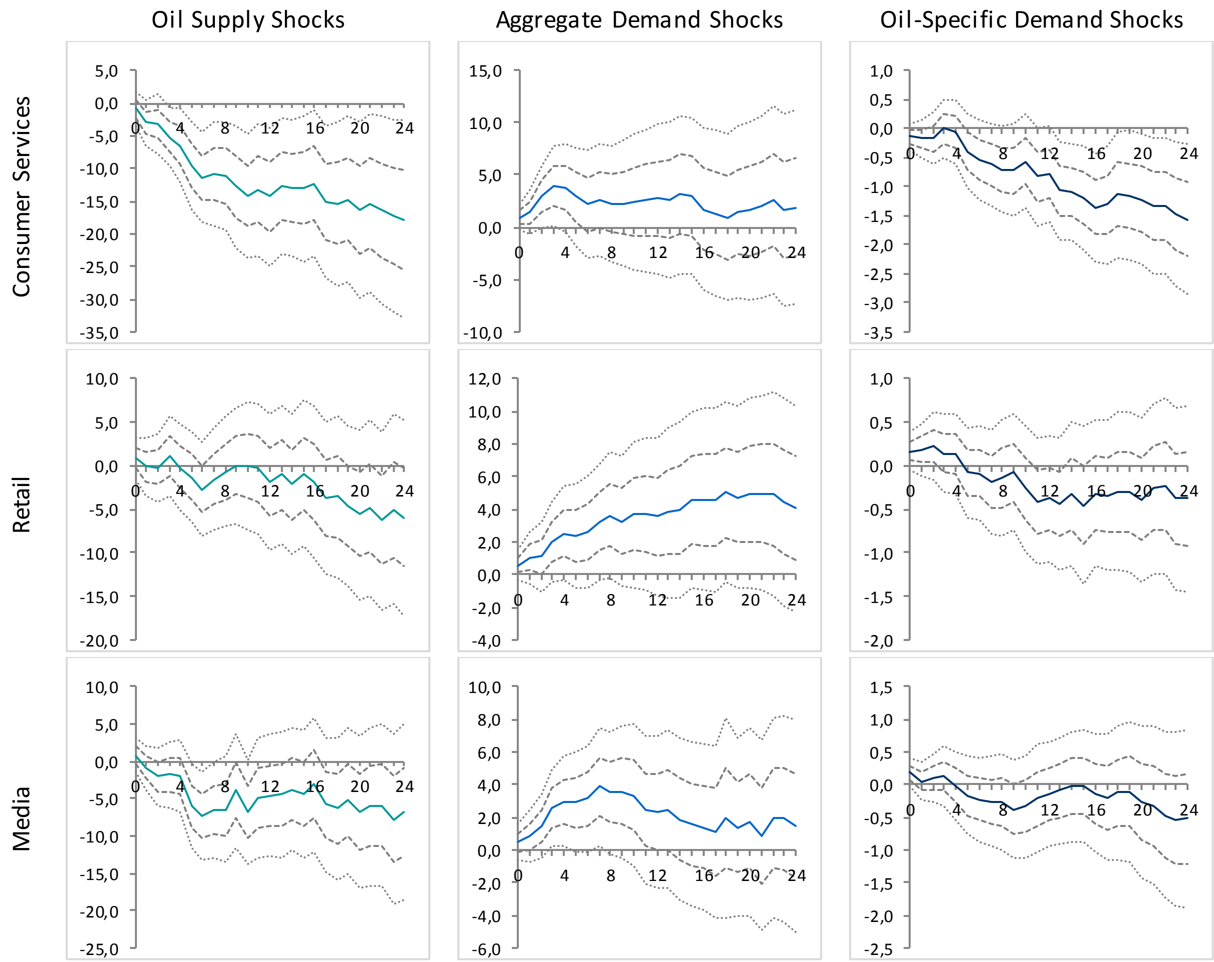

Figure 9: Cumulated responses of Consumer Services, Retail and Media to structural shocks (point estimates with one- and two-standard error bands)

Oil supply shocks have a negative effect on all three industries. However, while it is highly significant for consumer services, it is only partly significant for media and mostly insignificant for retail. This indicates that oil supply disruptions have a negative effect on the finances of Norwegian households, and that the effect on their spending is as expected. As previously discussed, oil supply shocks do not affect the Norwegian petroleum industry significantly, and the effects on other industries are therefore regarded as more likely to be related to the causes of oil supply disruptions rather than the actual effect to the price of oil. This substantiates the interpretation of effects on consumer services, media and retail as being related to the causes of oil supply disruptions rather than the associated price changes.

Aggregate demand shocks have a larger and more persistent effect on retail than on the other two industries. The positive effect on consumer services is only significant for the first six months, while the response of media stays significant for nine months. As products in the consumer services and media industries are considered to be luxury goods, it is reasonable that the positive effects of an aggregate demand shock are not as persistent in these industries as in retail.

An oil-specific demand shock has a delayed, though negative, effect on consumer services. This is somewhat surprising, as this shock clearly has a positive effect on the energy industry, which should consequently result in positive spillover effects to consumption of consumers that are employed in this industry. However, a high price of oil can also increase costs for consumers, and thereby decrease their disposable income. It is clear that this effect dominates in our results. The effects on the retail and media industries are unclear and mostly insignificant. Thus, our results imply a somewhat negative effect of positive oil-specific demand shocks to private consumption that mostly affects luxury goods.

8.3.4 IRF Analysis of Real Estate and Capital Goods

The impulse responses of the industry indices Real Estate and Capital Goods are graphed in Figure 10 below. The two industry indices are presented together as they are both associated with changes in demand and purchasing power from individual households and the business sector, as well as construction and real estate development.

The industry group real estate includes companies involved with management and development of both private housing and real estate related to the business sector. Capital goods include leading construction and engineering companies, as well as companies associated with machinery and development of industrial systems and equipment. The responses of both industries are expected to be positive following any of the three shocks, as economic growth should expectedly stimulate housing development and construction as well as consumer confidence. Conversely, activity is expected to decrease in response to stagnation in economic growth. However, the current high level of housing prices and continuingly improved performance by certain companies in the construction industry despite the low price of oil in recent years, indicate that the actual results may be conflicting with these expectations.

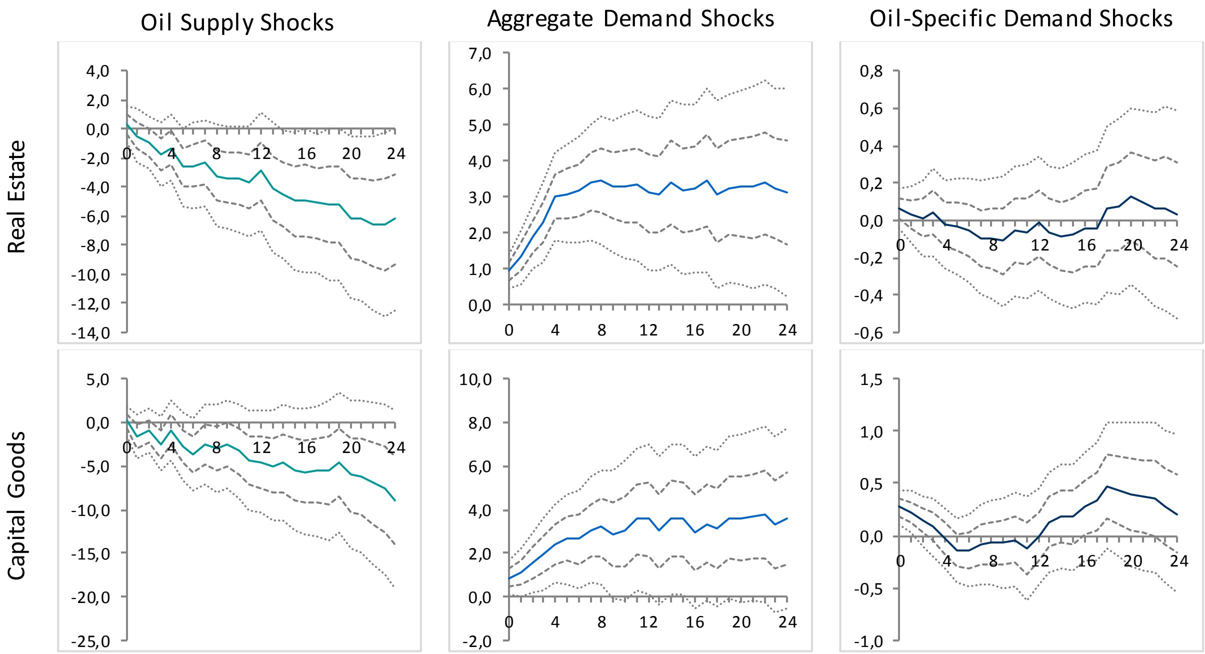

Figure 10: Cumulated responses of Real Estate and Capital Goods to structural shocks (point estimates with one- and two-standard error bands)

Both real estate and capital goods respond to oil supply shocks with a delayed and significant decrease. This result is surprising, as the initial expectation for these industries was a positive response to an increased price of oil. However, the interest rate is an important factor for development in housing prices and development due to the investments needed. A high price of oil and a corresponding increased interest rate could therefore decrease activity in the real estate industry, and consequently decrease demand for capital goods. The development of the two industries are highly dependent on activity in the other, as changes in demand from real estate need to be met by adequate supply from capital goods. Any imbalance between the two will consequently affect the industries' performance.

Furthermore, the industries' development is also related to factors independent of the price of oil. Urbanization, for example, is an important contributor to the performance of these industries and changes to this trend can affect activity in both real estate and capital good regardless of changes in economic growth caused by an oil price shock. It is also worth noting that, although the effect reflects the overall development of the industry, it may be somewhat reduced or offset by an opposite response from certain areas in Norway. Areas highly dependent on employment in the petroleum industry is likely to experience higher growth in times of increasing levels of oil activity and a corresponding high price of oil.

An aggregate demand expansion triggers a reaction in the industries more in line with the initial expectations. Both responses are immediately positive and continue to increase significantly throughout the impulse horizon. This is, as for the other variables analyzed, not unexpected. A high price of oil driven by aggregate demand expansions reflects increased economic activity. Growth in the Norwegian oil industry resulting in economic optimism is thereby naturally associated with increased performance in these industries.

The response to an oil-specific demand shock differs between the two industries. Despite a small and significant increase, the subsequent response of real estate is insignificant and fluctuates around zero throughout the impulse horizon. However, unlike the effect from an oil supply shock, the real estate industry does not react negatively. The vague effect may be caused by contradicting effects such as positive spillover effects from the oil industry and negative effects from an increased interest rate. Additionally, different parts of the country may experience different reactions to a change in the price of oil following an oil-specific demand shock, which may further contribute to an unclear effect.

Capital goods fluctuate more as a response to an oil-specific demand shock. The response is positive and significant for the first two months, after which it turns negative and insignificant. After 16 months, the response is again positive and significant. Due to the interdependencies between capital goods and real estate, it is not surprising that the effect is indistinct for one when it is indistinct for the other. Furthermore, the responses of both industries might be affected, or at least somewhat offset, by government influence in the capital goods industry. Certain companies act as important suppliers to state owned employers, and the Norwegian government often attempts to stabilize this industry in times of decreasing demand. The fluctuation in the response by capital goods to an oil-specific demand shock, for example, may be explained by this.

8.3.5 IRF Analysis of Professional Services, Technology and Software Services

Commercial & Professional Services (hereafter referred to as Professional Services), Technology Hardware & Equipment (hereafter referred to as Technology) and Software Services are suppliers mainly to the business sector. Professional Services includes consultancy services as well as other professional services such as waste handling. Technology consists of companies producing technological equipment, while the Software Services index is production and maintenance of software, data programs and applications.

If the effects on these industries are dependent on the general demand from Norwegian businesses, it is interesting to see how they are affected by oil price shocks as this would serve as an indication of the effect on the purchasing power of the Norwegian business sector. The impulse response functions for professional services, technology and software services are illustrated in Figure 11 below.

We would expect professional services to be one of the industries that is mostly affected by changes in purchasing power, as consultancy services may have a relatively low priority in challenging economic periods, while demand for these may increase in economic upturns. On the other hand, consultancy services may be required by companies experiencing changes in general, both good and bad. Consequently, our expectations for this industry are somewhat conflicting. Technology, on the other hand, is considered to be a crucial part of the current business environment and should therefore be relatively resilient to shocks to the price of oil in the short term. The expectations are similar for the software services industry, which is expected to be even more resilient due to the required maintenance and support of a given software once it is implemented in a firm.

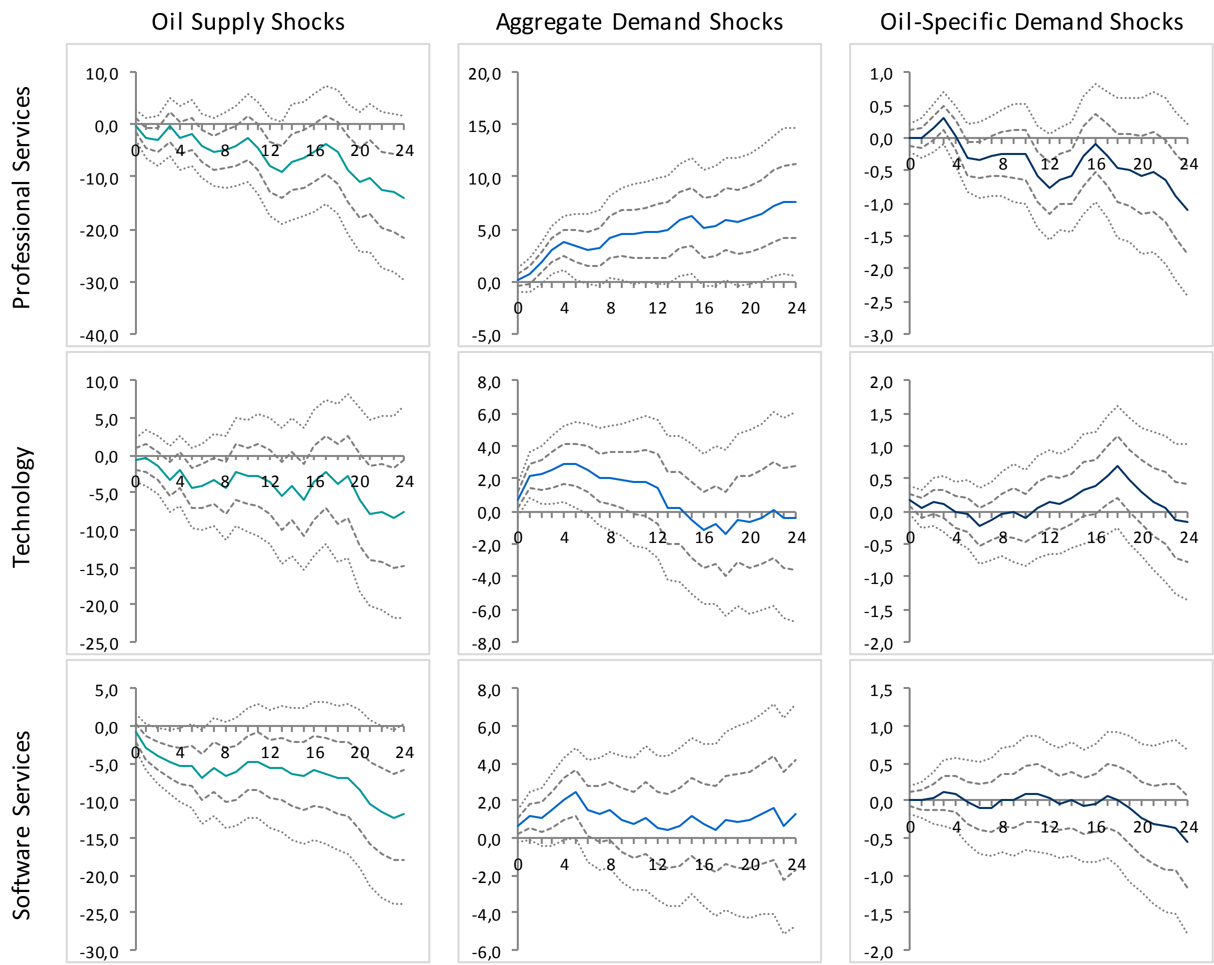

Figure 11: Cumulated responses of Professional Services, Technology and Software Services to structural shocks (point estimates with one- and two-standard error bands)

As illustrated by the graphs, oil supply shocks have a negative, though only partially significant effect on professional services and technology, and a more significant effect on the software services industry. The significant response of software services is unexpected, however it could potentially be explained by a certain level of export associated with this kind of services and thereby its exposure to an appreciation of the Norwegian currency. If so, this effect does not reflect the reaction of demand from Norwegian businesses, but rather demand from abroad.

Aggregate demand shocks to the price of oil clearly have the largest effect on professional services, as this industry has a positive and highly significant response to this shock. Technology and software services respond with a significant increase for the first ten and six months, respectively, before turning insignificant. This confirms our expectations that professional services are mostly affected by economic activity, while the two others are more resilient, at least in the short term.

An oil-specific demand shock does not have a clear effect on any of the three industries. Except from a peak after three months for professional services and after 18 months for technology, the results are insignificant. This could have several potential explanations. There could be an absence of spillover effects on these industries from the oil industry when changes in the price of oil are driven by precautionary demand. Alternatively, any existing positive effect could be cancelled out by the reversed effects of an appreciation of the Norwegian currency. A third explanation is, as already discussed, that these industries are such an integrated part of the business sector that they are demanded regardless of the overall economic development in the short term. The last explanation is substantiated by the response of technology and software services to an aggregate demand shock, while it is somewhat more difficult to accept for professional services. The professional services industry is seemingly less responsive to an oil-specific demand shock underlying the price of oil, despite the large effect this shock has the on the oil and oil-related industries. On the other hand, this can be explained by a demand for professional services in times of change, regardless of whether or not that change is positive.

8.3.6 IRF Analysis of Banks and Insurance

The industry group banks represents regional and diversified Norwegian banks, while Insurance represents insurance companies with both private and professional customers. They are analyzed together as neither of them is expected to be highly affected by shocks to the price of oil. However, they could both be affected through the interest rate, changes to the amount of investments made or through defaults or bankruptcies. As we know from the country-level analysis in *Section 7.4.2 IRF Analysis of CPI, the Interbank Rate and the Norwegian Krone TWI*, the interbank rate increases slightly as a result of oil supply and oil-specific demand shocks, and increases significantly from aggregate demand shocks. Due to higher margins, both banks and insurance companies are expected to improve performance as a result of an increased interest rate. However, this could also decrease the amount of investments, somewhat depending on the cause of the interest rate increase.

Companies in these industries may also be expected to respond negatively to oil supply disruptions if these are related to incidents that, for banks, increase the chances of defaults or bankruptcies or for insurance companies, accidents or other triggers of insurance payments. An increase in investments following aggregate demand expansions could be expected. The degree to which investments increase due to oil-specific demand shocks is less certain, however to some degree expected to be positive. The effects of oil-specific demand shocks in particular will depend on the degree to which banks and insurance companies are exposed to oil and oil-related companies. As an indication of the actual exposure in the market, DNB had a lending exposure to the petroleum industry of 8,8% in the fourth quarter of 2015 which at that point was the largest lending exposure to oil-related industries of the Nordic banks (DNB Markets, 2016).

The developments of the stock prices of banks are highly dependent on expectations of loan loss provisions and impairment provisions associated with their shipping and offshore portfolio. The development of banks' stock prices and performance following changes in the price of oil is therefore highly dependent on the market's consensus, which could be either beneficial or disadvantageous depending on expectations and uncertainties in the market. The responses of the bank and insurance industries to the three structural shocks are illustrated in Figure 12 below.

Both industries are negatively affected by oil supply disruptions. As previously discussed, this could potentially be caused by the underlying causes of the oil supply disruption that further causes bankruptcies, defaults or similar effects. This could affect both oil and non-oil related industries, something that explains the persistence of the effect. The appreciation of the Norwegian Krone resulting from this shock may also contribute to the response of these industries to this shock.

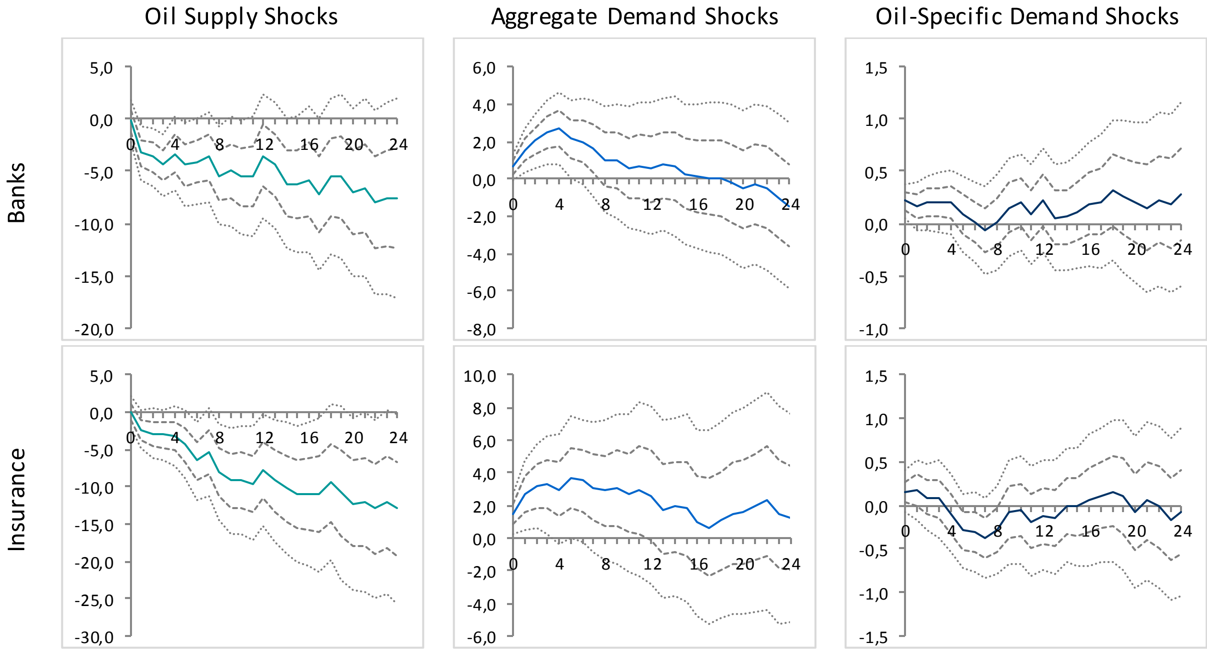

Figure 12: Cumulated responses of Banks and Insurance to structural shocks (point estimates with one- and two-standard error bands)

The responses to an aggregate demand shock are only slightly positive for both insurance companies and banks. The effect decreases and become insignificant after only six months. The initial positive response could be an indication of increased investments both in private households and in businesses, and the reversed effect may come from the significant increase in the interbank rate from the corresponding shock.

Oil-specific demand shocks induce overall positive reactions for both industries, however these are mainly insignificant. This indicates that the bank and insurance industries are relatively resilient to oil-specific demand shocks, which further indicate that they are relatively independent from the energy industry. Although the industries were not expected to be highly dependent on these shocks, it is somewhat surprising that the responses are of such small magnitude.

8.3.7 Summary of Industry Level IRF Analyses

As in *Section 7.4.4 Summary of Country-Level IRF analyses*, we find it convenient to summarize the main effects of the above analyzed variables before moving on to the next section. This section will therefore include a short summary of the main effects and their most probable interpretations.

Of the industry-level variables analyzed, Energy was naturally the variable with the most evident initial expectations. This industry index was expected to respond positively to any oil price shock regardless of the cause, while the expectations to utilities were more conflicting and highly uncertain. Due to this industry's position as a provider of alternative sources of energy, this variable was expected to have a higher level of dependency on the driver behind the oil price shocks and possibly result in responses opposite to those of energy. Both industries respond positively to an oil price shock caused by an aggregate demand expansion. Surprisingly, the energy industry's response to an oil supply disruption was insignificant. The negative response of utilities, however, confirmed our expectation that this industry might be differently affected by oil price shocks. An oil-specific demand shock causes a highly significant increase in energy while the effect on utilities reflects both positive and negative effects that balance out in an insignificant response.

The industries food and transportation were both considered as highly exposed to the effect from currency changes due to their level of exports and significant use of fuel as input in production. Thus, the possibility of a negative effect of an increased price of oil was expected. While both industries responded positively to demand shocks, the effect of oil supply shocks confirmed our expectations. For both food and transportation, an oil supply disruption and the associated increased price of oil have a negative effect on both industries as expected, which is considered to be due to an appreciation of the Norwegian Krone and the higher cost of fuel.

The variables Consumer Services, Retail and Media were all expected to respond positively to oil supply shocks. These industries are directly exposed to individual consumers whose demand was expected to reflect the overall Norwegian economic environment and thus grow as a consequence of a positive oil price shock. Surprisingly, the results indicate effects conflicting with these expectations. Despite the overall positive response to aggregate demand expansions, these industries are responding either insignificantly or negatively to most shocks. Thus, these industries could be relatively resilient to the price of oil due to a perceived necessity of the products they deliver, or experiencing decreased demand caused by higher individual costs associated with a high price of oil.

Real estate and capital goods were expected to react positively to positive oil price shocks. Surprisingly, both respond significantly negative to oil supply disruptions. Although the interest rate may be a natural cause of lower expectations and performance of these industries, the results are surprising and somewhat difficult to comprehend. However, real estate and capital goods are also influenced by forces relatively unrelated to the price of oil, and are highly dependent on the dynamics between the two. This could potentially explain the reasons for insignificant or negative responses to oil price shocks. Their responses to aggregate demand shocks are more in accordance with expectations, while responses to oil-specific demand shocks are rather unclear.

The industry groups professional services, technology and software services comprise of companies whose performance are expected to reflect demand from professional consumers. Despite overall Norwegian economic growth as a response to oil price shocks, the expected responses by these industries were not apparent. The need for professional services in times of economic change results in contradicting expectations to professional services, and the importance of technology in the modern business environment leads to an expectation of resilience of technology and software services. Unresponsiveness is the recurring effect across shocks and industries. However, software services respond significantly and negatively to oil supply disruptions, which could be explained by a possible high level of export activities.

The expectations of banks and insurance were somewhat unclear due to the complexity of these industries and the elements influencing their activity and performance. Both industries respond to oil supply disruptions by decreasing significantly, while the responses to oil-specific demand shocks are mainly insignificant. The responses to these variables can be caused by various influences, such as the interest rate, changes to the degree of investments or risk related to defaults or bankruptcies and the variation in the companies' exposure to the oil industry. The response to an aggregate demand shock was positive, yet again confirming the general reaction by Norwegian industries to increased global economic activity.

9. Aggregate Analysis of IRF Results

In the sections *7.4 Analysis of Results at Country Level* and *8.4 Analysis of Results at Industry Level* we have analyzed the effects of structural shocks to individual variables and discussed the causes of the individual responses as well as their relation to the most closely related variables. In this section we will focus on the bigger picture and analyze the general trends and the interdependencies between the effects of different variables. We will further analyze the impulse response analyses in relation to the recent situation in Norway, where the economy is currently affected by negative shocks to the oil price.

9.1 Recurring Issues and Trends

In terms of our initial expectations, we did not take into consideration the level of externality of oil supply disruptions to Norwegian oil and oil-related companies or to the overall Norwegian economy. However, this has been reflected quite consistently in most of the variables examined. We have not found support for the explanation that Norwegian oil supply is the main source of such oil supply disruptions, or that Norwegian oil supply exploits a shock in the supply of oil. Therefore, our results mainly capture the negative effects from higher oil prices. As a result, the effects of these shocks are more in line with those of oil importers than the two other shocks relating to demand. Oil supply disruptions are generally expected to be caused by geopolitical unrest or natural disasters, both of which can have a negative effect on economic development in general through insecurity or more direct effects. Additionally, oil supply shocks have comparatively the smallest effect on the price of oil. This enhances the probability of positive effects from an increased oil price being outweighed by other and more negative effects related to the cause of the oil supply shock.

Oil-specific demand shocks have the most interesting interpretations of the effects to the Norwegian economy from shocks to the oil price. This is because of the smaller simultaneous effects from external events to these shocks, as well as the more varied responses across different variables and industries. The general effects on the Norwegian industries examined support the expectation that the Norwegian stock indices are affected by shocks to the price of oil, although the effects are generally less significant than expected. The oil-specific demand shocks appear to capture the most apparent differences between the industries. A recurring trend among the industries that are positively affected by oil-specific demand shocks is their dependency on the interest or exchange rate.

The most surprising result at the country level is the small and generally insignificant response of GDP oil activities and ocean transport to all of the three shocks examined. Even more surprising is the only partially significant and negative response to an oil-specific demand shock. When comparing the response of GDP oil activities and ocean transport to the stock price index for the energy industry, the effect of GDP oil activities and ocean transport appears even more puzzling. As energy has a highly significant and positive response to an oil-specific demand shock, we would immediately expect to be able to extend this to the corresponding GDP measure. One explanation for the differences could be the nature of the variables. Stock indices should capture new information faster than quarterly measures such as GDP. Yet, both total GDP and GDP mainland are able to capture the effects of shocks to the oil price in the two-year time horizon examined. Therefore, as already discussed, other features of the nature of GDP oil activities and ocean transport are assumed to be causing the somewhat paradoxical effect.

Due to the Government Pension Fund Global and its considerable size, Norway may be considered one of the world's oil producing countries best equipped to handle the challenges associated with a low price of oil. Because of the rule that restricts the use of these funds to the expected return, the government spending will not necessarily be largely affected by the oil price shocks for many years to come. This emphasizes the separate effects to the Norwegian economy; an unusually resilient government sector, held together with a more sensitive private sector. As we have seen in the previous analyses, different industries and variables are affected by shocks to the price of oil; however it is still reasonable to believe that the Government Pension Fund Global has a cushioning effect on the responses of the Norwegian economy.

9.2 Analysis of the Current State of the Norwegian Economy

The impulse responses reflect the responses of Norwegian variables to oil supply disruptions, aggregate demand expansions and oil-specific demand shocks, which tend to raise the price of oil. Thus, the impulse responses of the Norwegian variables measured reflect responses to positive shocks. Norway is currently experiencing a contrasting situation, with a price of oil at significantly lower levels than expected only a few years ago. Instead of experiencing positive shocks to the price of oil, the Norwegian economy is affected by negative shocks to the price of oil, which result in opposite effects than the ones measured in this thesis. In this section we will analyze the most interesting aspects of our analysis so far in relation to the current situation in the Norwegian economy.

As apparent from the above analyses, the drivers behind a change in the price of oil is important to consider when examining its effects. Before discussing the current situation in Norway and the actual effects of the recent oil price fall, we therefore consider the causes of the current changes in the price of oil. As can be seen from the historical evolution of the structural shocks in Figure 2, there is a significant positive supply shock in 2014, while the oil-specific demand simultaneously has a significantly negative shock. In 2015, both effects decrease towards zero, while aggregate demand indicates a small negative shock. Due to unavailability of data material for 2016, we use the shocks for these years as a basis to understand the current situation. We will further support our analysis with recent news relating to the supply and demand for oil.

The price of oil decreased from over 110 USD per barrel in June 2014 to less than 30 USD per barrel in January 2016. This indicates that there have been large shocks to the price of oil during this period. An oversupply of oil has been attributed to a general increase in the world oil production, in addition to the increasing production of shale oil. Furthermore, uncertainties regarding increased production from Iran when sanctions were released have caused negative precautionary demand (DN, 2016). A cold front between large oil producers and political games between Iran and Saudi Arabia in particular, has substantiated the uncertainties related to future oil oversupply. In April 2016, several oil producing countries met in Doha to discuss possible production cuts as an attempt to stabilize the price of oil. However, Iran did not join the meeting and the negotiations collapsed (Havnes and Rørheim, 2016). Simultaneous events elsewhere, such as an oil strike in Kuwait and a temporary halt in oil production in Nigeria and Canada, contributed to prevent an even larger oil price drop as a result of the collapse (Havnes and Rørheim, 2016). Still, this meeting serves as a clear indicator of a current global oversupply of oil. The significant focus associated with it is furthermore likely to have caused negative shocks in the precautionary demand. The spring of 2016 has moreover been characterized by threats from both Saudi Arabia and Russia to further increase their levels of oil production (Havnes and Rørheim, 2016). This amplifies the probability of negative shocks to precautionary demand. Thus, the oil-specific demand shocks that reflect precautionary demand for oil and shocks to the supply are most likely the main divers of the current fluctuations and decreases in the price of oil. Therefore, these shocks will be the main focus in the following analysis.

The recent development of Interbank Rate, Krone TWI and Inflation are illustrated in Figure 13 below. Inflation is the difference in the CPI variable. This figure must not be confused with the previously analyzed impulse response functions, as Figure 13 and the following figures 14, 15 and 16 rather illustrate the actual and most recent development in the respective variables.

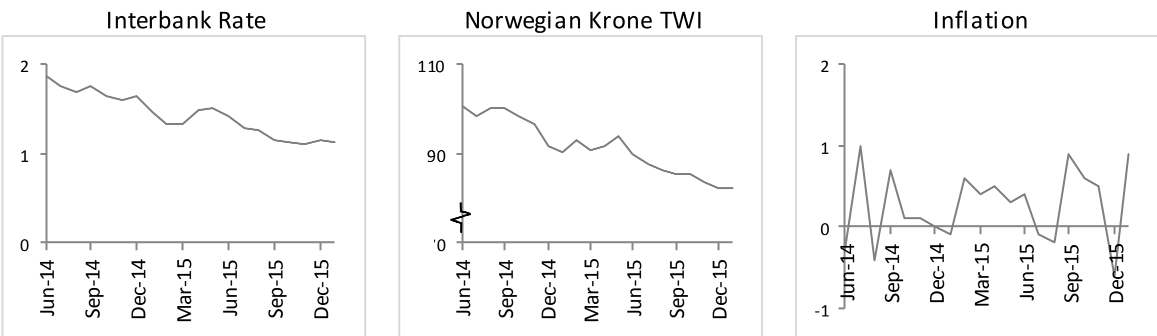

Figure 13: Development of Interbank Rate, Norwegian Krone TWI and Inflation, Jun 2014 – Jan 2016

The actual development in the interbank rate, Krone TWI and inflation, as illustrated by the graphs in Figure 13, corresponds to the results from the impulse responses in our analysis.

A negative precautionary demand shock in our modeled IRFs is reflected by a decrease in the interbank rate and a depreciation of the Norwegian Krone, while the effect on inflation is less apparent. The actual changes since June 2014 thus reflect the trends of oil-specific demand shocks, while neither conflict with the impulse responses found for oil supply shocks.

The actual development of Total Exports, Unemployment Rate and the OSEBX index are illustrated in Figure 14 below.

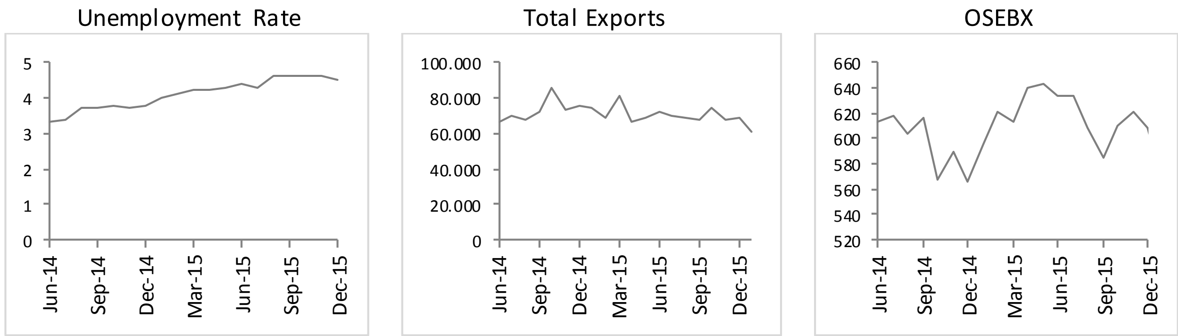

Figure 14: Development of Unemployment Rate, Total Exports and OSEBX, *Jun 2014 – Jan 2016*

The actual and most recent development of the unemployment rate, as seen from Figure 14, corresponds to the effect implied by an oil-specific demand shock. This is interpreted to be a result of extensive restructurings in large companies across several industries, particularly in the industries closely related to oil activities. Although already initiated projects are likely to not be as sensitive to a change in the price of oil, new investments become unprofitable and are put on hold as a result of a low price of oil. This results in reduced activity in the oil and oil-related industries and as a consequence, a reduction of the workforce in the affected industries. This could be expected to be somewhat sustained from for example the food industry, which is found to have a positive reaction to the corresponding negative shocks to the price of oil.

The actual development of total exports, as seen from Figure 14, has been relatively flat over the period examined. This reaction corresponds to the impulse response of an oil supply shock, which indicate an insignificant response of total exports. The estimated impulse responses indicate that a negative oil-specific demand shock would cause a decrease in total exports. This trend is seemingly non-existent in the actual development despite the current challenges related to the oil industry. The absence of an evident decrease in actual total exports may be caused by a neutralization due to increasing non-oil related exports. This is substantiated by the recent growth of companies in the Norwegian food industry, and seafood companies in particular, as a result of the current low price of oil.

The OSEBX index shows a decreasing trend in the second half of 2014, an effect that corresponds to the estimated impulse response of this variable to an oil-specific demand shock. From the beginning of 2015 however, the effect is reversed and becomes more reminiscent of that of an oil supply shock. Hence, in contrast to the Total Exports variable, the trend in the OSEBX index indicates a combination of the effects of an oil-specific demand shock and an oil supply shock on the Norwegian economy.

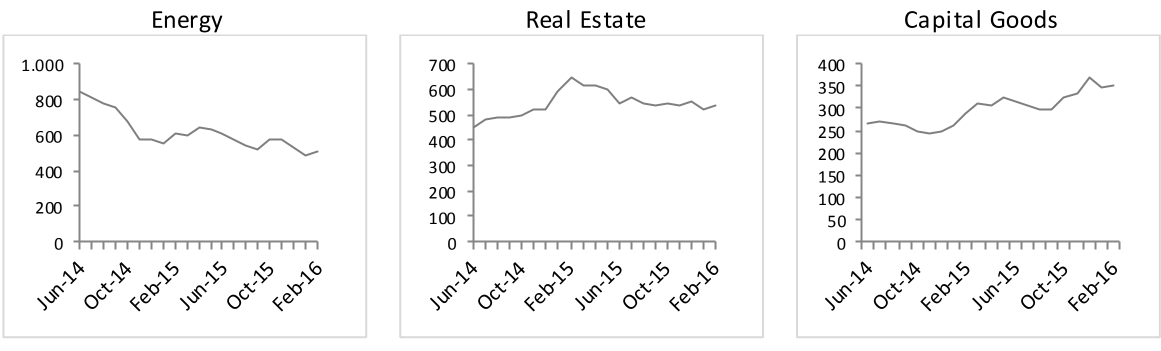

Figure 15: Development of Energy, Real Estate and Capital Goods, June 2014 - Feb 2016

The actual and most recent development of the industry indices Energy, Real Estate and Capital Goods is illustrated in Figure 15. Looking at the industry variables in Figure 7, the energy industry has a positive impulse response a positive oil-specific demand shock. This corresponds to a negative trend if the shock is negative, which clearly reflects the current situation in Norway. As a company-specific example, the Statoil stock was valued at almost 200 NOK in July 2014, while it cost less than 100 NOK in January 2016. Another indication of the negative implications for the oil industry is the many major rounds of layoffs. As already discussed, such layoff rounds have contributed to an increased unemployment rate.

The impulse responses in Figure 10 indicate that a high price of oil caused by an oil supply shock does not improve performance for companies in the real estate or capital goods industries. Thus, a low price of oil should therefore not necessarily pose as a threat to the Norwegian real estate or capital goods industry. Looking at the corresponding impulse responses from oil-specific demand shocks, one could currently expect a slight decrease in the capital goods industry while resilience from the real estate industry. The impulse response functions of both shocks correspond relatively well to the current situation in Norway, where the real estate industry has so far proved to be resilient to the challenging economic environment. For the capital goods industry, the impulse response of an oil supply shock appears to reflect the current situation better than the impulse response of an oil-specific demand shock.

Despite the low price of oil, housing prices in Norway are continuously rising in most parts of the country, and leading construction companies are experiencing significant growth. Low interest rates could partially explain this development. Furthermore, as real estate has an insignificant impulse response to precautionary demand, this further emphasizes the resilience of the real estate industry to changes in the price of oil driven by oil-specific shocks. However, the areas in Norway with significant employment in the petroleum industry are experiencing falling prices of housing. Although the real estate industry has experienced an overall growth despite the low price of oil, the effect may be reversed in the long term as negative spillover effects spread to other regions.

The actual and most recent development of the industry indices Banks, Food and Transportation is illustrated in Figure 16.

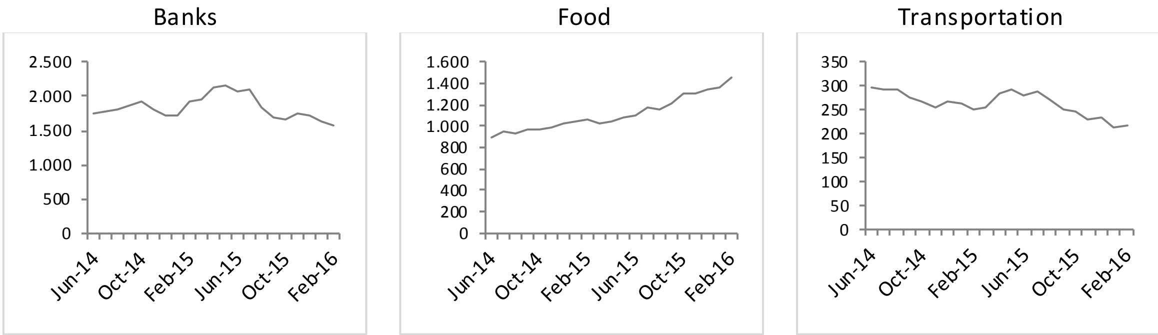

Figure 16: Development of Banks, Food and Transportation, June 2014 - Feb 2016

Looking at the impulse response function for Banks in Figure 12, a positive oil supply shock alone would be expected to increase their performance significantly. An oil-specific demand shock, however, cause a negative response in the bank industry. The actual trend in the Banks index since June 2014 is rather unclear; however there seems to be a negative effect starting from mid-2015. This could indicate a negative effect from the oil-specific demand shock that materializes with a delayed effect. Norwegian banks are in 2016 experiencing oil related losses materializing and expect them to increase in 2016 and 2017, something that supports this interpretation (DNB Markets 2016). Another factor that has affected the bank industry recently is the new and stricter capital requirements through the implementation of Basel III. The requirements have been increased over the last years, and from July 1st 2016, the requirements for Tier 1 capital are 13,5 percent and additionally a countercyclical buffer of 1,5 percent. Thus, a capital buffer of minimum 15 percent is required. This is likely to make the bank industry more solid and resilient towards external factors such as shocks to the price of oil (Finanstilsynet, 2015).

The food industry increases immediately in its impulse response to an oil supply shock, however it subsequently decreases and continues to decrease significantly throughout the impulse horizon. This response reflects the contrasting effect a change in the price of oil has on exporting companies. An oil supply shock and the associated high price of oil is clearly not advantageous, and is likely to be caused by the associated appreciation of Norwegian currency. These considerations are confirmed by the export growth this industry is currently experiencing. Export of seafood increased by 7.3 % between 2014 and 2015 (Statistics Norway, 2015b). While the price of oil has decreased significantly since 2014, so has the value of the Norwegian Krone. As a result, the cost of production measured in Norwegian currency is lower than revenues, which are measured in foreign currency. This causes margins for producers in this industry to increase. Since fisheries and exporters of seafood constitute a significant part of the Norwegian economy, it relieves some of the negative effects on the oil industry caused by a low price of oil. Employment, for example, can to some degree be sustained by this industry.

The significant increase in the stock prices of the airline companies SAS and Norwegian, both included in the Transportation index, are examples of how the transportation industry has performed in the period of a decreasing price of oil. This does not correspond to the estimated impulse response of the transportation industry to an oil-specific demand shock. It does, however, fit the impulse response to an oil supply shock. Both decreasing fuel prices and a depreciated Norwegian Krone can explain the positive effect.

Our quantitative analyses include a part of the time period after the oil price collapse in 2014. Consequently, our impulse response analysis is based on a period with shocks in different directions, and no additional period of similar negative shocks to the price of oil over a similar length of time. The state of the economy is currently developing and adapting to the low price of oil. Our impulse response analyses held together with the most recent developments have yielded interesting results, however they may only partially explain the current effects of changes in the price of oil on the Norwegian macroeconomic environment. It is important to emphasize that our impulse response analyses have been conducted with a two-year perspective, based on data from approximately 25 years. Therefore, results could differ substantially from these if the effects were analyzed at a later point in time when the effects have been fully absorbed by the economy. If the long-term effects were to be captured by a similar analysis, the focus would have needed to be on a longer-term perspective from the beginning. Our focus has been on understanding the current situation, and a two-year time horizon has therefore been regarded as sufficient. A further discussion of alternative ways of examining oil price shocks to the Norwegian economy can be found in *Section 11 Perspectivation.*

10. Conclusion

The most widespread way of analyzing effects of oil price shocks to macroeconomic aggregates built for a long time on an assumption that the price of oil is exogenous in the analysis. Kilian (2009) emphasizes the inappropriateness of this assumption, and presents a structural VAR method where the issue of dependence between oil and macroeconomic variables is taken into consideration. The method identifies three different shocks to the oil price: oil supply shocks, aggregate demand shocks and oil-specific demand shocks that are further interpreted as precautionary demand shocks. Through the use of a similar method, we have in this thesis searched to answer how changes in the price of oil affect the macroeconomic situation in Norway, as well as whether the effects of oil price shocks differ depending on the cause.

The historical evolution of the structural shocks estimated indicates that the shocks have been able to capture the major events in the time period 1990 to 2015. In 2014, the historical evolution identifies both a significant supply shock and a negative shock in oil-specific demand. This is in line with the large decrease in the price of oil starting in 2014. Impulse response functions are used to analyze the effects of the three structural shocks to the three input variables of the structural VAR. The overall trends are in accordance with those of Kilian (2009), and indicate that oil-specific demand shocks are the most significant contributors to changes in the price of oil, and oil supply shocks the smallest.

The estimated oil price shocks are used to analyze the effects on country- and industry-level variables to capture the effect of oil price shocks on Norwegian macroeconomic aggregates. As expected, shocks to the price of oil have a significant effect on many Norwegian macroeconomic aggregates. In general, however, the variables appear to be affected by the underlying causes of the oil supply and aggregate demand shocks as well as the resulting oil price changes. For oil supply shocks, uncertainties regarding the geopolitical situation appear to affect many variables negatively, while positive shocks to aggregate demand result in a generally increased performance. Oil-specific shocks to the price of oil induce more varied effects to the macroeconomic aggregates, indicating that oil-specific demand shocks capture the largest differences in variable responses. Several variables need to be analyzed in conjunction with each other's effects. Inflation, the interbank rate and the Norwegian currency in particular appear to be strongly interrelated, and additionally affect many of the further variables analyzed. Variables dependent on exports are found to be affected by the currency's reaction to the shock analyzed, and the interbank rate is found to affect the variables most dependent on investments. Oil-specific demand shocks generally induce the largest and most significant effects to country-level variables. The most striking result at the country level is the unexpected negative and insignificant responses of GDP oil activities and ocean transport to the three shocks. The only reasonable explanation found for why this variable does not react positively to increases in the price of oil is the composition of this particular measure. At the industry level, we find large differences depending on the cause of oil price shocks. Industries most dependent on exports are positively affected by shocks that depreciate the Norwegian currency, while industries highly exposed to private consumption show surprisingly small effects. Private consumption appears to be affected by opposite effects; positive spillover effects from the oil industry held together with increased costs associated with an increased price of oil. Suppliers to the business sector are relatively resilient towards shocks to the price of oil. As expected, the most significant effect of oil-specific demand shocks is induced to the oil and oil-related industry. An oil supply disruption has an insignificant effect on this industry, indicating that the majority of these shocks are not caused by or related to the Norwegian oil supply, and substantiating the interpretation of oil supply shocks as external to the Norwegian oil industry.

Norway is currently experiencing negative effects caused by a low price of oil, driven by positive shocks to the oil supply and negative oil-specific demand shocks. The most recent development of the majority of the variables analyzed corresponds to the impulse response functions estimated in our analysis when applying them to negative oil price shocks. While some correspond to an oil supply shock, others correspond to the response of an oil-specific demand shock. This is interpreted as an indication that the analysis conducted is useful when trying to understand the current macroeconomic situation in Norway.

11. Perspectivation

The following section examines our suggestions for further research as well as other interesting aspects that could potentially change the premises for a similar analysis.

In our thesis, we have chosen to examine a relatively wide range of Norwegian industries to acquire a comprehensive understanding of the different industry group reactions to shocks to the price of oil. This is in conjunction with our wish to gain an understanding of the general situation in the Norwegian economy. It could, however, be interesting to go further in detail with more specified sub-industry groups, or even specific companies, to examine their reactions to different shocks to the price of oil. Through an in-depth analysis at a company level, we believe the researcher could find valuable information such as how companies are differently affected by the three shocks as well as how they typically act in response to these shocks. An analysis at a more detailed level allows for a deeper understanding of the premises for each individual analysis. By such an analysis, the researcher could furthermore learn more about the reactions to different parts of the value chain, as well as gaining an even better understanding of which sub-industries or companies are mostly affected by shocks to the price of oil.

Although Norway is currently experiencing negative effects of a low price of oil, other oil exporters are experiencing far more severe effects. Inflation rates in Venezuela and Nigeria are growing rapidly and they are simultaneously experiencing a lack of currency, while Brazil is unable to make investments intended to secure the country's future. Russia is cutting their public expenses and Saudi Arabia is planning large restructurings as an attempt to decrease their dependence on income from the oil industry (Andreassen et al., 2016). Even though Norway is experiencing negative effects as well, there is no doubt that all of these countries are facing more extensive problems caused by the same shocks to the price of oil. Consequently, the cause of these different reactions is in interesting aspect for further research. A good starting point could be to base the analysis on the knowledge that the Norwegian economy is in a relatively unique position due to the State Pension Fund Global. This fund is cushioning both positive and negative effects of oil price shocks to the economy. A comparison of the effects on the Norwegian economy to the corresponding effects to other oil-exporting economies could contribute to identifying the extent to which the economy is protected by The State Pension Fund Global.

Our analysis emphasizes the significant importance of the oil and oil-related industries to the Norwegian economy. However, it is worth noticing that a continuing low price of oil may change the premises for the Norwegian oil industry. If oil prices remain low for a long period of time, the industry could become unprofitable and consequently diminish substantially. The deepwater-based oil industry such as the Norwegian is dependent on a price of oil between approximately USD 50 and 60 per barrel on average to break even in the long term, while onshore production areas such as the Middle East only need between approximately USD 20 and 30 or less per barrel on average to break even (Saltvedt, 2015b). In the short term, it is likely that the effects of such a scenario would turn out similar to the effects resulting from the negative oil price shocks analyzed in this thesis. Through a lack of profitability over time, however, the oil and oil-related industry could lose its relative contribution to the economy. Hence, in the long term, a large reduction of the oil and oil-related industry could fundamentally change the dynamics of the Norwegian economy.

We have examined the responses of different macroeconomic aggregates over a two-year time horizon. This is in concordance with our problem statement, which is to understand the current situation in the Norwegian economy. The impulse response functions we have estimated in our analysis are indicators of the effect of a one-standard deviation shock to the price of oil and identify the short-term responses of the respective variables to the different oil price shocks. Depending on how the oil market situation develops in the near future, however, the effects on the Norwegian economy may develop in different directions in the long term. If the price of oil increases again, the situation may move towards what has been regarded as normal over the last decades. If the economy is facing a continuing period of low prices of oil, however, it could be useful to analyze longer-term effects. In this scenario, the effects may spread further into the economy, and the impact of the already estimated effects could increase or change substantially. Other methods than the one used in this thesis may be better suited if conducting such an analysis.

Another possible extension of our thesis could be the use of our method and material as a basis for a forecast. In that case, the researcher could make a forecast of the future situation in the oil market and the consequent effects to the Norwegian economy. It should, however, be noted that the dynamics in the global oil market may be about to change drastically. This could potentially make it problematic to use historical data of oil market-related variables to forecast the situation in the oil market in the years to come. The transportation sector is currently responsible for 55 percent of the global oil usage; however the industry is changing towards a more environmentally friendly trend. An indication of the rapid changes in this market can be found in Norway, which has become one of the leading countries in the use of electrical vehicles. Although this trend does not yet affect airplanes, large ships are already being fueled by hybrid solutions or gas, and the technological development is moving this sector in the direction of independence to the price of oil (Saltvedt, 2015a). A shift towards less use of oil in this sector alone can dramatically reduce the world demand for oil, which could potentially distort the current oil market dynamics. Additional uncertainties are caused by the changes in the supply environment; the shale oil revolution, the new and decreased power of OPEC and the conflict between the large oil suppliers Iran and Saudi Arabia. This does not, however, make a forecast of the future situation either impossible or less interesting.

A well substantiated forecast of the future oil market situation as well as the effects to the Norwegian economy should be of high interest to various stakeholders. An analysis related to the oil market should be interesting for oil exporters, importers, traders and consumers worldwide, while an analysis of the impact to the Norwegian economy could be interesting for both private consumers, companies and the government due to the broad effects on the economy. When gaining an understanding of how different macroeconomic variables, industries and companies react to the price of oil, a forecast can put actors in a superior position when having to make decisions caused by comparable scenarios.

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Appendices

Appendix Table of Contents

A1. Choosing the Lag Length Structural VAR

A1.1 Selection Order Criteria

Selection-order criteria
Sample: 26 - 310 Number of obs = 285

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1285.51				1.69646	9.04218	9.05759	**9.08062***
1	-1263.12	44.789	9	0.000	1.54427	8.94818	9.00983	9.10197
2	-1246.24	33.746	9	0.000	**1.4613***	**8.89293***	**9.00082***	9.16206
3	-1242.33	7.8224	9	0.552	1.51452	8.92864	9.08277	9.31311
4	-1236.13	12.407	9	0.191	1.54469	8.94826	9.14863	9.44808
5	-1233.02	6.2147	9	0.718	1.61017	8.98962	9.23622	9.60477
6	-1229.13	7.7747	9	0.557	1.66939	9.02549	9.31833	9.75599
7	-1220.04	18.18	9	0.033	1.66888	9.02486	9.3639	9.8707
8	-1216.97	6.1526	9	0.725	1.74048	9.06643	9.45175	10.0276
9	-1212.16	9.6153	9	0.383	1.79343	9.09585	9.5274	10.1724
10	-1199.5	25.309	9	0.003	1.74922	9.07021	9.548	10.2621
11	-1193.07	12.876	9	0.168	1.78243	9.08818	9.61221	10.3954
12	-1185.01	16.118	9	0.064	1.79603	9.09479	9.66505	10.5173
13	-1178.77	12.476	9	0.188	1.83333	9.11417	9.73067	10.6521
14	-1176.47	4.6028	9	0.867	1.9242	9.16118	9.82392	10.8144
15	-1168.28	16.367	9	0.060	1.93832	9.16691	9.87588	10.9355
16	-1163.45	9.6703	9	0.378	1.99941	9.19613	9.95135	11.08
17	-1158.28	10.331	9	0.324	2.05815	9.22304	10.0245	11.2223
18	-1150.65	15.276	9	0.084	2.08272	9.2326	10.0803	11.3472
19	-1147.67	5.9508	9	0.745	2.17828	9.27488	10.1688	11.5048
20	-1143.06	9.2205	9	0.417	2.25291	9.30568	10.2459	11.651
21	-1138.7	8.711	9	0.464	2.33499	9.33828	10.3247	11.7989
22	-1131.93	13.542	9	0.140	2.38016	9.35392	10.3866	11.9299
23	-1120.94	21.985	9	0.009	2.35622	9.33994	10.4188	12.0312
24	-1110.06	**21.756***	9	0.010	2.33526	9.32676	10.4519	12.1334

A1.2 Test for Autocorrelation in Residuals

A1.2.1 Autocorrelation Tests Structural VAR 2 lags

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	12.6769	9	0.17778
2	12.9720	9	0.16388
3	10.0331	9	0.34781
4	8.7875	9	0.45712
5	11.2679	9	0.25779
6	7.0160	9	0.63545
7	14.7553	9	0.09788
8	6.5786	9	0.68090
9	4.9561	9	0.83812
10	20.9579	9	0.01284
11	22.0779	9	0.00864
12	9.3847	9	0.40254
13	10.5083	9	0.31092
14	6.6809	9	0.67030
15	7.9247	9	0.54175
16	4.7727	9	0.85366
17	6.3598	9	0.70343
18	13.5089	9	0.14090
19	7.3697	9	0.59869
20	7.1738	9	0.61903
21	9.3452	9	0.40604
22	5.5956	9	0.77961
23	6.5783	9	0.68093
24	32.3227	9	0.00018
25	7.2664	9	0.60941
26	7.9301	9	0.54120
27	6.0121	9	0.73870
28	3.5592	9	0.93796
29	4.8941	9	0.84344
30	5.7078	9	0.76876
31	4.3951	9	0.88354
32	6.3818	9	0.70118
33	9.3079	9	0.40936
34	6.3462	9	0.70483
35	12.3188	9	0.19593
36	11.4290	9	0.24744

H0: no autocorrelation at lag order

Durbin-Watson d-statistic (., 307) = 2.038901

A1.2.2 Autocorrelation Tests Structural VAR 24 lags

Lagrange-multiplier test

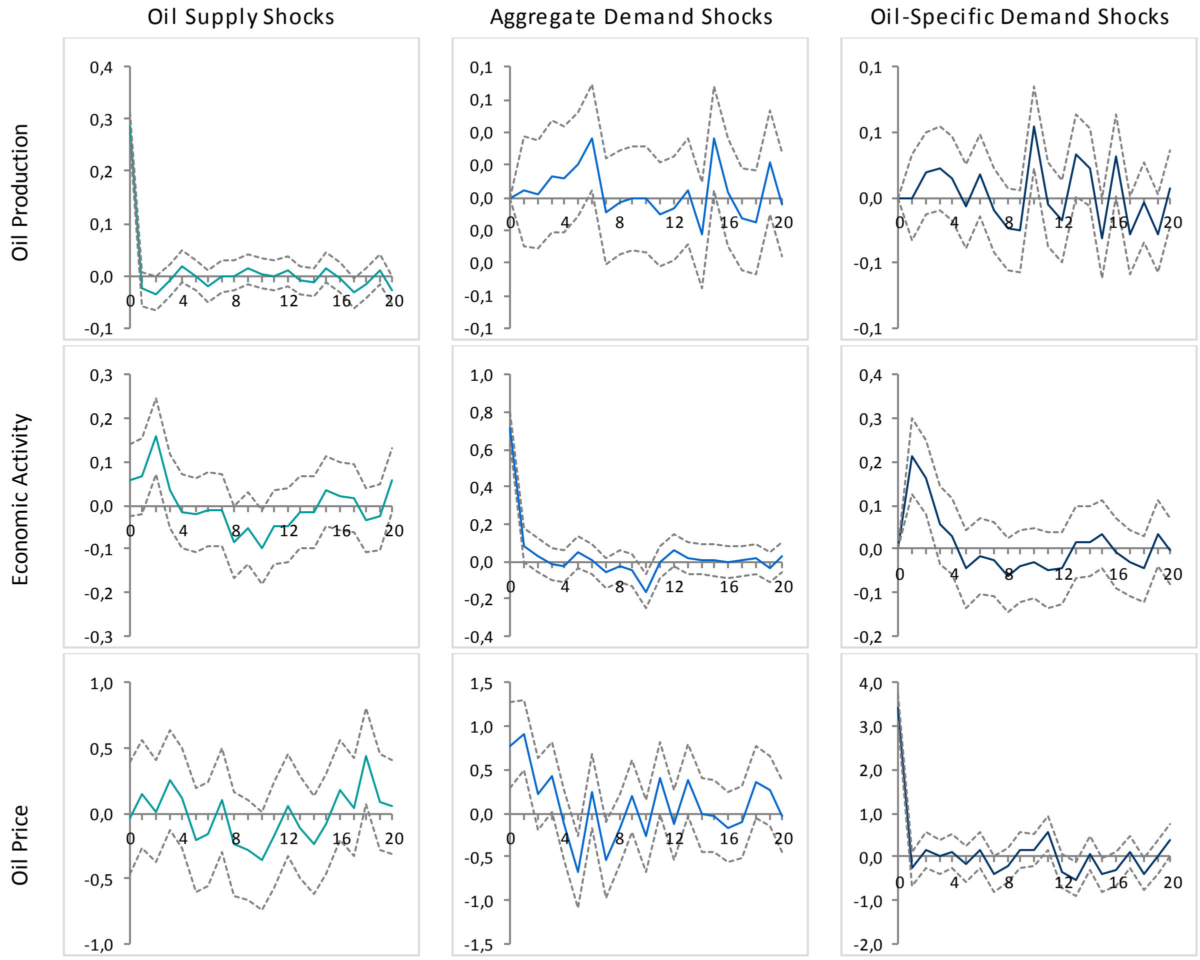
lag	chi2	df	Prob > chi2
1	12.3286	9	0.19541
2	7.7621	9	0.55828
3	2.5122	9	0.98055
4	2.7279	9	0.97411
5	6.4232	9	0.69693
6	5.4738	9	0.79121
7	5.5016	9	0.78858
8	13.2631	9	0.15106
9	9.0778	9	0.43012
10	8.3654	9	0.49779
11	19.0044	9	0.02516
12	7.9394	9	0.54026
13	8.9547	9	0.44147
14	7.4708	9	0.58823
15	7.5672	9	0.57828
16	12.8040	9	0.17168
17	8.8802	9	0.44841
18	7.2200	9	0.61423
19	3.9990	9	0.91148
20	4.3548	9	0.88655
21	7.5495	9	0.58010
22	5.1009	9	0.82542
23	5.9139	9	0.74851
24	14.0781	9	0.11958
25	6.9493	9	0.64240
26	10.4696	9	0.31382
27	5.3688	9	0.80105
28	4.8168	9	0.84997
29	4.5433	9	0.87217
30	13.3420	9	0.14773
31	8.7031	9	0.46512
32	12.8036	9	0.17170
33	11.3379	9	0.25326
34	8.3784	9	0.49651
35	7.3368	9	0.60210
36	9.5439	9	0.38865

H0: no autocorrelation at lag order

Durbin-Watson d-statistic (., 285) = 2.003129

A2. Estimation Results Structural VAR

A2.1 Impulse Response Functions from Structural VAR 24 lags



A2.2 Stability Test for Structural VAR 2 lags

Stability test for SVAR(2)
Eigenvalue stability condition

Eigenvalue	Modulus
-.2993984 + .2846159i	.413093
-.2993984 - .2846159i	.413093
-.01154037 + .3642027i	.364386
-.01154037 - .3642027i	.364386
.2957144 + .1143983i	.317071
.2957144 - .1143983i	.317071

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

A3. Information Criteria Tests Linear Regressions

A3.1 Country-Level Variables

	dlogUR		*dlogInterbank*		*dlogTotExp*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	935,7	1.188,8	1.234,7	1.487,9	1.298,0	1.552,0
P23	937,8	1.180,9	1.240,8	1.484,0	1.312,0	1.555,0
P22	942,3	1.175,2	1.242,0	1.475,0	1.315,0	1.547,0
P21	941,6	1.164,3	1.240,0	1.463,0	1.318,0	1.541,0
P20	943,3	1.155,8	1.241,0	1.454,0	1.326,0	1.539,0
P19	944,7	1.147,0	1.244,0	1.447,0	1.332,0	1.534,0
P18	947,1	1.139,2	1.243,0	1.435,0	1.331,0	1.523,0
P17	949,7	1.131,5	1.246,0	1.428,0	1.336,0	1.518,0
P16	946,8	1.118,3	1.248,0	1.419,0	1.339,0	1.511,0
P15	947,2	1.108,4	1.246,0	1.407,0	1.347,0	1.508,0
P14	948,8	1.099,7	1.248,0	1.399,0	1.349,0	1.500,0
P13	958,8	1.099,4	1.250,0	1.391,0	1.349,0	1.489,0
P12	956,9	1.087,1	1.255,0	1.385,0	1.348,0	1.478,0
P11	955,1	1.074,8	1.270,0	1.389,0	1.348,0	1.469,0
P10	951,8	1.061,1	1.281,0	1.390,0	1.355,0	1.464,0
P9	951,1	1.049,9	1.286,0	1.384,0	1.359,0	1.458,0
P8	948,1	1.036,5	1.291,0	1.379,0	1.363,0	1.452,0
P7	948,3	1.026,1	1.296,0	1.374,0	1.368,0	1.456,0
P6	945,3	1.012,6	1.301,0	1.368,0	1.372,0	1.440,0
P5	945,0	1.001,7	1.301,0	1.358,0	1.374,0	1.430,0
P4	945,7	991,9	1.303,0	1.349,0	1.376,0	1.422,0
P3	944,8	980,3	1.308,0	1.343,0	1.377,0	1.412,0
P2	943,9	968,8	1.317,0	1.342,0	1.379,0	1.403,0
P1	942,1	956,4	1.316,0	1.330,0	1.393,0	1.407,0

	dlogCPINOR		*dlogKRONE_TWI*		*dlogOSEBX*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	-15,9	237,0	424,6	677,8	1.205,6	1.458,8
P23	-21,3	221,8	424,9	668,0	1.208,0	1.451,0
P22	-25,5	207,5	426,9	659,9	1.203,5	1.436,1
P21	-23,9	198,8	427,1	649,8	1.207,2	1.429,5
P20	-23,9	188,7	438,4	651,0	1.206,2	1.417,9
P19	-22,0	180,4	434,3	636,6	1.203,5	1.404,9
P18	-23,4	168,0	433,1	625,2	1.200,4	1.391,4
P17	-24,7	157,2	428,0	609,9	1.200,9	1.381,0
P16	-25,8	145,8	426,8	598,3	1.198,5	1.368,6
P15	-11,9	149,3	436,6	597,9	1.192,6	1.352,3
P14	-4,4	146,6	434,8	585,7	1.188,1	1.337,4
P13	-11,1	129,5	435,7	576,2	1.183,9	1.322,8
P12	-11,5	118,6	444,7	574,8	1.180,8	1.309,3
P11	-8,1	111,6	452,7	572,4	1.175,2	1.293,3
P10	-13,4	95,9	448,7	558,0	1.171,2	1.278,8
P9	-16,3	82,5	448,5	547,3	1.171,0	1.268,3
P8	-18,5	69,9	445,7	584,0	1.168,4	1.255,2
P7	-15,5	62,3	445,4	523,3	1.164,8	1.241,2
P6	-22,1	45,2	443,6	510,9	1.165,7	1.231,7
P5	-26,7	30,0	441,2	497,9	1.167,4	1.222,9
P4	-33,8	12,3	440,5	486,6	1.162,3	1.207,4
P3	-35,2	0,3	436,8	472,3	1.158,7	1.193,5
P2	-25,2	-0,3	441,2	466,1	1.157,5	1.181,8
P1	-30,5	-16,3	440,8	455,1	1.156,8	1.170,7

	dlogGDP		*dlogGDP_mainland*		*dlogGDP_oilocean*	
	AIC	BIC	AIC	BIC	AIC	BIC
P12	270,8	356,0	115,2	200,4	299,0	384,2
P11	272,1	350,9	109,4	188,2	308,2	387,0
P10	280,0	352,3	104,4	176,7	316,2	388,4
P9	285,4	351,0	100,8	166,4	324,7	390,3
P8	284,4	343,4	99,2	158,1	326,2	385,1
P7	306,8	358,9	107,7	159,9	326,9	379,0
P6	313,7	359,0	109,2	154,5	324,6	369,9
P5	318,0	356,3	111,9	150,2	328,2	366,5
P4	317,8	349,1	107,8	139,1	330,6	361,9
P3	331,6	355,8	104,7	128,9	331,3	355,5
P2	341,1	358,1	103,9	121,0	335,1	352,1
P1	348,2	358,0	102,8	112,6	336,7	346,5

A3.2 Industry-Level Variables

	dlogFood		*dlogBanks*		*dlogTech*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1.309,3	1.555,1	1245,534	1.491,3	1.355,3	1.601,0
P23	1.315,2	1.551,1	1252,448	1.488,4	1.355,6	1.591,5
P22	1.319,5	1.545,6	1254,362	1.480,5	1.361,8	1.587,9
P21	1.318,3	1.534,6	1260,887	1.477,2	1.361,8	1.578,1
P20	1.318,0	1.524,4	1259,678	1.466,1	1.370,3	1.576,7
P19	1.323,0	1.519,5	1261,784	1.458,4	1.381,9	1.578,4
P18	1.323,5	1.510,2	1263,027	1.449,7	1.385,1	1.571,7
P17	1.327,7	1.504,4	1269,268	1.446,0	1.390,0	1.566,7
P16	1.331,1	1.497,9	1270,915	1.437,6	1.396,5	1.563,3
P15	1.332,5	1.489,2	1275,209	1.431,9	1.406,5	1.563,2
P14	1.345,1	1.491,8	1277,59	1.424,3	1.408,0	1.554,7
P13	1.344,6	1.481,2	1278,913	1.415,6	1.408,1	1.544,8
P12	1.348,6	1.475,1	1288,521	1.415,1	1.411,1	1.537,7
P11	1.347,7	1.464,1	1295,954	1.412,4	1.412,3	1.528,7
P10	1.347,4	1.453,7	1299,891	1.406,2	1.417,1	1.523,4
P9	1.349,1	1.445,2	1304,381	1.400,5	1.418,5	1.514,6
P8	1.357,6	1.443,5	1307,932	1.393,9	1.426,0	1.512,0
P7	1.365,4	1.441,2	1319,732	1.395,5	1.427,6	1.503,4
P6	1.366,9	1.432,3	1333,524	1.399,0	1.432,4	1.497,9
P5	1.374,0	1.429,2	1338,72	1.393,9	1.433,6	1.488,8
P4	1.396,5	1.441,4	1351,452	1.396,4	1.436,8	1.481,7
P3	1.397,9	1.432,5	1355,613	1.390,2	1.437,9	1.472,5
P2	1.422,8	1.447,1	1363,425	1.387,7	1.439,3	1.463,5
P1	1.428,7	1.442,6	1371,639	1.385,5	1.443,1	1.456,9

	dlogRetail		*dlogMedia*		*dlogSoftwServ*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1.349,4	1.595,1	1.345,7	1.591,4	1.315,1	1.560,8
P23	1.350,9	1.586,8	1.348,8	1.584,7	1.320,0	1.555,9
P22	1.358,3	1.584,4	1.356,9	1.583,0	1.324,1	1.550,3
P21	1.361,3	1.577,6	1.360,4	1.576,7	1.325,1	1.541,4
P20	1.365,0	1.571,5	1.364,5	1.570,9	1.331,9	1.538,3
P19	1.367,4	1.564,0	1.367,3	1.563,9	1.335,9	1.532,5
P18	1.367,9	1.554,5	1.370,4	1.557,0	1.335,8	1.522,4
P17	1.370,9	1.547,6	1.370,1	1.546,8	1.336,7	1.513,4
P16	1.373,5	1.540,2	1.377,5	1.544,2	1.339,6	1.506,3
P15	1.379,6	1.536,4	1.377,8	1.534,5	1.344,7	1.501,4
P14	1.384,8	1.531,5	1.382,0	1.528,7	1.347,1	1.493,8
P13	1.387,6	1.524,2	1.384,2	1.520,8	1.348,3	1.485,0
P12	1.392,5	1.519,1	1.387,3	1.513,8	1.351,1	1.477,7
P11	1.393,1	1.509,6	1.388,7	1.505,2	1.353,9	1.470,3
P10	1.393,0	1.499,4	1.391,0	1.497,3	1.355,4	1.461,8
P9	1.394,7	1.490,9	1.391,2	1.487,3	1.358,9	1.455,0
P8	1.399,6	1.485,6	1.403,1	1.489,1	1.360,9	1.446,9
P7	1.398,7	1.474,5	1.403,3	1.479,1	1.362,6	1.438,4
P6	1.400,9	1.466,3	1.404,2	1.469,7	1.363,2	1.428,7
P5	1.404,4	1.459,6	1.406,2	1.461,4	1.366,4	1.421,6
P4	1.414,6	1.459,6	1.430,8	1.475,8	1.365,9	1.410,9
P3	1.418,4	1.453,0	1.432,1	1.466,7	1.367,5	1.402,0
P2	1.430,7	1.454,9	1.440,4	1.464,7	1.370,2	1.394,5
P1	1.430,9	1.444,7	1.443,8	1.457,7	1.379,4	1.393,3

	dlogTransportation		*dlogRealEst*		*dlogInsurance*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1188,726	1.434,4	1.045,9	1.291,6	1.347,9	1.593,6
P23	1.193,5	1.429,5	1.044,6	1.280,6	1.350,0	1.586,0
P22	1.196,7	1.422,8	1.046,1	1.272,3	1.357,5	1.583,7
P21	1.198,2	1.414,5	1.045,2	1.261,5	1.357,6	1.573,9
P20	1.197,4	1.403,9	1.045,0	1.251,4	1.364,9	1.571,4
P19	1.199,5	1.396,1	1.046,7	1.243,3	1.373,1	1.569,7
P18	1.203,8	1.390,5	1.046,9	1.233,5	1.374,0	1.560,6
P17	1.210,6	1.387,3	1.052,1	1.228,8	1.377,2	1.553,9
P16	1.209,4	1.376,1	1.049,7	1.216,5	1.378,3	1.545,0
P15	1.208,7	1.365,4	1.053,4	1.210,1	1.382,8	1.539,5
P14	1.208,9	1.355,6	1.054,8	1.201,5	1.384,6	1.531,3
P13	1.208,2	1.344,8	1.057,3	1.193,9	1.387,1	1.523,8
P12	1.206,9	1.333,4	1.069,2	1.195,8	1.388,7	1.515,2
P11	1.206,2	1.322,6	1.072,6	1.189,0	1.391,6	1.508,0
P10	1.205,0	1.311,3	1.075,6	1.181,9	1.394,3	1.500,6
P9	1.204,7	1.300,9	1.078,1	1.174,2	1.398,3	1.494,4
P8	1.207,4	1.293,3	1.083,3	1.169,3	1.400,0	1.485,9
P7	1.207,2	1.282,9	1.082,2	1.157,9	1.408,7	1.484,4
P6	1.206,5	1.272,0	1.083,1	1.148,6	1.411,7	1.477,2
P5	1.208,7	1.263,9	1.085,2	1.140,5	1.412,8	1.468,0
P4	1.215,6	1.260,5	1.092,6	1.137,5	1.421,3	1.466,2
P3	1.217,3	1.251,9	1.097,7	1.132,3	1.426,8	1.461,4
P2	1.221,6	1.245,8	1.099,7	1.123,9	1.427,1	1.451,4
P1	1.224,7	1.238,6	1.112,7	1.126,6	1.428,6	1.442,5

	dlogPharmaBio		*dlogUtilities*		*dlogConsServ*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1.486,9	1.732,6	1.165,1	1.410,8	1.404,5	1.650,3
P23	1.490,9	1.726,8	1.163,4	1.399,4	1.405,2	1.641,1
P22	1.495,4	1.721,5	1.163,1	1.389,2	1.411,2	1.637,4
P21	1.497,1	1.713,5	1.161,9	1.378,2	1.412,8	1.629,1
P20	1.504,5	1.711,0	1.163,8	1.370,3	1.412,6	1.619,0
P19	1.506,6	1.703,2	1.171,9	1.368,4	1.414,6	1.611,2
P18	1.508,3	1.695,0	1.173,8	1.360,5	1.415,4	1.602,0
P17	1.517,6	1.694,3	1.172,5	1.349,2	1.419,4	1.596,1
P16	1.521,2	1.687,9	1.172,9	1.339,6	1.424,0	1.590,7
P15	1.523,7	1.680,4	1.174,7	1.331,4	1.431,4	1.588,2
P14	1.527,8	1.674,5	1.173,1	1.319,8	1.442,3	1.589,0
P13	1.535,0	1.671,6	1.179,6	1.316,2	1.446,0	1.582,7
P12	1.538,8	1.665,3	1.178,3	1.304,9	1.459,1	1.585,7
P11	1.551,3	1.667,8	1.176,6	1.293,0	1.461,9	1.578,3
P10	1.551,5	1.657,8	1.177,5	1.283,8	1.470,4	1.576,7
P9	1.560,8	1.656,9	1.176,5	1.272,7	1.473,1	1.569,2
P8	1.561,3	1.647,2	1.181,5	1.267,4	1.474,0	1.560,0
P7	1.570,9	1.646,6	1.182,5	1.258,2	1.474,0	1.549,7
P6	1.572,4	1.637,8	1.180,6	1.246,1	1.479,3	1.544,8
P5	1.572,8	1.628,0	1.186,5	1.241,7	1.483,5	1.538,7
P4	1.573,1	1.618,0	1.192,2	1.237,1	1.512,1	1.557,1
P3	1.574,3	1.608,9	1.201,9	1.236,5	1.515,3	1.549,9
P2	1.574,2	1.598,5	1.202,4	1.226,6	1.527,9	1.552,1
P1	1.579,5	1.593,3	1.207,1	1.221,0	1.547,7	1.561,6

	dlogConsDur		*dlogProfServ*		*dlogCapital*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1.186,3	1.432,0	1.405,4	1.651,1	1.239,9	1.485,6
P23	1.187,9	1.423,8	1.414,4	1.650,3	1.241,2	1.477,2
P22	1.194,4	1.420,5	1.420,6	1.646,7	1.245,1	1.471,2
P21	1.194,4	1.410,8	1.428,6	1.644,9	1.247,4	1.463,7
P20	1.202,5	1.408,9	1.430,7	1.637,1	1.247,2	1.453,7
P19	1.208,9	1.405,5	1.435,8	1.632,4	1.248,6	1.445,2
P18	1.212,7	1.399,3	1.445,5	1.632,2	1.250,4	1.437,0
P17	1.219,6	1.396,3	1.450,9	1.627,6	1.254,4	1.431,1
P16	1.220,6	1.387,3	1.456,6	1.623,4	1.253,1	1.419,9
P15	1.231,6	1.388,3	1.462,9	1.619,7	1.254,6	1.411,4
P14	1.234,3	1.381,0	1.471,9	1.618,6	1.254,6	1.401,3
P13	1.237,4	1.374,0	1.477,1	1.613,7	1.256,1	1.392,7
P12	1.238,7	1.365,2	1.478,2	1.604,8	1.258,3	1.384,9
P11	1.245,7	1.362,2	1.491,0	1.607,4	1.257,1	1.373,6
P10	1.245,5	1.351,8	1.498,5	1.604,8	1.261,5	1.367,8
P9	1.254,1	1.350,2	1.499,4	1.595,6	1.261,2	1.357,3
P8	1.257,7	1.343,6	1.499,0	1.585,0	1.264,0	1.349,9
P7	1.263,3	1.339,0	1.498,9	1.574,7	1.263,1	1.338,9
P6	1.265,7	1.331,2	1.499,6	1.565,1	1.263,3	1.328,8
P5	1.271,0	1.326,2	1.499,9	1.555,1	1.263,5	1.318,8
P4	1.276,7	1.321,6	1.504,4	1.549,3	1.272,6	1.317,5
P3	1.283,3	1.317,9	1.506,5	1.541,0	1.276,2	1.310,8
P2	1.293,0	1.317,2	1.512,2	1.536,4	1.279,1	1.303,3
P1	1.293,4	1.307,3	1.518,8	1.532,7	1.279,4	1.239,3

	dlogMaterials		*dlogEnergy*		*dlogHealth*	
	AIC	BIC	AIC	BIC	AIC	BIC
P24	1.236,5	1.482,3	1.201,9	1.447,6	1.230,5	1.474,2
P23	1.236,8	1.472,8	1.204,7	1.440,6	1.237,9	1.471,8
P22	1.239,6	1.465,7	1.204,7	1.430,8	1.244,2	1.468,5
P21	1.244,4	1.460,7	1.208,0	1.424,4	1.262,7	1.477,3
P20	1.246,7	1.453,1	1.212,8	1.419,2	1.262,9	1.467,7
P19	1.246,4	1.443,0	1.212,5	1.409,1	1.263,4	1.458,3
P18	1.249,0	1.435,6	1.218,2	1.404,8	1.270,6	1.455,8
P17	1.249,9	1.426,6	1.219,8	1.395,5	1.270,3	1.448,8
P16	1.249,1	1.415,8	1.218,4	1.385,2	1.275,7	1.441,1
P15	1.250,1	1.406,9	1.226,1	1.382,8	1.275,2	1.430,7
P14	1.253,5	1.400,2	1.227,6	1.374,3	1.280,4	1.425,9
P13	1.252,8	1.389,4	1.230,3	1.366,9	1.284,1	1.419,6
P12	1.253,8	1.380,4	1.234,9	1.361,5	1.289,3	1.414,8
P11	1.256,4	1.372,9	1.235,0	1.351,5	1.289,8	1.405,4
P10	1.255,8	1.362,1	1.236,6	1.342,9	1.295,2	1.400,7
P9	1.255,9	1.352,0	1.237,6	1.333,8	1.298,8	1.394,2
P8	1.256,1	1.342,0	1.244,1	1.330,1	1.305,9	1.391,2
P7	1.256,7	1.332,4	1.244,7	1.320,4	1.309,2	1.384,3
P6	1.255,5	1.321,0	1.246,4	1.311,8	1.313,8	1.378,8
P5	1.254,6	1.309,8	1.245,6	1.300,8	1.318,8	1.373,6
P4	1.269,0	1.313,9	1.248,6	1.293,7	1.321,3	1.365,9
P3	1.269,3	1.303,9	1.248,4	1.283,0	1.324,6	1.359,0
P2	1.270,7	1.294,9	1.249,0	1.273,2	1.329,0	1.353,1
P1	1.269,8	1.283,7	1.249,2	1.263,1	1.344,8	1.358,6

	dlogTelecom		*dlogDivFin*	
	AIC	BIC	AIC	BIC
P24	1.264,9	1.508,5	1.150,3	1.393,9
P23	1.265,7	1.499,7	1.152,2	1.386,2
P22	1.279,4	1.503,6	1.152,6	1.376,8
P21	1.299,6	1.514,1	1.156,9	1.371,4
P20	1.300,5	1.505,2	1.158,0	1.362,8
P19	1.303,6	1.498,6	1.157,6	1.352,5
P18	1.306,4	1.491,5	1.161,4	1.346,5
P17	1.310,9	1.486,2	1.167,5	1.342,8
P16	1.311,5	1.476,9	1.167,1	1.332,5
P15	1.327,4	1.482,8	1.165,5	1.321,0
P14	1.326,2	1.471,7	1.165,9	1.311,4
P13	1.325,9	1.461,4	1.165,0	1.300,6
P12	1.333,6	1.459,2	1.173,7	1.299,3
P11	1.336,1	1.451,6	1.179,9	1.295,4
P10	1.341,3	1.446,8	1.180,7	1.286,2
P9	1.343,2	1.438,6	1.189,4	1.284,8
P8	1.348,3	1.433,5	1.190,6	1.275,9
P7	1.349,4	1.424,6	1.196,4	1.271,5
P6	1.353,8	1.418,8	1.196,4	1.261,4
P5	1.383,5	1.438,3	1.198,3	1.253,1
P4	1.390,8	1.435,3	1.205,0	1.249,6
P3	1.391,9	1.426,3	1.204,7	1.239,0
P2	1.401,4	1.425,5	1.206,9	1.231,0
P1	1.414,9	1.428,6	1.206,5	1.220,2

A4. Tests for Autocorrelation in Linear Regressions

A4.1 Country-Level Variables

GDP - 8 lags
Durbin-Watson d-statistic(28, 78) = 2.492435

GDP oilocean - 8 lags
Durbin-Watson d-statistic(28, 78) = 2.705564

OSEBX - 24 lags
Durbin-Watson d-statistic(76, 237) = 1.731115

Total Exports - 24 lags
Durbin-Watson d-statistic(76, 237) = 2.954807

Krone TWI - 24 lags
Durbin-Watson d-statistic(76, 237) = 1.833956

GDP mainland - 8 lags
Durbin-Watson d-statistic(28, 78) = 2.617356

Unemployment Rate - 24 lags
Durbin-Watson d-statistic(76, 237) = 1.654509

Interbank Rate - 24 lags
Durbin-Watson d-statistic(76, 237) = 2.134862

CPI Norway - 24 lags
Durbin-Watson d-statistic(76, 237) = 1.650823

A4.2 Industry-Level Variables

Food - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.268257

Tech - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.085581

Retail - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.94949

Transport - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.684601

Insurance - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.980908

Utilities - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.848364

ConsDur - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.358666

Capital - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.03987

Energy - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.957686

DivFin - 24 lags *data series starting in 1996
Durbin-Watson d-statistic(76, 208) = 1.887342

Banks - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.315666

Media - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.763991

SoftwServ - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.771393

RealEst - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.962716

PharmaBio - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.780538

ConsServ - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.085319

ProfServ - 24 lags
Durbin-Watson d-statistic(76, 214) = 2.033646

Materials - 24 lags
Durbin-Watson d-statistic(76, 214) = 1.927651

Telecom - 24 lags *data series starting in 1996
Durbin-Watson d-statistic(76, 208) = 1.944937

Health- 24 lags *data series starting in 1996
Durbin-Watson d-statistic(76, 208) = 2.407874

A5. Seasonality Tests

A5.1 Country-Level Variables

INTERBANK

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	2,1
Observations	265,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	4.497,2	374,8	86,8
Residual	253,0	1.092,9	4,3	
Total	265,0	5.590,1		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	4,1	0,4	9,4	0,0
Feb	4,0	0,4	9,1	0,0
Mar	4,0	0,4	9,1	0,0
Apr	4,0	0,4	9,1	0,0
May	4,0	0,4	9,1	0,0
Jun	4,1	0,4	9,2	0,0
Jul	4,1	0,4	9,2	0,0
Aug	4,1	0,4	9,2	0,0
Sep	4,2	0,4	9,5	0,0
Oct	4,3	0,4	9,8	0,0
Nov	4,3	0,4	9,7	0,0
Dec	4,2	0,4	9,4	0,0
Average	*4,1*			

Seasonal Index	
Jan	*4,1*
Feb	*4,0*
Mar	*4,0*
Apr	*4,0*
May	*4,0*
Jun	*4,1*
Jul	*4,1*
Aug	*4,1*
Sep	*4,2*
Oct	*4,3*
Nov	*4,3*
Dec	*4,2*

TOTEXP

Regression Statistics	
Multiple R	0,9
R Square	0,9
Adjusted R Squ	0,9
Standard Error	20.827,5
Observations	265,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	708.834.579.466	59.069.548.289	136,2
Residual	253,0	109.747.452.345	433.784.397	
Total	265,0	818.582.031.811		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	52.934,5	4.342,8	12,2	0,0
Feb	50.245,2	4.440,4	11,3	0,0
Mar	54.689,3	4.440,4	12,3	0,0
Apr	50.557,9	4.440,4	11,4	0,0
May	49.852,0	4.440,4	11,2	0,0
Jun	49.233,5	4.440,4	11,1	0,0
Jul	49.739,0	4.440,4	11,2	0,0
Aug	49.114,4	4.440,4	11,1	0,0
Sep	49.960,8	4.440,4	11,3	0,0
Oct	55.420,4	4.440,4	12,5	0,0
Nov	54.316,6	4.440,4	12,2	0,0
Dec	53.903,4	4.440,4	12,1	0,0
Average	*51.663,9*			

Seasonal Index	
Jan	*52.934,5*
Feb	*50.245,2*
Mar	*54.689,3*
Apr	*50.557,9*
May	*49.852,0*
Jun	*49.233,5*
Jul	*49.739,0*
Aug	*49.114,4*
Sep	*49.960,8*
Oct	*55.420,4*
Nov	*54.316,6*
Dec	*53.903,4*

CPINOR

Regression Statistics	
Multiple R	1,0
R Square	1,0
Adjusted R Squ	1,0
Standard Error	14,8
Observations	265,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	3.520.672,2	293.389,4	1.338,0
Residual	253,0	55.477,3	219,3	
Total	265,0	3.576.149,6		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	115,1	3,1	37,3	0,0
Feb	114,5	3,2	36,3	0,0
Mar	114,8	3,2	36,4	0,0
Apr	115,1	3,2	36,4	0,0
May	115,1	3,2	36,5	0,0
Jun	115,1	3,2	36,5	0,0
Jul	115,0	3,2	36,4	0,0
Aug	114,8	3,2	36,4	0,0
Sep	115,6	3,2	36,6	0,0
Oct	115,8	3,2	36,7	0,0
Nov	116,0	3,2	36,8	0,0
Dec	116,1	3,2	36,8	0,0
Average	*115,3*			

Seasonal Index	
Jan	*115,1*
Feb	*114,5*
Mar	*114,8*
Apr	*115,1*
May	*115,1*
Jun	*115,1*
Jul	*115,0*
Aug	*114,8*
Sep	*115,6*
Oct	*115,8*
Nov	*116,0*
Dec	*116,1*

OSEBX

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	161,8
Observations	242,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	23.034.122,9	1.919.510,2	73,3
Residual	230,0	6.023.487,8	26.189,1	
Total	242,0	29.057.610,8		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	306,6	35,3	8,7	0,0
Feb	298,3	36,2	8,2	0,0
Mar	301,4	36,2	8,3	0,0
Apr	309,8	36,2	8,6	0,0
May	316,5	36,2	8,7	0,0
Jun	314,6	36,2	8,7	0,0
Jul	316,0	36,2	8,7	0,0
Aug	311,1	36,2	8,6	0,0
Sep	309,0	36,2	8,5	0,0
Oct	305,5	36,2	8,4	0,0
Nov	311,3	36,2	8,6	0,0
Dec	302,0	35,3	8,6	0,0
Average	*308,5*			

Seasonal Index	
Jan	*306,6*
Feb	*298,3*
Mar	*301,4*
Apr	*309,8*
May	*316,5*
Jun	*314,6*
Jul	*316,0*
Aug	*311,1*
Sep	*309,0*
Oct	*305,5*
Nov	*311,3*
Dec	*302,0*

GDP					

Regression Statistics	
Multiple R	0,935674844
R Square	0,875487414
Adjusted R Squ	0,859135774
Standard Error	192316,4542
Observations	88

ANOVA

	df	*SS*	*MS*	*F*
Regression	4	2,18448E+13	5,5E+12	147,658
Residual	84	3,10679E+12	3,7E+10	
Total	88	2,49516E+13		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0	#N/A	#N/A	#N/A
Q1	489479,5	41002,00581	11,9379	0,0000
Q2	486982,3182	41002,00581	11,877	0,0000
Q3	489872,2727	41002,00581	11,9475	0,0000
Q4	525576,2273	41002,00581	12,8183	0,0000
Average	497977,5795			

Seasonal Index	
Q1	*-8.498,08*
Q2	*-10.995,26*
Q3	*-8.105,31*
Q4	*27.598,65*

QUARTERLY CPI					

Regression Statistics	
Multiple R	0,992278
R Square	0,984616
Adjusted R Squ	0,972161
Standard Error	14,73391
Observations	88

ANOVA

	df	*SS*	*MS*	*F*
Regression	4	1167082,801	291770,7	1344,02062
Residual	84	18235,38896	217,088	
Total	88	1185318,19		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0	#N/A	#N/A	#N/A
Q1	114,4018	3,141279154	36,41886	3,1603E-53
Q2	115,0982	3,141279154	36,64055	1,9557E-53
Q3	115,1409	3,141279154	36,65415	1,8991E-53
Q4	116,0018	3,141279154	36,92821	1,0532E-53
Average	*115,1607*			

Seasonal Index	
Q1	*-0,76*
Q2	*-0,06*
Q3	*-0,02*
Q4	*0,84*

KRONE TWI

Regression Statistics	
Multiple R	1,0
R Square	1,0
Adjusted R Squ	1,0
Standard Error	5,3
Observations	265,0

ANOVA

	df	SS	MS	F
Regression	12,0	2.685.874,4	223.822,9	7.822,0
Residual	253,0	7.239,5	28,6	
Total	265,0	2.693.113,8		

	Coefficients	Standard Error	t Stat	P-value
Intercept	-	#N/A	#N/A	#N/A
Jan	101,6	1,1	91,1	0,0
Feb	100,6	1,1	88,2	0,0
Mar	100,4	1,1	88,0	0,0
Apr	100,1	1,1	87,8	0,0
May	99,8	1,1	87,5	0,0
Jun	100,3	1,1	87,9	0,0
Jul	100,7	1,1	88,3	0,0
Aug	100,6	1,1	88,2	0,0
Sep	100,6	1,1	88,2	0,0
Oct	100,8	1,1	88,4	0,0
Nov	101,0	1,1	88,5	0,0
Dec	101,6	1,1	89,1	0,0
Average	*100,7*			

Seasonal Index	
Jan	*101,6*
Feb	*100,6*
Mar	*100,4*
Apr	*100,1*
May	*99,8*
Jun	*100,3*
Jul	*100,7*
Aug	*100,6*
Sep	*100,6*
Oct	*100,8*
Nov	*101,0*
Dec	*101,6*

CRUDE OIL PRODUCTION

Regression Statistics	
Multiple R	1,00
R Square	0,99
Adjusted R Sq	0,99
Std Error	6.095,06
Observations	309,00

ANOVA

	df	SS	MS	F
Regression	12,0	1.475.280.258.609	122.940.021.551	3.309
Residual	297,0	11.033.466.632	37.149.719	
Total	309,0	1.486.313.725.241		

	Coefficients	Standard Error	t Stat	P-value
Intercept	0	#N/A	#N/A	#N/A
Jan	69.292,2	1.219,0	56,8	0,0
Feb	69.165,5	1.195,3	57,9	0,0
Mar	69.120,1	1.195,3	57,8	0,0
Apr	68.962,7	1.195,3	57,7	0,0
May	68.741,1	1.195,3	57,5	0,0
Jun	68.624,2	1.195,3	57,4	0,0
Jul	69.150,4	1.195,3	57,9	0,0
Aug	68.878,7	1.195,3	57,6	0,0
Sep	69.097,7	1.195,3	57,8	0,0
Oct	69.526,6	1.195,3	58,2	0,0
Nov	69.311,5	1.219,0	56,9	0,0
Dec	69.309,8	1.219,0	56,9	0,0
Average	69.098,4			

Seasonal Index	
Jan	*193,8*
Feb	*67,1*
Mar	*21,7*
Apr	*-135,7*
May	*-357,3*
Jun	*-474,2*
Jul	*52,1*
Aug	*-219,7*
Sep	*-0,6*
Oct	*428,3*
Nov	*213,1*
Dec	*211,4*

STEEL PRODUCTION

Regression Statistics	
Multiple R	1,00
R Square	0,99
Adjusted R Sq	0,99
Std Error	2.768,43
Observations	309,00

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	437.314.063.937	36.442.838.661	4.755
Residual	297,0	2.276.262.450	7.664.183	
Total	309,0	439.590.326.387		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0	#N/A	#N/A	#N/A
Jan	37.651,1	553,7	68,0	0,0
Feb	37.497,7	542,9	69,1	0,0
Mar	37.527,7	542,9	69,1	0,0
Apr	37.558,7	542,9	69,2	0,0
May	37.588,7	542,9	69,2	0,0
Jun	37.619,7	542,9	69,3	0,0
Jul	37.649,7	542,9	69,3	0,0
Aug	37.680,7	542,9	69,4	0,0
Sep	37.711,7	542,9	69,5	0,0
Oct	37.741,7	542,9	69,5	0,0
Nov	37.590,1	553,7	67,9	0,0
Dec	37.620,1	553,7	67,9	0,0
Average	37.619,8			

Seasonal Index	
Jan	*31,3*
Feb	*-122,1*
Mar	*-92,1*
Apr	*-61,1*
May	*-31,1*
Jun	*-0,1*
Jul	*29,9*
Aug	*60,9*
Sep	*91,9*
Oct	*121,9*
Nov	*-29,7*
Dec	*0,3*

BRENT CRUDE OIL PRICE

Regression Statistics	
Multiple R	0,81
R Square	0,65
Adjusted R Sq	0,64
Std Error	35,73
Observations	309,00

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	718.712	59.893	47
Residual	297,0	379.093	1.276	
Total	309,0	1.097.805		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0	#N/A	#N/A	#N/A
Jan	45,9	7,1	6,4	0,0
Feb	47,0	7,0	6,7	0,0
Mar	47,6	7,0	6,8	0,0
Apr	49,0	7,0	7,0	0,0
May	48,9	7,0	7,0	0,0
Jun	49,6	7,0	7,1	0,0
Jul	50,0	7,0	7,1	0,0
Aug	50,4	7,0	7,2	0,0
Sep	49,4	7,0	7,1	0,0
Oct	47,9	7,0	6,8	0,0
Nov	46,8	7,1	6,6	0,0
Dec	45,7	7,1	6,4	0,0
Average	48,2			

Seasonal Index	
Jan	*-2,3*
Feb	*-1,2*
Mar	*-0,6*
Apr	*0,8*
May	*0,7*
Jun	*1,4*
Jul	*1,8*
Aug	*2,2*
Sep	*1,2*
Oct	*-0,2*
Nov	*-1,4*
Dec	*-2,5*

A5.2 Industry-Level Variables

ENERGY

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,7
Standard Error	224,5
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	36.336.792,0	3.028.066,0	60,1
Residual	231,0	11.639.998,1	50.389,6	
Total	243,0	47.976.790,1		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	370,0	49,0	7,6	0,0
Feb	381,3	49,0	7,8	0,0
Mar	382,2	50,2	7,6	0,0
Apr	396,3	50,2	7,9	0,0
May	402,8	50,2	8,0	0,0
Jun	399,1	50,2	8,0	0,0
Jul	396,1	50,2	7,9	0,0
Aug	392,7	50,2	7,8	0,0
Sep	385,4	50,2	7,7	0,0
Oct	385,1	50,2	7,7	0,0
Nov	378,0	50,2	7,5	0,0
Dec	371,5	49,0	7,6	0,0
Average	*386,7*			

Seasonal Index

Jan	*370,0*
Feb	*381,3*
Mar	*382,2*
Apr	*396,3*
May	*402,8*
Jun	*399,1*
Jul	*396,1*
Aug	*392,7*
Sep	*385,4*
Oct	*385,1*
Nov	*378,0*
Dec	*371,5*

MATERIALS

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	140,2
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	21.857.553,9	1.821.462,8	92,6
Residual	231,0	4.542.304,5	19.663,7	
Total	243,0	26.399.858,4		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	301,5	30,6	9,9	0,0
Feb	307,2	30,6	10,0	0,0
Mar	299,5	31,4	9,6	0,0
Apr	304,0	31,4	9,7	0,0
May	307,0	31,4	9,8	0,0
Jun	305,9	31,4	9,8	0,0
Jul	304,1	31,4	9,7	0,0
Aug	297,0	31,4	9,5	0,0
Sep	283,8	31,4	9,1	0,0
Oct	290,1	31,4	9,3	0,0
Nov	295,6	31,4	9,4	0,0
Dec	301,8	30,6	9,9	0,0
Average	*299,8*			

Seasonal Index

Jan	*301,5*
Feb	*307,2*
Mar	*299,5*
Apr	*304,0*
May	*307,0*
Jun	*305,9*
Jul	*304,1*
Aug	*297,0*
Sep	*283,8*
Oct	*290,1*
Nov	*295,6*
Dec	*301,8*

CAPITAL GOODS	

Regression Statistics	
Multiple R	0,9
R Square	0,9
Adjusted R Squ	0,8
Standard Error	75,1
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	7.807.266,0	650.605,5	115,4
Residual	231,0	7.807.266,0	5.638,9	
Total	243,0	7.807.266,0		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	174,9	16,4	10,7	0,0
Feb	175,8	16,4	10,7	0,0
Mar	175,3	16,8	10,4	0,0
Apr	181,1	16,8	10,8	0,0
May	181,5	16,8	10,8	0,0
Jun	181,5	16,8	10,8	0,0
Jul	181,2	16,8	10,8	0,0
Aug	181,1	16,8	10,8	0,0
Sep	177,2	16,8	10,6	0,0
Oct	178,4	16,8	10,6	0,0
Nov	180,6	16,8	10,8	0,0
Dec	182,3	16,4	11,1	0,0
Average	*179,2*			

Seasonal Index	
Jan	*174,9*
Feb	*175,8*
Mar	*175,3*
Apr	*181,1*
May	*181,5*
Jun	*181,5*
Jul	*181,2*
Aug	*181,1*
Sep	*177,2*
Oct	*178,4*
Nov	*180,6*
Dec	*182,3*

PROFSERV	

Regression Statistics	
Multiple R	0,6
R Square	0,4
Adjusted R Squ	0,4
Standard Error	44,2
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	322.981,9	26.915,2	13,8
Residual	231,0	450.294,0	1.949,3	
Total	243,0	773.276,0		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	38,1	9,6	4,0	0,0
Feb	37,9	9,6	3,9	0,0
Mar	36,7	9,9	3,7	0,0
Apr	36,7	9,9	3,7	0,0
May	36,4	9,9	3,7	0,0
Jun	36,2	9,9	3,7	0,0
Jul	37,0	9,9	3,7	0,0
Aug	36,6	9,9	3,7	0,0
Sep	35,1	9,9	3,6	0,0
Oct	35,2	9,9	3,6	0,0
Nov	34,2	9,9	3,5	0,0
Dec	36,9	9,6	3,8	0,0
Average	*36,4*			

Seasonal Index	
Jan	*38,1*
Feb	*37,9*
Mar	*36,7*
Apr	*36,7*
May	*36,4*
Jun	*36,2*
Jul	*37,0*
Aug	*36,6*
Sep	*35,1*
Oct	*35,2*
Nov	*34,2*
Dec	*36,9*

CONSDUR

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	389,0
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	177.026.230,9	14.752.185,9	97,5
Residual	231,0	34.951.231,9	151.304,0	
Total	243,0	211.977.462,8		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	862,4	84,9	10,2	0,0
Feb	873,3	84,9	10,3	0,0
Mar	853,1	87,0	9,8	0,0
Apr	867,2	87,0	10,0	0,0
May	880,4	87,0	10,1	0,0
Jun	859,5	87,0	9,9	0,0
Jul	859,6	87,0	9,9	0,0
Aug	851,7	87,0	9,8	0,0
Sep	837,2	87,0	9,6	0,0
Oct	834,5	87,0	9,6	0,0
Nov	841,6	87,0	9,7	0,0
Dec	820,0	84,9	9,7	0,0
Average	*853,4*			

Seasonal Index

Jan	*862,4*
Feb	*873,3*
Mar	*853,1*
Apr	*867,2*
May	*880,4*
Jun	*859,5*
Jul	*859,6*
Aug	*851,7*
Sep	*837,2*
Oct	*834,5*
Nov	*841,6*
Dec	*820,0*

CONSUMER SERVICES

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	217,9
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	35.835.078,7	2.986.256,6	62,9
Residual	231,0	10.969.057,8	47.485,1	
Total	243,0	46.804.136,5		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	412,3	47,6	8,7	0,0
Feb	398,3	47,6	8,4	0,0
Mar	372,3	48,7	7,6	0,0
Apr	356,3	48,7	7,3	0,0
May	361,5	48,7	7,4	0,0
Jun	368,6	48,7	7,6	0,0
Jul	379,5	48,7	7,8	0,0
Aug	376,2	48,7	7,7	0,0
Sep	369,2	48,7	7,6	0,0
Oct	388,1	48,7	8,0	0,0
Nov	401,1	48,7	8,2	0,0
Dec	415,3	47,6	8,7	0,0
Average	*383,2*			

Seasonal Index

Jan	*412,3*
Feb	*398,3*
Mar	*372,3*
Apr	*356,3*
May	*361,5*
Jun	*368,6*
Jul	*379,5*
Aug	*376,2*
Sep	*369,2*
Oct	*388,1*
Nov	*401,1*
Dec	*415,3*

HEALTH

Regression Statistics	
Multiple R	0,9
R Square	0,9
Adjusted R Squ	0,8
Standard Error	96,2
Observations	238,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	12.743.285,3	1.061.940,4	114,9
Residual	226,0	2.089.507,2	9.245,6	
Total	238,0	14.832.792,5		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	237,6	21,5	11,1	0,0
Feb	238,3	21,5	11,1	0,0
Mar	240,1	22,1	10,9	0,0
Apr	234,3	22,1	10,6	0,0
May	225,1	21,5	10,5	0,0
Jun	225,0	21,5	10,5	0,0
Jul	229,8	21,5	10,7	0,0
Aug	231,0	21,5	10,7	0,0
Sep	230,8	21,5	10,7	0,0
Oct	228,9	21,5	10,6	0,0
Nov	227,0	21,5	10,6	0,0
Dec	228,7	21,5	10,6	0,0
Average	*231,4*			

Seasonal Index

Jan	*237,6*
Feb	*238,3*
Mar	*240,1*
Apr	*234,3*
May	*225,1*
Jun	*225,0*
Jul	*229,8*
Aug	*231,0*
Sep	*230,8*
Oct	*228,9*
Nov	*227,0*
Dec	*228,7*

DIVERSIFIED FINANCIALS

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,7
Standard Error	172,2
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	21.659.896,4	1.804.991,4	60,9
Residual	231,0	6.850.267,7	29.654,8	
Total	243,0	28.510.164,1		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	294,0	37,6	7,8	0,0
Feb	305,3	37,6	8,1	0,0
Mar	301,6	38,5	7,8	0,0
Apr	307,9	38,5	8,0	0,0
May	303,3	38,5	7,9	0,0
Jun	298,0	38,5	7,7	0,0
Jul	299,4	38,5	7,8	0,0
Aug	296,3	38,5	7,7	0,0
Sep	290,4	38,5	7,5	0,0
Oct	292,1	38,5	7,6	0,0
Nov	298,2	38,5	7,7	0,0
Dec	295,7	37,6	7,9	0,0
Average	*298,5*			

Seasonal Index

Jan	*294,0*
Feb	*305,3*
Mar	*301,6*
Apr	*307,9*
May	*303,3*
Jun	*298,0*
Jul	*299,4*
Aug	*296,3*
Sep	*290,4*
Oct	*292,1*
Nov	*298,2*
Dec	*295,7*

TELECOMMUNICATION

Regression Statistics	
Multiple R	0,8
R Square	0,7
Adjusted R Squ	0,7
Standard Error	321,6
Observations	239,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	50.835.299,0	4.236.274,9	40,9
Residual	227,0	23.485.073,2	103.458,5	
Total	239,0	74.320.372,1		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	482,4	71,9	6,7	0,0
Feb	479,2	71,9	6,7	0,0
Mar	471,4	71,9	6,6	0,0
Apr	447,0	73,8	6,1	0,0
May	434,2	71,9	6,0	0,0
Jun	452,3	71,9	6,3	0,0
Jul	450,2	71,9	6,3	0,0
Aug	463,9	71,9	6,4	0,0
Sep	454,7	71,9	6,3	0,0
Oct	450,7	71,9	6,3	0,0
Nov	474,0	71,9	6,6	0,0
Dec	470,9	71,9	6,5	0,0
Average	*460,9*			

Seasonal Index

Jan	*482,4*
Feb	*479,2*
Mar	*471,4*
Apr	*447,0*
May	*434,2*
Jun	*452,3*
Jul	*450,2*
Aug	*463,9*
Sep	*454,7*
Oct	*450,7*
Nov	*474,0*
Dec	*470,9*

UTILITIES

Regression Statistics	
Multiple R	0,9
R Square	0,7
Adjusted R Squ	0,7
Standard Error	122,0
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	10.286.633,3	857.219,4	57,6
Residual	231,0	3.438.720,0	14.886,2	
Total	243,0	13.725.353,4		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	202,9	26,6	7,6	0,0
Feb	205,7	26,6	7,7	0,0
Mar	198,9	27,3	7,3	0,0
Apr	207,1	27,3	7,6	0,0
May	207,6	27,3	7,6	0,0
Jun	207,7	27,3	7,6	0,0
Jul	208,1	27,3	7,6	0,0
Aug	207,7	27,3	7,6	0,0
Sep	207,7	27,3	7,6	0,0
Oct	204,1	27,3	7,5	0,0
Nov	206,8	27,3	7,6	0,0
Dec	204,7	26,6	7,7	0,0
Average	*205,7*			

Seasonal Index

Jan	*202,9*
Feb	*205,7*
Mar	*198,9*
Apr	*207,1*
May	*207,6*
Jun	*207,7*
Jul	*208,1*
Aug	*207,7*
Sep	*207,7*
Oct	*204,1*
Nov	*206,8*
Dec	*204,7*

PHARMABIO	
Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	31,4
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	922.469,6	76.872,5	77,8
Residual	231,0	228.164,0	987,7	
Total	243,0	1.150.633,6		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	62,3	6,9	9,1	0,0
Feb	61,1	6,9	8,9	0,0
Mar	64,2	7,0	9,1	0,0
Apr	66,9	7,0	9,5	0,0
May	66,9	7,0	9,5	0,0
Jun	63,9	7,0	9,1	0,0
Jul	63,2	7,0	9,0	0,0
Aug	59,8	7,0	8,5	0,0
Sep	57,2	7,0	8,1	0,0
Oct	56,4	7,0	8,0	0,0
Nov	57,6	7,0	8,2	0,0
Dec	58,7	6,9	8,6	0,0
Average	*61,5*			

Seasonal Index	
Jan	*62,3*
Feb	*61,1*
Mar	*64,2*
Apr	*66,9*
May	*66,9*
Jun	*63,9*
Jul	*63,2*
Aug	*59,8*
Sep	*57,2*
Oct	*56,4*
Nov	*57,6*
Dec	*58,7*

INSURANCE	
Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	95,5
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	9.759.232,2	813.269,4	89,1
Residual	231,0	2.108.009,2	9.125,6	
Total	243,0	11.867.241,5		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	202,1	20,8	9,7	0,0
Feb	206,5	20,8	9,9	0,0
Mar	196,1	21,4	9,2	0,0
Apr	200,5	21,4	9,4	0,0
May	200,5	21,4	9,4	0,0
Jun	199,1	21,4	9,3	0,0
Jul	202,7	21,4	9,5	0,0
Aug	199,4	21,4	9,3	0,0
Sep	196,7	21,4	9,2	0,0
Oct	199,8	21,4	9,4	0,0
Nov	201,4	21,4	9,4	0,0
Dec	199,5	20,8	9,6	0,0
Average	*200,4*			

Seasonal Index	
Jan	*202,1*
Feb	*206,5*
Mar	*196,1*
Apr	*200,5*
May	*200,5*
Jun	*199,1*
Jul	*202,7*
Aug	*199,4*
Sep	*196,7*
Oct	*199,8*
Nov	*201,4*
Dec	*199,5*

REAL ESTATE

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	181,6
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	27.823.939,2	2.318.661,6	70,3
Residual	231,0	7.620.939,1	32.991,1	
Total	243,0	35.444.878,3		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	341,2	39,6	8,6	0,0
Feb	347,3	39,6	8,8	0,0
Mar	338,6	40,6	8,3	0,0
Apr	341,3	40,6	8,4	0,0
May	345,8	40,6	8,5	0,0
Jun	334,9	40,6	8,2	0,0
Jul	337,6	40,6	8,3	0,0
Aug	337,6	40,6	8,3	0,0
Sep	330,9	40,6	8,1	0,0
Oct	335,1	40,6	8,3	0,0
Nov	336,4	40,6	8,3	0,0
Dec	333,1	39,6	8,4	0,0
Average	*338,3*			

Seasonal Index

Jan	*341,2*
Feb	*347,3*
Mar	*338,6*
Apr	*341,3*
May	*345,8*
Jun	*334,9*
Jul	*337,6*
Aug	*337,6*
Sep	*330,9*
Oct	*335,1*
Nov	*336,4*
Dec	*333,1*

TRANSPORT

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	93,7
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	10.137.992,7	844.832,7	96,1
Residual	231,0	2.030.171,7	8.788,6	
Total	243,0	12.168.164,4		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	203,9	20,5	10,0	0,0
Feb	204,4	20,5	10,0	0,0
Mar	201,8	21,0	9,6	0,0
Apr	204,2	21,0	9,7	0,0
May	208,3	21,0	9,9	0,0
Jun	204,6	21,0	9,8	0,0
Jul	206,9	21,0	9,9	0,0
Aug	207,2	21,0	9,9	0,0
Sep	202,1	21,0	9,6	0,0
Oct	202,9	21,0	9,7	0,0
Nov	201,7	21,0	9,6	0,0
Dec	202,9	20,5	9,9	0,0
Average	*204,3*			

Seasonal Index

Jan	*203,9*
Feb	*204,4*
Mar	*201,8*
Apr	*204,2*
May	*208,3*
Jun	*204,6*
Jul	*206,9*
Aug	*207,2*
Sep	*202,1*
Oct	*202,9*
Nov	*201,7*
Dec	*202,9*

SOFTWARE AND SERVICES

Regression Statistics	
Multiple R	0,9
R Square	0,8
Adjusted R Squ	0,8
Standard Error	65,4
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	5.048.839,1	420.736,6	98,3
Residual	231,0	988.751,2	4.280,3	
Total	243,0	6.037.590,3		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	150,6	14,3	10,5	0,0
Feb	156,8	14,3	11,0	0,0
Mar	152,4	14,6	10,4	0,0
Apr	147,3	14,6	10,1	0,0
May	148,1	14,6	10,1	0,0
Jun	141,1	14,6	9,6	0,0
Jul	141,5	14,6	9,7	0,0
Aug	139,9	14,6	9,6	0,0
Sep	132,9	14,6	9,1	0,0
Oct	134,8	14,6	9,2	0,0
Nov	140,6	14,6	9,6	0,0
Dec	141,0	14,3	9,9	0,0
Average	*143,9*			

Seasonal Index

Jan	*150,6*
Feb	*156,8*
Mar	*152,4*
Apr	*147,3*
May	*148,1*
Jun	*141,1*
Jul	*141,5*
Aug	*139,9*
Sep	*132,9*
Oct	*134,8*
Nov	*140,6*
Dec	*141,0*

RETAIL

Regression Statistics	
Multiple R	0,8
R Square	0,7
Adjusted R Squ	0,7
Standard Error	215,4
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	23.606.243,1	1.967.186,9	42,4
Residual	231,0	10.717.003,6	46.394,0	
Total	243,0	34.323.246,7		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	319,9	47,0	6,8	0,0
Feb	323,5	47,0	6,9	0,0
Mar	303,8	48,2	6,3	0,0
Apr	317,5	48,2	6,6	0,0
May	301,2	48,2	6,3	0,0
Jun	306,5	48,2	6,4	0,0
Jul	307,4	48,2	6,4	0,0
Aug	306,8	48,2	6,4	0,0
Sep	303,4	48,2	6,3	0,0
Oct	306,3	48,2	6,4	0,0
Nov	326,0	48,2	6,8	0,0
Dec	315,3	47,0	6,7	0,0
Average	*311,5*			

Seasonal Index

Jan	*319,9*
Feb	*323,5*
Mar	*303,8*
Apr	*317,5*
May	*301,2*
Jun	*306,5*
Jul	*307,4*
Aug	*306,8*
Sep	*303,4*
Oct	*306,3*
Nov	*326,0*
Dec	*315,3*

MEDIA

Regression Statistics	
Multiple R	0,8
R Square	0,6
Adjusted R Squ	0,6
Standard Error	208,9
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	16.203.814,5	1.350.317,9	30,9
Residual	231,0	10.082.964,7	43.649,2	
Total	243,0	26.286.779,2		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	271,2	45,6	5,9	0,0
Feb	270,2	45,6	5,9	0,0
Mar	243,6	46,7	5,2	0,0
Apr	242,2	46,7	5,2	0,0
May	248,4	46,7	5,3	0,0
Jun	241,0	46,7	5,2	0,0
Jul	250,5	46,7	5,4	0,0
Aug	251,5	46,7	5,4	0,0
Sep	256,0	46,7	5,5	0,0
Oct	261,9	46,7	5,6	0,0
Nov	280,9	46,7	6,0	0,0
Dec	275,2	45,6	6,0	0,0
Average	*257,7*			

Seasonal Index	
Jan	*271,2*
Feb	*270,2*
Mar	*243,6*
Apr	*242,2*
May	*248,4*
Jun	*241,0*
Jul	*250,5*
Aug	*251,5*
Sep	*256,0*
Oct	*261,9*
Nov	*280,9*
Dec	*275,2*

TECHNOLOGY

Regression Statistics	
Multiple R	0,9
R Square	0,9
Adjusted R Squ	0,9
Standard Error	57,5
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	4.946.982,9	412.248,6	124,7
Residual	231,0	763.753,4	3.306,3	
Total	243,0	5.710.736,3		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	147,0	12,5	11,7	0,0
Feb	151,4	12,5	12,1	0,0
Mar	144,7	12,9	11,3	0,0
Apr	142,7	12,9	11,1	0,0
May	140,5	12,9	10,9	0,0
Jun	138,3	12,9	10,8	0,0
Jul	142,9	12,9	11,1	0,0
Aug	140,2	12,9	10,9	0,0
Sep	136,3	12,9	10,6	0,0
Oct	141,8	12,9	11,0	0,0
Nov	142,7	12,9	11,1	0,0
Dec	142,6	12,5	11,4	0,0
Average	*142,6*			

Seasonal Index	
Jan	*147,0*
Feb	*151,4*
Mar	*144,7*
Apr	*142,7*
May	*140,5*
Jun	*138,3*
Jul	*142,9*
Aug	*140,2*
Sep	*136,3*
Oct	*141,8*
Nov	*142,7*
Dec	*142,6*

BANKS

Regression Statistics	
Multiple R	0,8
R Square	0,7
Adjusted R Squ	0,7
Standard Error	528,8
Observations	243,0

ANOVA

	df	*SS*	*MS*	*F*
Regression	12,0	136.406.471,4	11.367.205,9	40,7
Residual	231,0	64.590.271,7	279.611,6	
Total	243,0	200.996.743,1		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	726,5	115,4	6,3	0,0
Feb	759,8	115,4	6,6	0,0
Mar	728,2	118,2	6,2	0,0
Apr	755,2	118,2	6,4	0,0
May	761,6	118,2	6,4	0,0
Jun	740,5	118,2	6,3	0,0
Jul	774,9	118,2	6,6	0,0
Aug	756,6	118,2	6,4	0,0
Sep	743,7	118,2	6,3	0,0
Oct	758,2	118,2	6,4	0,0
Nov	753,8	118,2	6,4	0,0
Dec	731,7	115,4	6,3	0,0
Average	*749,2*			

Seasonal Index	
Jan	*726,5*
Feb	*759,8*
Mar	*728,2*
Apr	*755,2*
May	*761,6*
Jun	*740,5*
Jul	*774,9*
Aug	*756,6*
Sep	*743,7*
Oct	*758,2*
Nov	*753,8*
Dec	*731,7*

FOOD

Regression Statistics	
Multiple R	0,8
R Square	0,7
Adjusted R Squ	0,6
Standard Error	290,3
Observations	243,0

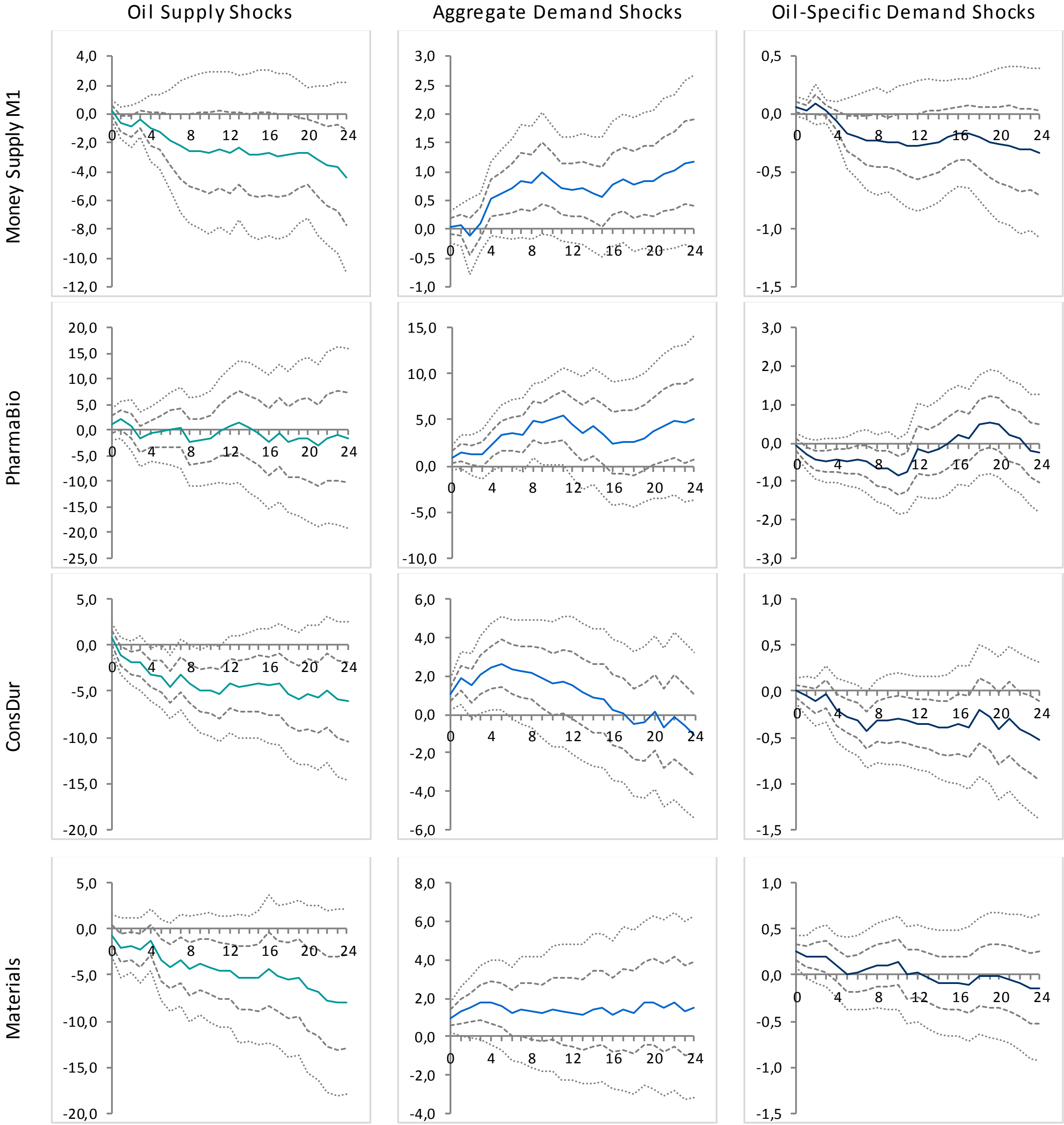
ANOVA

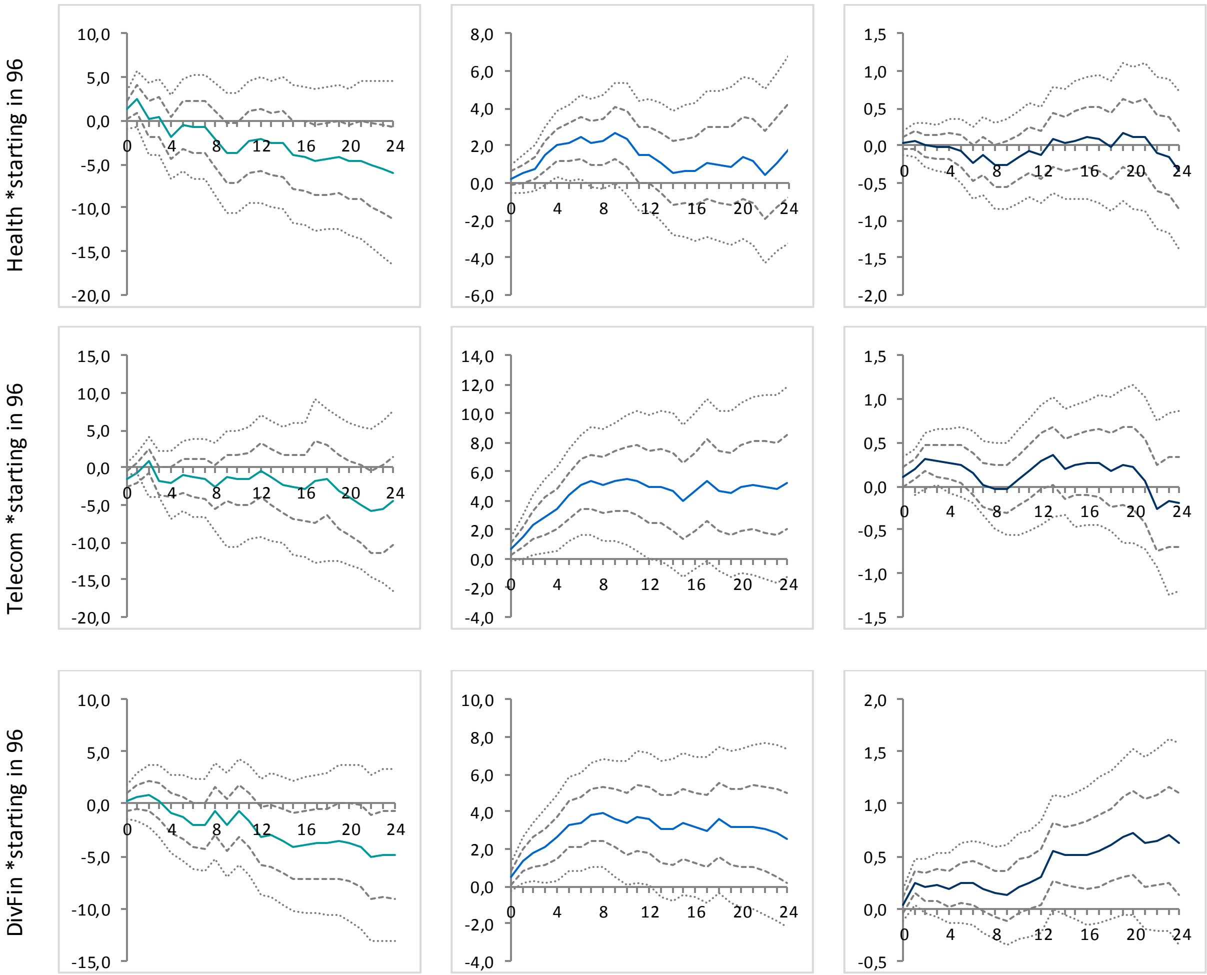
	df	*SS*	*MS*	*F*
Regression	12,0	36.767.875,2	3.063.989,6	36,4
Residual	231,0	19.466.269,3	84.269,6	
Total	243,0	56.234.144,5		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-	#N/A	#N/A	#N/A
Jan	397,2	63,3	6,3	0,0
Feb	415,1	63,3	6,6	0,0
Mar	368,6	64,9	5,7	0,0
Apr	382,8	64,9	5,9	0,0
May	388,0	64,9	6,0	0,0
Jun	392,5	64,9	6,0	0,0
Jul	395,1	64,9	6,1	0,0
Aug	384,1	64,9	5,9	0,0
Sep	382,7	64,9	5,9	0,0
Oct	386,2	64,9	5,9	0,0
Nov	387,0	64,9	6,0	0,0
Dec	385,2	63,3	6,1	0,0
Average	*388,7*			

Seasonal Index	
Jan	*397,2*
Feb	*415,1*
Mar	*368,6*
Apr	*382,8*
May	*388,0*
Jun	*392,5*
Jul	*395,1*
Aug	*384,1*
Sep	*382,7*
Oct	*386,2*
Nov	*387,0*
Dec	*385,2*

A6. Impulse Response Functions from Structural VAR 2 lags, Variables Not Analyzed




Health *starting in 96
Telecom *starting in 96
DivFin *starting in 96

A7. Variable Abbreviations

Code	Name
UR	Unemployment Rate
Interbank	Interbank 3m Offered Rate
TotExp	Total Exports
CPINOR	Norwegian CPI
OSEBX	Oslo Stock Exchange Benchmark Index
KRONE_TWI	Norwegian Krone Trade Weighted Index
GDP	GDP
GDP_mainland	GDP Mainland
GDP_oilocean	GDP Oil Activities and Ocean Transport

Code	Industry Group (GICS Classification Standards)
Food	Food, Beverage and Tobacco
Banks	Banks
Tech	Technology Hardware and Equipment
Media	Media
Retail	Retailing
SoftwServ	Software Services
Transport	Transportation
RealEst	Real Estate
Insurance	Insurance
PharmaBio	Pharmaceuticals and Biotechnology
Utilities	Utilities
Telecom	Telecommunication Services
DivFin	Diversified Financials
Health	Health Care Equipment and Services
ConsServ	Consumer Services
ConsDur	Consumer Durables and Apparel
ProfServ	Commercial and Professional Services
Capital	Capital Goods
Materials	Materials
Energy	Energy