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RELATIONSHIP BETWEEN OIL PRICE AND SECTOR INDEX RETURNS: EVIDENCE FROM NORDIC AND QATARI MARKETS

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TABLE OF CONTENTS **page**

LIST OF FIGURES AND TABLES page

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ABSTRACT

The purpose of this paper is to investigate the relationship between oil price changes and stock market returns. The paper examines how oil price fluctuations influence on the returns of industry-level indices in Nordic and Qatari markets. The purpose for studying both markets is the aim of being able to compare sector-level oil price correlations between the stock markets of oil-importers and oil-exporters. By comparing the oil price correlations between the Nordic and Qatari markets, it is possible to find out the possible market-specific relationships with oil as a commodity.

The study investigates the relationship between unexpected oil price changes and sector index returns by examining the seven available sector indices from Qatar Stock Exchange and 24 Nasdaq OMX Nordic sector indices. The examined oil price index is West Texas Intermediate Cushing. The indices are analyzed with both weekly and monthly returns for the period from April 2012 to September 2017. The study utilizes a standard market model that is expanded with the oil price factor in order to estimate the sector-level correlation coefficients for oil price sensitivity. In addition, the paper examines if the oil price sensitivity is asymmetric or not. The asymmetric model is included with a dummy variable to capture the correlations for both positive and negative unexpected oil price changes.

This paper contributes empirical findings to the study of Nandha and Faff (2008). The contribution of this paper is presenting more focused and detailed information of the relationship between oil price changes and market-specific industry-level stock indices. Based on the main findings of this paper, the oil price sensitivities are both sector-specific and market-specific. In contrast to previous studies, this paper presents empirical evidence that oil price correlations are mostly positive across industries in both Nordic and Qatari stock markets.

KEYWORDS: Oil price sensitivity, stock pricing, sector indices, Qatar, Nordic

1. INTRODUCTION

Oil is a remarkable source of energy and its price is followed closely around the world. As commodities in general, the price of oil is set in markets by its demand and supply. Oil differs from other commodities with its extraordinary group of suppliers. The supply of oil is considerably centered as the Organization of the Petroleum Exporting Countries (OPEC) covers a significant market share in the oil markets. When the supply of a commodity is centered, all the decisions that influences to the volume of supply have remarkable effect on the prices. Also political issues and natural phenomena can have an effect on the oil prices. During the last decades price of oil has experienced a lot of volatility.

The oil prices have fluctuated dramatically during the 2000s. At the beginning of the century the price for Brent crude oil quality was about 25 US dollars per barrel. By the year 2008 the oil price levels multiplied and the price for Brent quality reached 140 US dollars per barrel. (Kjärstad & Johnsson 2009: 442.)

During the past few years the fluctuations of oil prices have continued. For instance, the price levels collapsed only in eight months approximately 57% from 111 US dollars down to 48 US dollars per barrel between June 2014 and January 2015. In 2015 the price levels continued decreasing while the prices fell about 40% reaching the average price of 29,90 US dollars per barrel in January 2016. During the year of 2017 the crude oil prices have started to stabilize at the level of 50 US dollars per barrel. (Tuzova & Qayum 2016: 140; IMF 2016; OPEC 2017.)

As the oil price levels have changed dramatically during the last decades, it is necessary to research the impacts and consequences that the oil price changes are able to cause. Because oil is significantly important energy source for world's economy, the remarkable price level changes may cause unexpected issues globally. As the importance of oil as a commodity is significant, the oil prices are not ignorable. In the end, most of us are enjoying from the by-products and end products of oil such as heating, industrial products and fuel in transportation in daily basis. In addition, according to OPEC (2017: 41) the total world demand for oil in 2017 is 96,8 million barrels per day. This means that the size of oil business with this trading volume and the current average price of 50 US dollars per barrel is over 4,8 billion US dollars in daily basis. Therefore, it is reasonable to expect that oil price fluctuations do matter.

1.1. The purpose of the study

As energy is one of the typical costs that every company have to face, it is reasonable to expect that when the price of oil increases, the energy costs get higher and the profitability of businesses tend to decrease, and vice versa. On the other hand, some industries may benefit from higher oil price levels. Overall, because oil is often associated with companies' expense or income structures, changes in oil prices should reflect to their profitability, stock prices and industry indices.

The purpose of this study is to investigate if the oil price changes have influence on stock returns. More specifically, the paper examines the effects of oil price changes on the returns of industry indices. In addition, the purpose of this paper is to contribute the empirical findings studied by Nandha and Faff (2008).

Nandha and Faff (2008) study the relationship between oil price changes and the returns of 35 industry indices. In the study they examine global industry-level index returns for the period from April 1983 to September 2005. In contrast to their study, this paper examines the effect of oil price changes on the sector indices of both Nasdaq OMX Nordic and Qatar Stock Exchange. The both Nordic and Qatari sector indices will be examined for the period from April 2012 to September 2017. Therefore, in contrast to the study of Nandha and Faff (2008), this paper will provide empirical results for more specific markets and with the latest data. In addition, instead of examining only monthly returns, this paper will study the relationship by using data with both weekly and monthly returns of the sector indices.

The purpose for examining both Nordic and Qatari sector indices is to find out possible differences in oil price correlations between the similar sector indices of these markets. The opposition of these two markets is reasonable since the relationship with oil differs between these markets. According to the International Energy Agency (2014), the included countries of the Nasdaq OMX Nordic indices (i.e., Finland, Sweden, Denmark and Iceland) do not have their own oil production and, therefore, they can be categorized to oil-importers. In contrast, as Qatar is one of the OPEC members it can be categorized to oil-exporters. In fact, according to Ulussever & Demirer (2017: 78), Qatar is the most oil-dependent Gulf Cooperation Council country since the contribution of oil to its gross domestic product is higher than in other GCC economies. Thus, the opposition of the markets of this paper is between oil-importers and oil-exporters while the Nordic indices represent oil-importer markets whereas the Qatari indices represent oil-exporter markets.

As the paper examines sector indices from two different markets that have different relationships with oil, the possible contribution of this paper to the previous empirical results is finding empirical evidence for the differences between these two markets. It is interesting to find out if similar sector indices correlate differently with oil price changes in different markets.

1.2. Previous main studies

Several researchers have investigated the influences of oil price changes on stock returns. Based on the studies presented in the fifth chapter of the paper, oil price can be considered as both macroeconomic and microeconomic factor.

The oil price movements have various impacts in different industries. Faff and Brailsford (1999) research the relationship between Australian industry and oil prices over the period 1983-1996. They find the relationship statistically significant while the energy industry seems to benefit from the increased oil prices while the paper, packaging and transport industries suffer the most.

Also Al-Mudhaf and Goodwin (1993) find significant relationship between energy companies and oil prices while they investigate the returns of 29 listed oil companies during an oil price shock in 1973. In the study they use the arbitrage pricing theory to see if investors' included the risk of oil in the market risk as a macroeconomic factor. According to their study, the market risk was included by oil price risk temporarily during the price shock.

Nandha and Hammoudeh (2007) examine the influence of oil price changes on stock market returns for fifteen Asia-Pacific countries. Based on their findings, only the stock markets of Philippines and South Korea are statistically significantly affected by oil price changes.

Nandha and Faff (2008) investigate the relationship between oil price changes and industry-level index returns by using 35 global industry indices provided by Datastream. In the paper they examine monthly returns for the period from April 1983 to September

2005. They estimate the relationship by using a standard market model that is expanded with an oil price factor. Their model assumes that the possible relationship can be revealed by estimating the sensitivity of a sector index to unexpected changes in market and oil price indices. In other words, if a sector index is statistically significantly influenced by unexpected change in oil price, there is an evidence of the relationship. They find negative correlations to all other industries except the mining and energy industry.

In addition, Nandha & Faff (2008) investigate if the sector indices have asymmetric correlation with the unexpected oil price changes. They utilize a dummy variable in the asymmetric model to capture the specific correlations for both positive and negative unexpected changes in oil prices. Their findings suggest that oil price factor has mostly significant effect on global industry-level index returns and the effect is symmetric in most of the industries.

1.3. Development of hypotheses

This study investigates the relationship between oil price changes and industry-level stock returns. By estimating the standard market model presented in the methodology, the aim is to find out if the sector indices are statistically significantly influenced by oil price returns. The estimations will be done for available sector indices in both Nasdaq OMX Nordic and Qatar Stock Exchange markets. In addition, the estimations will be done with both weekly and monthly data. The results of the first equation will either reject or accept the following four hypotheses of the paper:

H0: Oil price returns have not statistically significant influence on sector indices.
H1: Oil price returns have statistically significant influence on sector indices.
H2: Correlations between oil price and sector index returns vary across industries.
H3: Oil price coefficients for weekly returns are the same with oil price coefficients for monthly returns.

As the null hypothesis suggests no significant correlation, the first hypothesis assumes that the sector index returns are influenced by changes in oil prices. According to the second hypothesis, oil price changes influence differently on different industries. The first and second hypotheses are in line with the findings of previous studies assuming that the sector indices from Nordic and Qatari stock markets are similarly influenced by the oil factor as previously studied sector indices.

The third hypothesis of the paper assumes that the correlation coefficients are the same with weekly and monthly returns. By using this hypothesis, the paper tests the efficiency of the examined markets. According to the theory of market efficiency, if the stock returns are influenced by oil price changes, stock prices should reflect the information of oil price changes immediately and correctly. Therefore, the correlations should not vary between weekly and monthly returns.

The second equation of the paper, asymmetric model, examines with a dummy variable if the possible relationship between oil price and sector index returns is asymmetric. The results of the asymmetric model either reject or accept the following hypothesis:

H4: The sector indices have symmetric sensitivity for oil price (i.e. $\gamma_{ui} = \gamma_{di}$).

The fourth hypothesis of the paper assumes that the sector indices do not have asymmetric correlations with the returns of oil price index. According to Nandha and Faff (2008), most of the global sector indices have symmetric sensitivity for oil price changes. In this paper Qatar Stock Exchange and Nasdaq OMX Nordic represent different kind of stock markets and, therefore, this paper is motivated to test if the possible oil price sensitivities are symmetric also in these markets.

Furthermore, because the models will be estimated for the available sector indices in both Nordic and Qatari stock markets, it is possible to compare the results of these different markets. While the countries behind the Nasdaq OMX Nordic indices are oil-importers and Qatar is an oil-exporter, it is interesting to notice if their sector indices share different oil price sensitivity with each other. Therefore, the results of this paper are able to either accept or reject the following hypothesis:

H5: The correlations between oil price and sector index returns vary in Nordic and Qatari stock markets when comparing indices that represent similar industries.

According to Nandha and Hammoudeh (2007), the oil price sensitivity may vary across stock markets. Therefore, the fifth hypothesis of the paper assumes that the correlations between oil price and sector index returns vary in Nordic and Qatari markets. However, since the available data for Nordic and Qatari indices are different, accepting or rejecting this hypothesis may have its difficulties. The reason for this is the fact that the Nordic stocks are categorized into 24 sector indices whereas the Qatari stocks are categorized only into 7 sector indices. Therefore, this hypothesis is applied only for the industries that have similar counterparts in both markets.

1.4. The structure of the paper

The paper is divided into eight main chapters. As the first chapter of the paper is introduction, the second chapter presents oil as a commodity including the information of oil reserves, historical prices, oil pricing, demand and supply and also the introduction of OPEC. In addition, the second chapter presents the oligopolistic characteristics of oil markets.

The third chapter presents the basics of the theory of stock pricing. By presenting the main stock pricing models, the chapter determines the most important factors that have influence on stock prices. The fourth chapter of the paper is based on the theory of financial market efficiency. The chapter presents the idea of perfect and efficient markets as well as their theoretical requirements for the stock markets.

The fifth chapter presents the literature review of the studies that investigate the relationship between oil price changes and stock returns. The chapter includes studies from 1983 to 2016. The sixth chapter of this paper presents the data and methodology that are used to examine the relationship between unexpected changes in oil prices and industry-level index returns. The seventh chapter presents the empirical results of the study whereas the last chapter concludes the main findings of this paper.

2. OIL AS A COMMODITY

Oil is currently the most important energy source of modern civilization. It is widely used as an ingredient in many industrial products and as an energy source in civilization’s transport system and highly productive agriculture. In 2014 oil had the biggest market share of the world’s energy demand in fuels with 31,5% while the total fossil fuel market share was 82% leaving the rest 18% for nuclear, hydro, biomass and other renewable energy sources. Based on the forecasts the market share of oil will decrease to 25,2% by the year 2040 while gas, nuclear and renewables will face increase in their demand. Nevertheless oil will still maintain its position as one of the most important energy sources in the world. The importance of oil forces geologist, economist and political scientists to research the production, exploitation, supply, demand and pricing of oil. (Matutinovic 2009: 4251; OPEC 2015: 9.)

Around the world there is over 160 traded crude oils with different qualities and characteristics. The two most traded oil contracts on a physical commodity are WTI (West Texas Intermediate) and Brent crude oil (Fattouh 2010: 334–335).

2.1. World’s oil reserves

The total amount of world’s oil reserves is challenging to be estimated and it can be said that nobody knows the exact number of the reserves. For example the estimates of total oil reserves only for the five major OPEC members and Russia vary from about 440 to almost 800 billion barrels. Those estimates are made between 2005 and 2007. The fact is that the amount of new discoveries has decreased remarkably since the 1960s. In the past it was possible to compensate and justify the produced oil as discovering new oil reserves while production was slower than discovering. As the discovering of new oil reserves are declining the growing demand of oil is depending on costs, oil prices, improving technology and access to reserves. (Kjärstad & Johnsson 2009: 441–464.)

It is estimated that the total conventional resources are 2 715 billion barrels in the world. The conventional resources include 2 239 billion barrels crude oil. The total unconventional resources are 3 296 billion barrels. Therefore, the total resources in the world would be 6 010 billion barrels while 1 699 billion barrels are proven reserves. (IEA 2014: 111.)

The unconventional oil resources become more interesting when improving technology enables utilizing the resources with competitive costs (Kjärstad & Johnsson 2009: 452). Loutia, Mellios and Andriosopoulos (2016: 262–263) list the main proven unconventional resources that are US shale oil, Canada's tar sands, Brazil's deep-sea offshore oil, Venezuela's heavy oil and Arctic offshore oil. Based on the information of the research these mentioned resources with other unconventional resources are estimated to cover approximately 50% of the found global oil and gas reserves. However, Matutinovic (2009: 4252) points out that oil is a non-renewable resource and therefore with continuous consuming someday it will be out of stock.

2.2. The history of oil prices

The oil price levels have varied a lot over time and oil markets have also faced several crises. The two most known oil crises were in 1973 and 1978. In 1973 during Yom Kippur war OPEC members, Egypt and Syria decided to reduce oil production monthly by 5% and ban oil from Israel supporters. This decision multiplied oil prices from 2,59 US dollars to 11,65 US dollars per barrel in less than six months. In 1978 the Iranian Revolution drove Iran into a crisis that caused a remarkable reduction in its oil production and reduced the total world oil production by 10%. This together with the war between Iran and Iraq almost tripled oil prices in three years. (Kesicki 2010: 1597.)

In the early 2000s the market price for Brent crude oil was around 25 US dollars per barrel. After couple years of increasing demand with decreased supply caused mainly by political conflicts started to raise the price levels of oil. From January 2004 to July 2008 the prices multiplied from 31 US dollars per barrel to more than 140 US dollars per barrel. The historically high oil price of 140 US dollars per barrel may caused increasing interests for alternative energy sources and slowed the growth of oil demand. (Kjärstad & Johnsson 2009: 442.)

During the past decade the oil prices have faced dramatic changes. First the increasing demand of developing countries and other growing economies together with conflicts in major oil exporting countries like Iraq created a classic scenario of over-demand. When suppliers were not able to follow the growing demand, the oil prices started to get higher. High prices drove oil companies to utilize unconventional oil resources with new production methods and increased the supply. Over the last two years the oil demand started to slow down because of the weak economic growth and new efficiency measures. At the same time oil producers decided to increase the production amount that developed a market surplus for oil. This caused a significant reduction in oil price levels while the Brent crude oil fell from 111 US dollars per barrel down to 48 US dollars per barrel between June 2014 and January 2015. (Tuzova & Qayum 2016: 140.)

Furthermore, oil prices continued decreasing in 2015. The prices declined almost 40% in one year and the average crude oil price was 29,90 US dollars per barrel in January 2016. The reason behind the decreasing price levels was that OPEC members maintained their high supply and markets worried the prospects for future demand. During the year of 2017 the crude oil prices have started to stabilize at the level of 50 US dollars per barrel since OPEC and non-OPEC countries have started to agree limiting the oil supply in order to decrease the surplus of the world oil stocks. (IMF 2016; OPEC 2017.)

2.3. Oil pricing as a commodity

Oil prices are determined in commodity markets by several factors such as demand, supply, world economy growth rate, political instability of oil exporting countries, new production methods, oil reserves, the value of US dollar currency and the speculations in the oil futures markets. Therefore the pricing of oil is very complex process and forecasting the prices is very challenging. (Matutinovic 2009: 4253.)

The world oil markets can be observed as one large market where oil prices are connected to each other despite the fact that there are several different crude oils on the market. The crude oil prices may vary based on the quality and region of the oil. (Fattouh 2010: 334–341.)

Based on the theory of commodity market pricing the prices are influenced by demand and supply of the commodity. On the Figure 1 increasing demand and decreasing supply push the price levels higher while the increased supply and decreased demand have negative influence on commodity prices. If the demand increases while supply remains stable the commodity prices rise and if the demand decreases the prices go down. If the supply increases while demand remains stable the market price for commodity declines and if the supply decreases the price level starts to get higher. When the supply or demand increases their curves move to the right and if they decrease the curves move to the left. The price level where the demand and supply curves meet is called the equilibrium price. Therefore the market price for commodities is based on the equilibrium of market demand and supply. (Varian 2010: 297–298.)

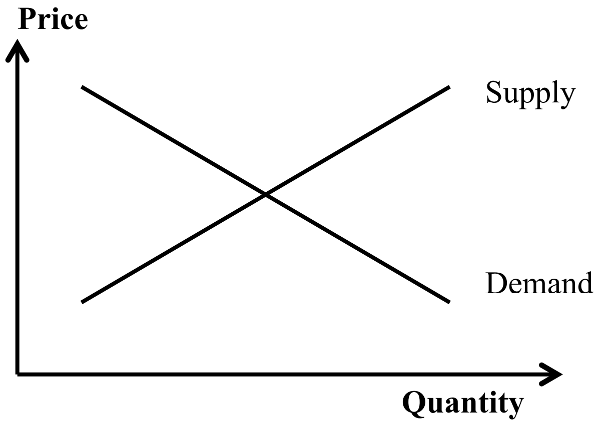


Figure 1. Commodity pricing (Varian 2010: 298–311).

Oil prices are partly determined by the factors of demand and supply. Therefore understanding the behavior of supply and demand curves is necessary while considering the market price movements of oil.

2.4. Demand and supply of oil

The total world demand of oil was 91,3 million barrels per day in 2014. According to the forecasts the demand is going to increase 18,4 million barrels per day or approximately 20,2% to 109,8 million barrels per day by the year 2040. The forecasted future demand increase is mostly based on the developing countries. The demand of developing countries is forecasted to increase 25,8 million barrels per day from the demand of 2014 40,3 million to 66,1 million barrels per day by the year 2040. The demand of OECD (Organisation for Economic Co-operation and Development) countries is forecasted to decrease 8,0 million barrels per day from 45,8 million to 37,8 million barrels per day. According to the forecasts, the growth in oil demand is mainly based on road transportation, petrochemicals and aviation sectors while developing countries especially China and India with their emerging economies represent important role for growing oil demand as well. (OPEC 2015: 11–12.)

The most important oil suppliers in the world in 2014 were OPEC countries with 38,9 % market share, the United States and Canada with 18,7% market share and Russia with the market share of 11,6%. The total world supply of oil was 92,4 million barrels per day in 2014. The total OPEC oil production was 35,9 million barrels per day while the non-OPEC countries produced 56,5 million barrels per day. (OPEC 2015: 14.)

Based on the long-term forecasts the world oil supply is going to increase 17,6 million barrels per day or approximately 19,0% to 110 million barrels per day by the year 2040. This supply increase is mainly based on OPEC production. According to the forecasts OPEC will increase its oil supply 14,3 million barrels per day by the year 2040 while the same number for non-OPEC countries is only 3,2 million barrels per day. Based on the estimations oil-related investments of 10 trillion US dollars are required to cover the future oil demand by the year 2040. (OPEC 2015: 14–15.)

2.5. The power of OPEC

OPEC (Organization of the Petroleum Exporting Countries) is an intergovernmental organization that is established in 1960. The mission of OPEC is to coordinate its members' petroleum policies and ensure the stabilization of oil markets. In addition OPEC aims to maintain the continuous and efficient petroleum supply to consumers without decreasing the profitability of its members' petroleum industry. OPEC represents its 13 member countries including Algeria, Angola, Ecuador, Indonesia, the Islamic Republic of Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela. (OPEC 2016.)

The total supply of OPEC in 2014 was 35,9 million barrels per day when the total world supply were 92,4 million barrels per day including liquid energy sources such as tight crude oil, biofuels and natural gas liquids. Based on these numbers OPEC's market share of the total world supply was approximately 38,9% in 2014. OPEC has forecasted to increase its daily supply to 50,2 million barrels by the year 2040 increasing the market share to 45,6% of the forecasted total world supply of 110 million barrels per day. (OPEC 2015: 13–14.)

While the market share of OPEC in world's oil production is significant several researchers are willing to find out if the power of OPEC have an effect on oil markets. Loutia et al. (2016) investigate the effect of OPEC decisions of increasing, cutting or maintaining the oil production on both WTI and Brent crude oil prices. Based on their findings there is a link between OPEC decisions and oil price changes but the effects change over time depending on production decisions and oil prices. According to the study OPEC's decisions are most influential when oil prices are low and unconventional resources are not in use.

Even though OPEC seems to have an influential power to oil prices making the decisions about oil production may be challenging. With lower oil prices OPEC could decrease the market share of competing high-cost production but at the same time it would cause reduction in oil business revenues of its member countries. This dilemma forces OPEC to re-decide its agenda to be either market share increase or profit maximization. While technology improves and becomes less expensive the position of unconventional oil resources may increase making it more influential in the future. This scenario could harm the power of OPEC but currently the power of OPEC exists. (Loutia et al. 2016: 270–271.)

2.6. Oligopolistic markets

Oligopoly is a form of market structure with a few competitors where these competitors can have an influence on the market prices. Under oligopolistic competition a small number of companies are able to make strategic decisions that have foreseeably significant effect on the market price formation. (Varian 2010: 497.)

Typically on oligopolistic markets competitors have homogeneous products and companies' main interests are based on the market price and production quantity. Therefore competitors' strategic decisions are made on the prices and quantities. (Varian 2010: 498.)

2.6.1. Game theory

Under oligopolistic competition the strategic decisions of market participants can lead to three different market games that form the levels of competition. These games are called a sequential game, simultaneous game and cooperative game. In the sequential game the market participants make their decisions on prices and quantities after each other. In this game there is price leader, price followers, quantity leader and quantity followers and those positions are based on the order who makes the decision first. (Varian 2010: 498.)

In the simultaneous game the market participants make their decisions on prices or production quantities without knowing their competitors' decisions. The participants make their decisions simultaneously while the decisions are based on the guesses about competitors' next move. (Varian 2010: 498.)

In the cooperative game market participants decide not to compete against each other. Participants cooperate and make the decisions on prices and supplied quantities together. Therefore they are able to ensure that their business operations are as lucrative as possible. (Varian 2010: 498.)

2.6.2. Oligopolistic oil markets

According to OPEC (2015) its market share in the world oil markets was 38,9% while the United States and Canada had 18,7% and Russia 11,6% in 2014. The total share of these market participants was 69,2%. Therefore oil markets can be observed as oligopolistic markets because there are only a few market participants who cover majority of the total production.

According to Fattouh (2010: 334–335) oil is traded with numerous qualities and characteristics but the oil markets can be observed as a one large market. Based on this information oil can be considered as a homogeneous product which is typical for oligopolistic markets.

Oil markets differ from pure oligopolistic markets by the fact that market prices are formed on the exchange markets where oil contracts are traded. Therefore the market suppliers are not able to make decisions on the exact prices. On the other hand suppliers are able to decide their production quantity and have effect on the market prices.

The oil markets can be considered as a combination of the sequential game and cooperative game that were presented on the game theory part. As in the sequential game oil market suppliers make their decisions on their supply after each other. The information of those decisions are available for all immediately after the announcements when the other suppliers start to make their decisions on whether they increase, maintain or cut their production levels. As in the cooperative game oil markets do also have suppliers with contracts that determine the production levels. For example, OPEC operates as a cartel for its members because it announces the production levels that the members have agreed together and they should follow. In addition, as said before, one of the main missions of OPEC is to maintain the profitability of its members' petroleum industry.

Based on the mentioned information the oil markets can be considered as oligopolistic markets where its suppliers have more influence on market prices than they would on a market with pure competition. Therefore it can be concluded that the major oil producers are able to have an effect on oil price formation and play significant role behind the market price movements of oil.

3. STOCK PRICING

Before examining the relationship between oil price changes and stock returns, it is reasonable to present the valuation models how stocks are priced in the stock markets. After all, the paper examines if oil price changes have an influence on stock prices because of the possible change in companies' profitability.

The first thing that has to be considered when pricing stocks, is to determine what the ownership of stocks means. Companies are owned by a certain number of stocks and a stock gives an ownership of the underlying company to its owner. Company ownership gives a right to the profits of the company and power for decision-making. Usually investors are interested in the profits and cash flows that are generated by the stock ownership. Investors buy stocks expecting to receive dividends and gain the value of the invested capital (Brealey et al. 2011: 106). As stock valuation models are associated with stock returns, the determinations for stock returns, nominal and real returns, are presented before the valuation models.

3.1. Return of a stock

The nominal return of a stock can be determined by summarizing the paid dividends and the difference between the current price and the paid price, as follows (Martikainen 1995: 71):

(1) $$R_N = \frac{P_1 - P_0 + D_T}{P_0},$$

where R_N is nominal return, P_0 is paid stock price, P_1 is current stock price and D_T is total of received dividends.

If the investment period is longer than one year, the compound interests should be taken into account to the return of the stock. This means that the cash flows are reinvested by the investor to increase the future cash flows. If the rate of return is the same every year, the nominal return could be calculated with the formula of (Martikainen 1995: 72):

(2) $$R_N = \frac{P_0 \times (1+r)^t}{P_0},$$

where r is rate of return and t is time in years.

For an investor the more relevant information instead of the nominal return is the real return. The real return takes into account the effect of inflation. Therefore, the real return is more realistic indicator to the added value on the investment. The real rate of return can be calculated with the formula of (Martikainen 1995: 72):

(3) $$R_R = \frac{P_0 \times (1 + R_N)}{P_0 \times (1 + r_i)},$$

where R_R is real return and r_i is rate of inflation.

3.2. Stock values

Companies are not committed to pay dividends to stockholders. Therefore stock valuation includes uncertain factors. Investors' discount rates and possible future cash flows are unpredictable. When the values of stocks are evaluated, these factors have to be estimated as properly as possible. (Knüpfer & Puttonen 2007: 88–89.)

Stocks have two different values at the same time. These values are book value and market value. The book value can be evaluated with the information of liabilities on the balance sheet. The information of assets and therefore also the book value updates every time when the company announces its new financial report. The book value includes the invested equity and the total amount of the profits. Therefore the book value is based on the historical information of the company. It may be determined differently because of different policies in companies' financial statements. The book value per stock is (Knüpfer & Puttonen 2007: 89–90):

(4) $$BV_s = \frac{E_i + P_T}{S_n},$$

where BV_s is book value per stock, E_i is invested equity, P_T is total profits and S_n is number of shares.

The more relevant value for stockholders is the market value that is determined everyday by the supply and demand on the stock exchange markets. The market value reflects the real current value of the stock and the value of investment. The market price includes the expectations of the future cash flows to stockholders from the company.

Therefore the market price is a value that indicates the future of the company. (Knüpfer & Puttonen 2007: 89.)

3.3. Stock pricing models

The price of the stock is based on the present value of the future cash flows. Therefore, the pricing includes the estimations of cash flows and discount rates. The main challenge in pricing is to estimate the cash flows that investors get from the company. These cash flows are mainly dividends that are part of the annual profits or the capital that can be paid to stockholders. In addition, investors are paid dividend, it can also be assumed that investors receive money when they sell the stocks. (Knüpfer & Puttonen 2007: 90.)

Growing cash flows increase the value of the stock and negative cash flow changes decrease the stock value. The expectations of future cash flows may change because of changes in the company's profits, the value of currency and the taxation of dividends. If the stock markets are efficient, similar factors like these should have an effect on market prices immediately. (Martikainen & Martikainen 2009: 104.)

Another significant factor in stock pricing is the investor's discount rate. The discount rate is the minimum return that investor demands from the investment. The discount rate is determined by the risk of the investment. Higher risk leads to higher discount rate that decreases the value of the stock. (Martikainen & Martikainen 2009: 105.)

Stock pricing is usually challenging because estimating company's long-term cash flows, dividends and/or profits is uncertain. If these factors can be assumed to be at the same level, or growing steadily, the stock pricing models are reliable. (Nikkinen et al. 2002: 154.)

3.3.1. Dividend discount model

In practice, the received dividends are the only cash flows that investors get from the stock investments. The dividend discount model is based on the dividend cash flows in stock pricing. According to the model the stock price is equal to the future dividends that are discounted with the discount rate, as follows (Nikkinen et al. 2002: 149–150):

(5) $$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots,$$

where P_0 is stock price, D_t is future dividends and *r* is the discount rate.
The model assumes that the dividends are an endless stream of annual cash flows. According to Knüpfer & Puttonen (2007: 91), if the number of dividends is limited, and it can be assumed that the stock remains valuable in the end of the investment period, the formula is:

(6) $$P_0 = \frac{D_1}{(1+r)^1} + \cdots + \frac{D_n}{(1+r)^n} + \frac{P_n}{(1+r)^n} = \sum_{t=1}^{n} \frac{D_t}{(1+r)^t} + \frac{P_n}{(1+r)^n},$$

where D_n is dividend of the last year and P_n is the forecasted stock price in the end of the investment period.

If the dividends are an endless stream of annual cash flows and do not increase in time the formula is:

(7) $$\mathrm{P_0} = \frac{\mathrm{D}}{\mathrm{r}}.$$

If the future dividends increase every year with the same growth rate, the formula is:

(8) $$P_0 = \frac{D_1}{r-g},$$

where *g* is the growth rate.

According to the formula the stock price is next year's dividends divided by the difference between the discount rate and the dividend growth rate. This model is called the Gordon growth model. Based on the model, the discount rate decreases the stock price while the dividend growth rate increases the price. (Nikkinen et al. 2002: 150.)

When the dividend discount model is used in stock pricing, the dividends are usually forecasted for couple of years. After the last forecasted dividend, the future dividends are assumed to grow infinitely with a stable growth rate. Since forecasting the dividends for the first years is assumed to be easier than forecasting for 10 years, the resulted stock price is more realistic. (Nikkinen et al. 2002: 150.)

Although the dividend discount model is theoretically appropriate, using it is difficult. Forecasting the future dividends is challenging and only one little error in estimations may conclude to significantly different stock price. Also the dividend payment policy of a company may differ over time, especially if the company is growing. (Nikkinen et al. 2002: 151–152.)

3.3.2. Free cash flow model

In the free cash flow model the stock price is the present value of free cash flows. Free cash flow is the amount of cash that is payable to investors after the necessary investments for future growth. If a company is growing fast, the free cash flow can be negative. The benefit of the model is that free cash flows are not affected by the dividend payment policy of a company. Therefore the risk for estimation error in calculations are lower with free cash flows than dividends. (Brealey et al. 2011: 118; Nikkinen et al. 2002: 152.)

Before the stock price can be calculated with the free cash flow model, it is necessary to solve the free cash flows of the company. The calculation model for the free cash flow that is available to equity holders is presented on table 1.

Earnings before interest and taxes
- Corporate taxes
+ Depreciation
- Capital expenditures
- Increase in net working capital
- Interest expense
+ Corporate taxes on interest expense
+ Increases in net debt
= Free cash flow available to equity holders

Table 1. Calculation for free cash flow (Bodie, Kane & Marcus 2014: 618).

When the free cash flows are known, it is possible to calculate the present value of the equity by discounting the free cash flows with the discount rate. The formula is (Nikkinen et al. 2002: 153):

(9) $$P_0 = \frac{FCF_1}{1+r} + \frac{FCF_2}{(1+r)^2} + \frac{FCF_3}{(1+r)^3} + \cdots,$$

where P_0 is stock price, FCF_t is free cash flow and r is discount rate.
In practice, the free cash flow model is used similarly with the dividend discount model. At first, the free cash flows are forecasted for couple of years, and then they are assumed to grow infinitely with a stable growth rate. Using free cash flow model is challenging because forecasts of cash flows are uncertain. If a company is growing rapidly, its cash flows may be negative for a long time. (Nikkinen et al. 2002: 153–154.)

3.3.3. Economic value added model

The economic value added model is based on discounting the company profits. The model uses the calculations of residual income. Residual income is the amount of how much the net present value of a company is added after an investment. If the returns of an investment are reduced by its costs, the outcome is residual income. The purpose of the residual income is to show the ratio of return on equity to the required return. (Nikkinen et al 2002: 154–155.)

Economic value added model calculates the annually added values on equity. According to the model, if the annual added values are positive, the value of the company is higher than the current book value. Therefore, the value of the company consists of the book value and the present value of future added values. The formula of the model is (Nikkinen et al 2002: 155.):

$$(10) \qquad P_0 = BV_0 + \frac{ab_1}{1+r} + \frac{ab_2}{(1+r)^2} + \frac{ab_3}{(1+r)^3} + \cdots,$$

where BV_0 is the book value, ab_t is added value on year t and r is required rate of return.

Before calculating the stock price, the annual added values have to be estimated. These estimations require the forecasts of annual profits and book values. The formula needed to calculate the added value is (Nikkinen et al 2002: 156):

$$(11) \qquad ab_t = EPS_t - r \times BV_t,$$

where EPS_t is earnings per share on year t.

In practice, the economic value added model is used similarly with the dividend discount model and free cash flow model. Usually, the estimations for annual profits and book values are made for couple of years and then assumed stable growth to infinity. When estimating the annual book values, the future profits and dividend payout ratio have to be forecasted. The dividend payout ratio determines the amount of profits that increases the book value after the dividend payment. (Nikkinen et al. 2002: 156.)

It can be concluded that economic value added model is more practical than the other models that are presented in this paper. The model is based on the future book value and profits that are more easily available than estimations for future dividends or cash flows. The first book value is available on the balance sheet. If the evaluated company is quoted on the stock exchange markets, the profit forecasts are made by numerous stock analysts. When the book value is used in the stock price calculations, the estimation errors in profits do not affect significantly the final price. (Nikkinen et al. 2002: 152–158.)

Even though the model can be beneficial, it is not perfect. The problems that can be linked to the usefulness of the model are in the estimations. The differences in financial statement policies may effect on the profits and added values. The book value may not reflect the real current value and some companies may not even have potential book value for the calculations because of a different business form. (Nikkinen et al. 2002: 158.)

3.4. Determination of discount rates

Based on the stock pricing models the stock prices are influenced by the discount rates. Therefore it is necessary to understand the formation of discount rates. The discount rates can be used as the required rates of return that include investors' risk on the investment.

3.4.1. Capital asset pricing model

The Capital Asset Pricing Model (later CAPM) is presented by William Sharpe, John Lintner and Jack Treynor in the 1960s. The CAPM assumes that the risk of stocks can be divided into two separate factors that are the specific risk and the market risk. The specific risk includes the singular risk factors of the stock while the market risk includes all the market-based risks that are common for all stocks. Investors are able to eliminate the specific risk by the diversification of the stock portfolio and therefore it can be ignored. (Brealey et al. 2011: 213–221.)

The CAPM divides the expected rate of return on a stock into two separate rates that are the risk-free rate of return and the rate of market return. The total risk of a stock can be determined when the sensitivity of a stock for market movements is known. The coefficient for this sensitivity is called beta. According to the CAPM the expected rate of return on a stock is the sum of risk-free rate of return and expected risk premium on market that is multiplied by the stock-specific beta coefficient. The formula for CAPM is (Brealey et al. 2011: 213–221; Knüpfer & Puttonen 2007: 148–149):

(12) $$E(r_i) = r_f + \beta_i\left[E(r_m) - r_f\right],$$

where $E(r_i)$ is expected rate of return on a stock, r_f is the risk-free rate of return, β_i is the beta coefficient of a stock and $E(r_m)$ is the expected market return.

3.4.2. Arbitrage pricing theory

The Arbitrage Pricing Theory (later APT) is presented by Stephen Ross. According to the APT the expected risk premium on a stock depends on different kind of factors or macroeconomic risks that have an effect on the company of the stock. The sensitivity for these factors is calculated with the beta coefficient that can be individual for each factor. According to the formula of APT the total expected rate of return on a stock is (Brealey et al. 2011: 228):

(13) $$E(r_i) = r_f + b_1\left(r_{factor\,1} - r_f\right) + b_2\left(r_{factor\,2} - r_f\right) + \cdots,$$

where $E(r_i)$ is expected rate of return on a stock, r_f is the risk-free rate of return, b_x is the beta coefficient for the factor x and $r_{factor\,x}$ is the rate of return for the factor x.

3.5. Stock pricing models in practice

The stock pricing includes a lot of difficulties. The estimations of profits, cash flows and dividends are always uncertain and even a little error in especially growth rate estimations may generate a significant difference between the estimated price and the real price. (Nikkinen et al. 2002: 158.)

In addition to stock pricing difficulties, the determination of discount rates can also be challenging. According to Fama and French (2004: 43–44) CAPM is not working properly. Based on the empirical studies CAPM tends to give too high estimations for high beta stocks and too low estimations for low beta stocks when the estimations are compared to the historical average returns. The difficulties on the APT are based on the fact that the model does not specify the factors that should be used in the calculations (Brealey et al. 2011: 229).

Even though the pricing models may not be useful in practice, the information that is presented by the models is important. Based on the information of the models it can be concluded that how much different factors do have an effect on the stock prices. With this information, the impact of possible economic scenarios in stock prices can be considered. (Nikkinen et al. 2002: 159.)

4. FINANCIAL MARKET EFFICIENCY

Before the studies of the relationship between oil price changes and stock returns are presented, it is important to understand market efficiency and the idea of perfect markets. Stock valuation is related to company's financial key figures such as profitability, equity ratio and growth. Therefore, it could be concluded that the stock prices are predictable. In 1950s, researchers started to investigate stock prices with statistical methods. Based on these researches stock prices act perfectly randomly. According to the researchers the results are proof that the stock markets are efficient and daily price changes are unpredictable. (Nikkinen, Rothovius & Sahlström 2002: 79–80.)

4.1. Perfect markets

The concept of efficient markets is based on the idea of perfect markets. Therefore it is necessary to understand the criteria for perfect capital markets before introducing the financial market efficiency.

Copeland and Weston (1988: 330–331) present the following four necessary conditions for perfect capital markets:

1. Markets are free from transaction costs, taxes and regulations. All assets can be traded.
2. There is perfect competition in financial markets. This means that no individual market participant can have an impact on pricing.
3. Information is costless and available for all market participants.
4. All market participants are rational and try to maximize their profits.

These four mentioned conditions form the basis for perfect capital markets and the following theories are based on these conditions.

4.2. The concept of efficient markets

For the economy it is important that companies having the most lucrative investment projects are able to get equity. This is the main mission of financial markets and possible only if they are allocatively efficient. To be allocatively efficient markets have to be efficient both inside and outside. Inner efficiency means that markets are informatively efficient and new information fully and immediately reflects to stock prices. Outer efficiency means that markets are operationally effective when transaction costs are low and trading is fast. (Nikkinen et al. 2002: 80.)

If markets are not efficient, investors are able to manage risk-free returns. Then equities are not allocated efficiently from investors to companies which has a negative effect on the whole economy. (Knüpfer & Puttonen 2007: 164.)

On efficient stock exchange markets stock prices react to new public and relevant information immediately and right. Stocks are priced right when prices include all information of right values of companies. If the stock prices differ from the actual values of companies then the differences are random and unpredictable. This means that on efficient markets it is not possible for investors to make risk-free returns with stocks that are mispriced. (Knüpfer & Puttonen 2007: 161–166.)

Market efficiency doesn't require that the market price is always the same as the actual value of the stock. The stock can be either overvalued or undervalued at any time but the bias of the market price must be random and unpredictable. The bias cannot be correlated with any variable of the stock. On efficient markets none of the key figures of the company determine if the stock is mispriced or not. If markets are efficient then none of the investors are able to continuously benefit from the biases of market prices. On efficient markets none of the investment strategies can achieve abnormal returns. Abnormal return is a return that is considered with the risk of the investment. On efficient markets the return on the equity should be higher if the risk is higher. Abnormal return is a higher return with a lower risk. (Knüpfer & Puttonen 2007: 165–166.)

Because it is impossible to achieve abnormal returns, on efficient markets the best investment strategy is passive with as few trades as possible. On efficient markets the extra costs of transactions and company analyses are waste of money. (Knüpfer & Puttonen 2007: 166.)

4.3. Random walk

Kendall (1953) presents the behavior of stock and commodity prices in his study. According to Kendall's findings the stock prices follow unsystematic pattern. This means that tomorrow's price change is not predictable with the information of today's price changes. The possibility for negative and positive price change is the same. Therefore the stocks and commodities follow a random walk. (Kendall 1953; Brealey, Myers & Allen 2011: 342–345.)

4.4. Efficient market hypothesis

Fama (1970) present his theory of the efficient market hypothesis (later EMH). Based on the assumptions of the EMH the markets are efficient if all the available information is fully reflected to stock prices. According to Fama (1970) the EMH can be divided into three different forms depending on the quality of the information that reflects to stock prices on the markets.

The first level is the weak form of the market efficiency where stock prices reflect to the information of historical prices (Fama 1970). This information includes previous prices of the stock, profit results, dividends, interest rate level, sizes of companies and other historical market information (Nikkinen et al. 2002: 85). According to the weak form of market efficiency it is not possible to achieve higher returns than average with investment decisions that are based on historical prices (Malkamäki 1989: 23–24).

The second level is the semi-strong form of the market efficiency where all publicly available information is taken into account when considering the current price. The semi-strong form level includes the stock price reflection to the new information of individual company events such as stock splits and financial report announcements (Fama 1970). Therefore on the markets that meet the terms of semi-strong form of the market efficiency, investors are not able to achieve higher returns than average by analyzing the financial reports of companies (Malkamäki 1989: 24).

The third level is the strong form of the market efficiency where stock prices perfectly reflect to all available information. When all available information is fully reflected to stock prices there is no possibility for anyone to benefit from possible inside information. (Fama 1970.)

The forms are related to each other. The markets that meet the terms of semi-strong form of market efficiency have to meet also the terms of the weak form. Therefore the markets that meet the terms of strong form have to meet also the terms of semi-strong form of market efficiency. If the markets do not fulfill all these requirements, the prices cannot be reflected by all relevant information. (Malkamäki 1989: 35.)

4.5. Market efficiency in practice

Financial markets are more efficient than many other markets. The reason for this is the fact that financial markets are included with voluminous amount of participants and the financial information is easily available. In practice, on financial markets participants are facing transaction costs and taxes. Even though financial information is easily available, investigating it may cause expenses. Therefore the markets are not perfect but they still can be efficient. Investors are dedicated in trying to win the markets, and the competition improves the market efficiency. (Knüpfer & Puttonen 2007: 164–168.)

Despite the high market efficiency, in academic researches have been found several investment strategies that can achieve abnormal returns. These exceptional biases are called anomalies. The anomalies are typically recognized without explanations for their existence. (Knüpfer & Puttonen 2007: 168.)

Investors are interested in the anomalies because the investment strategies that are optimized to them are able to achieve abnormal returns. Researchers have found anomalies that are focused on the key figures of the companies. Based on the researches the companies that have either small market capital, high P/BV ratio (price to book value) or high E/P ratio (earnings to price) tend to achieve high returns with low risks. There is also found anomalies that are focused on timing issues. It is noticed that during the turn of the month and year the returns are higher than normally. In the end of the week the returns are also higher than in the start of the week. (Martikainen & Martikainen 2009: 187.)

On efficient markets anomalies should disappear because rational investors use all the earning possibilities until the biases normalize. Some researchers believe that the markets are efficient and the reported anomalies are result of several measurement errors (Martikainen & Martikainen 2009: 187–188). Despite the possible anomalies exist they might be useless for investors because of the possible transaction costs that eliminate the profits (Knüpfer & Puttonen 2007: 167).

5. OIL AS AN ECONOMIC FACTOR

This chapter presents the literature review of the studies that explore influences that are caused by oil price changes. These studies are divided into two separate sections. The first section includes the studies that investigate if oil is an important macroeconomic factor. The second section presents the research evidence of the relationship between oil price fluctuations and the stock markets.

5.1. Oil as a macroeconomic factor

Hamilton (1983) finds oil as a macroeconomic factor while investigating the relationship between oil price changes and macroeconomic changes. First of all, he finds significant correlation between oil prices and outputs. In addition, he finds that oil is significant macroeconomic factor while macro variables are correlated by oil price changes. Based on the information of the study, most of the recessions in the United States are leaded by dramatic oil price increases. Even so, changes in oil prices are not the only responsible for those recessions. In addition, even if oil prices have impact on economy, the oil prices cannot be predicted by macroeconomic changes.

The oil price movements have various impacts in different countries. Most of the countries do have negative correlations while their gross domestic product (later GDP) tend to be hurt by oil price increases. These kind of countries are the United States, Japan, Canada, the United Kingdom, Germany and France while the negative correlation seems to be highest in the United States. On the other hand, there are also countries that are not significantly affected by oil price movements. In addition, oil price increases seem to be beneficial for Norway because it is a relatively large oil exporter. Therefore high oil prices are more profitable for Norwegian economy than low prices. The negative correlation for other countries can be explained by the increasing costs that most of the companies face when oil prices increase. (Mork, Olsen & Mysen 1994.)

According to An, Jin and Ren (2014) oil prices and real economic activity have asymmetric relationship in the United States. The oil price increases tend to influence negatively on outputs, gross savings, total salary paid to employees’, housing prices and consumer expectations. At the same time higher oil prices have positive effect on the rates of Fed Funds. Based on their findings, the higher price levels of oil have more negative influence on the economy than the lower price levels affect positively. These reactions also seem to be more significant in the short-term than in the long-term.

In contrast, Kilian and Vigfusson (2011) find that the evidence of the asymmetric relationship between oil prices and macroeconomic changes is relatively weak. According to them, various time-periods are able to give different kind of results. Therefore it is appropriate to be skeptical when considering this asymmetrical relationship.

Nevertheless, also Herwatz and Plödt (2016) find supporting evidence that significant movements in oil prices have influence on macroeconomy. In addition, they find that the impact of oil price changes is similar in the United States and the euro zone than in China.

5.2. Evidence from the stock markets

Chen, Roll and Ross (1986) explore the economic variables that determine the market risk of a stock and how those variables influence on asset pricing. They find that several economic factors such as industrial production have a remarkable effect on the expected stock returns and therefore also on the stock pricing. They also examine the consumption and oil price index as a variable but do not find them to have a significant influence on asset pricing. Based on their conclusion stock prices are affected by economic news that influence on the market risk but the effect of oil price changes is unimportant.

Huang, Masulis and Stoll (1996) investigate the link between oil futures returns and stock returns during the 1980s. Based on their study the stock prices are not correlated by oil returns. The only exception seems to happen with oil companies while their stock prices are affected by the oil price changes. According to the study oil companies' stocks react to oil futures return with the delay of one day but the correlation seems to be significant.

Al-Mudhaf and Goodwin (1993) investigate the returns of 29 listed oil companies during an oil price shock in 1973. In the study they use the arbitrage pricing theory to see if investors' included the risk of oil in the market risk as a macroeconomic factor.

According to their study, the market risk was included by oil price risk temporarily during the price shock.

Jones and Kaul (1996) study the relationship between oil price changes and real stock returns in the United States, Canada, Japan and the United Kingdom. The time period that they use in their study is the postwar period being between 1970-1991. In the study they use real cash flow variables and oil prices to test if stock markets tend to act rationally or irrationally with the new information of oil price shocks. According to the study the stock markets in the United States and Canada act rationally because stock pricing seems to be reflected by the real cash flow changes that are affected by the changes in oil prices. On the other hand the stock markets in Japan and the United Kingdom seem to act irrationally while the same variables do not give the same relationship in correlation between changes in stock prices and oil prices.

Sadorsky (1999) investigates the dynamic between oil prices and economic activity by using vector autoregression. According to his study the oil prices changes have a significant influence on economic activity but economic activity changes are only slightly influential on oil prices. An increase in oil prices seems to have negative effect on real stock returns. At the same time real stock returns are positively correlated with interest rates and industrial production. Therefore it can be concluded that oil price changes also have a negative correlation on interest rates, industrial production and the whole economy. The oil price dynamics have changed over time because since 1986 oil price changes have been more influential on stock prices than interest rates.

Faff and Brailsford (1999) research the relationship between Australian industry and oil prices over the period 1983-1996. They find the relationship significant while the energy industry seems to benefit from the increased oil prices and at the same time the paper, packaging and transport industries suffer the most. Also Sadorsky (2001) finds oil price increases beneficial for energy companies while he investigates the Canadian energy company stock returns by using oil as a risk factor in the multifactor market model. In addition, Boyer and Filion (2007) find positive correlation between the stock returns of Canadian energy companies and oil prices. According to El-Sharif, Brown, Burton, Nixon and Russell (2005) also the energy companies that are listed in the United Kingdom stock market tend to benefit from higher oil prices.

Hammoudeh and Aleisa (2004) investigate the oil price correlations to the stock markets of the Gulf Cooperation Council (GCC) countries that are large oil exporters. They find the positive correlation significance for Saudi index to be so high that its movements can predict and also be predicted by the prices of NYMEX (New York Mercantile Exchange) oil futures. In contrast, Maghyereh and Al-Kandari (2007) find evidence that GCC stock markets are not correlated by oil prices even if oil exporting is the main income for those economies.

Hammoudeh, Dibooglu and Aleisa (2004) find bi-directional behavior between S&P Oil Composite index and both oil spot and futures prices. In addition, Hammoudeh and Li (2005) find negative bi-directional behavior between oil prices and the returns of the world capital market. Based on their findings, the world capital market reacts more to the oil price changes than oil prices to changes in world capital market.

Nandha and Hammoudeh (2007) investigate the relationship between oil prices and stock markets in fifteen Asia-Pacific countries. According to their study, only the stock markets of Philippines and South Korea are significantly affected by oil price changes. Basher and Sadorsky (2006) find significant asymmetric relationship between oil price changes and emerging stock market returns. According to their findings, emerging stock markets are influenced positively on both oil price increases in daily and monthly basis as well as oil price decreases in weekly and monthly basis.

Björnland (2009) find that oil price increases have positive impact on Norwegian economy and eventually cause lower unemployment, higher inflation and higher interest rates. Based on the findings of the study, also the stock market returns tend to increase after increased oil prices.

Nandha and Faff (2008) investigate the relationship between changes in oil prices and 35 industries. They find negative correlations to all other industries except the mining and energy industry. Henriques and Sadorsky (2008) study the correlations between oil prices and alternative energy companies. They find that even if the stocks of alternative energy companies have positive correlation with oil prices, the impact of price movements in technology stocks is more significant.

Driesprong, Jacobsen and Maat (2008) show evidence that there is correlation between the changes in stock prices and oil prices. In addition, based on their findings, stock returns can be predicted by oil price changes because the market reaction is delayed.

Park and Ratti (2008) investigate the impact of oil price shocks in the United States and thirteen European countries over the period 1986–2005. They find that real oil prices influence on real stock returns significantly in all countries. According to the study, European stock markets react to oil price shocks during one month and higher volatility of oil tends to decrease European real stock returns.

Miller and Ratti (2009) present that the long-term behavior of stock markets and oil prices proves the negative correlation between them. However, according to the study, this long-term relationship has not actualized during the 2000s and the bubbles of stock prices or oil prices may appear over time.

Kang and Ratti (2015) find negative correlation between the oil demand in China and China's economic policy uncertainty. This means that increased economic policy uncertainty in China has negative impact on China's oil demand. This has negative consequences on the global oil markets causing reduction in oil production, oil prices and eventually these effects reaches the global stock markets. This impact has increased in the 2000s as the importance of China's emerging economy has risen in global economy.

Le and Chang (2015) show that stock market reactions to oil price shocks vary based on the structure of the economy and also the used time-period in the tests. According to the study, economies can be divided into three groups of oil-exporters, oil-importers and oil-refiners. Also the characteristics of oil price shocks are necessary to take into account, either they are caused by shocks in demand or supply. Also Martín-Barragán, Ramos and Veiga (2015) investigate the correlations between stock prices and oil price shocks. They find that during dramatic oil price shocks the correlations tend to increase significantly.

6. DATA AND METHODOLOGY

For investigating the relationship of oil price changes and industry-specific stock market returns, the paper follows the same methodology as Nandha and Faff (2008). Instead of using the 35 global industry indices, this paper examines the effect of oil price changes on both Nasdaq OMX Nordic sector indices and Qatar Stock Exchange sector indices. The idea behind investigating the sector indices from these markets is to find out if the impact of oil price changes differs from oil-exporter markets to oil-importer markets.

6.1. Data

The needed data consists of historical oil prices, Nasdaq OMX Nordic indices and Qatar Stock Exchange indices. The data will be collected from Datastream and Nasdaq OMX Nordic website. The Nasdaq OMX Nordic indices cannot be found from the database of Datastream and, therefore, they are collected from the Nasdaq OMX Nordic website (Nasdaq OMX Nordic 2017).

Furthermore, since the Nasdaq OMX Nordic indices are presented in euros, the currency of the oil price that is examined with the Nordic indices also needs to be converted to euros. In this way, the currency conversion rate fluctuations can be taken into account to the study. Therefore, also the historical EUR/USD conversion rates are collected from the database.

Qatar Stock Exchange indices are presented in Qatari Riyal currency. However, the Qatari Riyal has been fixed against the US dollar at a rate of 3,64 QR per 1 US dollar since July 2001 (Qatar Central Bank 2017). Therefore, since the currency is pegged to the US dollar, there is no need for converting the currency of the oil price to Qatari Riyals. Even if the value of dollar fluctuates, the relative value of Qatari Riyal against the US dollar remains the same.

Instead of the 22-year sample period used by Nandha and Faff (2008), the used sample period in this paper is from April 2nd 2012 to September 27th 2017. The reason for this relatively short time period is the lack of data from the Qatar stock markets. In March 2012, Qatar Stock Exchange updated its indices by making a sector reclassification (Qatar Exchange 2012). As a result of the reclassification, the number of sector indices increased from four to seven. Therefore, the data for the indices with the current classification is available only since April 2012.

Nandha and Faff (2008) study the impact of oil price changes on industry-level indices by using monthly data. However, this paper will study the relationship between oil price changes and sector index returns by examining both weekly and monthly returns. The sample period covers 286 observations at the weekly frequency and 66 observations at the monthly frequency.

The studied sector indices are price indices and, therefore, they exclude the possible dividend income. On the other words, the dividend income is not reinvested to the overall indices. The reason for choosing price indices instead of total return indices is that the Qatar Stock Exchange sector indices are available only as price indices. In addition, price indices share similar characteristics with the oil price index since oil price index is not included with a dividend factor.

However, the all-share market indices of Nasdaq OMX Nordic and Qatar Stock Exchange are total return indices where the dividend income is reinvested to the overall indices. The reason behind this decision is that the Qatar Stock Exchange provides an all share index only as a total return index (Qatar Exchange 2012). Therefore, for similarity, also the Nasdaq OMX Nordic index is chosen as a total return index. Nandha and Faff (2008) study the impact of oil price changes on total return indices.

6.1.1. Oil price index

As mentioned before, there are over 160 traded crude oils with different qualities and characteristics in the world oil markets. However, most of the trades on a physical commodity are covered by the contracts of WTI (West Texas Intermediate) and Brent crude oil. (Fattouh 2010: 334–335.)

Nanda and Faff (2008) study the effect of oil price changes by using the price index of West Texas Intermediate Cushing as a benchmark for oil price. Therefore, the used oil quality for representing the oil price in this paper is also West Texas Intermediate. The oil price index is expressed in US dollars per barrel.

6.1.2. Nasdaq OMX Nordic indices

Nasdaq OMX Nordic Sector indices are used in this paper to represent the sector-specific returns in oil-importers' stock markets. The sector indices are included with stocks that are listed in stock exchange markets of Helsinki, Stockholm, Copenhagen and Iceland. The stocks are divided into 24 different industry sectors by using the FTSE Industry Classification Benchmark. The Industry Classification Benchmark system consists of four levels of classification that are industry, supersector, sector and subsector. However, the Nordic sector indices are divided only into industry and supersector levels. The currencies of the stocks that are listed in stock exchange markets of Stockholm, Copenhagen and Iceland are converted to the euro currency. (Nasdaq 2017.)

The reason for using the Nordic sector indices on the study is to see if the impact of oil price changes differs across industries in the Nordic stock markets. According to the International Energy Agency (2014), the included countries behind the indices do not have own oil production and, therefore, they can be categorized to oil-importers. In addition to the sector indices, this paper examines the overall effect of oil price changes on the total market index. Therefore, also the OMX Nordic price index will be used in this paper.

6.1.3. Qatar Stock Exchange indices

Qatar Stock Exchange sector indices are used in this paper to represent the sector-specific returns in oil-exporter's stock markets. The sector indices consist of all the stocks that are listed in the Qatar Stock Exchange. The stocks are under the QE All Share Total Return Index and divided into seven industry sectors. The sector indices are price indices and, therefore, the dividend income is excluded from the indices. In addition to the sector indices, this paper examines the overall effect of oil price changes on the QE All Share Total Return Index. The currency for these indices is Qatari Riyal. (Qatar Exchange 2012.)

The purpose for using the Qatar Stock Exchange sector indices on the study is to see if the impact of oil price changes differs across industries in the Qatar Stock Exchange markets. Qatar is one of the OPEC members and, therefore, can be categorized to oil-exporters.

The most oil-dependent Gulf Cooperation Council economies are Saudi Arabia and Qatar since their contribution of oil to GDP is higher than in other GCC economies. The most oil-dependent GCC economy is Qatar. Mostly because of this, the Qatar Stock Exchange indices have been chosen for the study of this paper. (Ulussever & Demirer 2017: 78.)

On the other hand, the stock markets of Saudi Arabia are significantly more liquid and have higher market capitalization than Qatar Stock Exchange (Ulussever & Demirer 2017: 78–79). However, it was not possible to choose the sector indices of Saudi Arabia stock markets for this study because the currently available data is too short. The Saudi Arabia's stock exchange, Tadawul, has reclassified its industry sectors on 8th of January 2017 (Tadawul 2017). As Tadawul provides only one year calculated history for the new indices, the possible sample period would not have been more than 21 months. Therefore, Qatar Stock Exchange indices provide better data for this research.

6.1.4. Descriptive statistics for weekly data

The tables for descriptive statistics present the name of the index, number of observations, mean, median, standard deviation, maximum return, minimum return, skewness and kurtosis. The statistics are based on weekly returns with 286 observations.

Table 2 contains the descriptive statistics for the WTI Cushing oil price index in both currencies. According to the descriptive statistics, oil price index has faced high fluctuations during the sample period on weekly basis. The maximum weekly change for the euro price is approximately 33 percent positive while the minimum weekly change is up to 15 percent negative. The mean weekly return of oil is negative. The standard deviation of oil price index is 5 percentage points. The skewness of oil returns is positive. Oil price returns have high kurtosis values with up to 10,99 for the euro price. This means that the returns of oil do not follow normal distribution.

Table 2. Descriptive statistics for the WTI Cushing oil price index. The statistics are based on weekly returns with 286 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Oil(€)	Oil($)
WTI (€)	-0,0010	-0,0014	0,3299	-0,1503	0,05	1,09	10,99	1,00	0,97
WTI ($)	-0,0014	-0,0002	0,2873	-0,1464	0,05	0,88	8,02	0,97	1,00

In addition, based on the statistics, the EUR/USD currency conversion rate fluctuations do have an effect on the euro prices. Because of the EUR/USD conversion rate fluctuations, the correlation between the euro and US dollar prices is 0,97. If the conversion rate would be fixed against the US dollar, the correlation would be 1,00.

Table 3 presents the descriptive statistics for the Nasdaq OMX Nordic indices including the OMX Nordic market index and 24 sector indices. The mean return of OMX Nordic market index is 0,28%. The highest mean returns of 0,42% and 0,36% are in Oil & Gas sector and Travel & Leisure sector. Only the sectors of Media and Telecommunications have negative average returns of -0,05% and -0,01% on weekly basis. During the sample period, the highest maximum weekly returns have been in Chemicals and Technology sectors while the highest minimum returns have been in Utilities and Health Care sectors. Technology and Chemicals sectors have increased up to 16,95% and 12,59% whereas Utilities and Health Care sectors have decreased up to -14,18% and -14,50%. Oil & Gas sector has the highest standard deviation of 4 percentage points. All of the returns are modestly negatively skewed. The most negative skewness is recorded for Health Care sector (-0,95) whereas the skewness of Technology sector returns is -0,03. The highest value of kurtosis is in Health care sector (7,27) and the lowest in Media sector (3,82).

The sectors of Financials, Financial Services and Industrials have the highest correlation with the market index of OMX Nordic with the correlation of 0,94. The sectors of Media (0,69), Travel & Leisure (0,69) and Utilities (0,60) have the lowest correlations with the market index. The correlation between oil price and OMX Nordic market index is 0,33. Automobiles & Parts (0,35), Oil & Gas (0,33) and Consumer Goods (0,33) have the highest correlation with oil price index on weekly basis. The sectors of Health Care and Travel & Leisure have the lowest correlations with the oil price index with the correlations of 0,18 and 0,19. Interestingly, based on the descriptive statistics, all of the Nordic sectors have positive correlation with oil price index.

Table 3. Descriptive statistics for the Nasdaq OMX Nordic indices. The statistics are based on weekly returns with 286 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Market	Oil (€)
OMX Nordic	0,0028	0,0043	0,0685	-0,1113	0,02	-0,79	6,13	1,00	0,33
Automobiles & Parts	0,0017	0,0026	0,0793	-0,1201	0,03	-0,32	3,97	0,74	0,35
Banks	0,0026	0,0045	0,0799	-0,1109	0,03	-0,42	4,73	0,86	0,28
Basic Materials	0,0025	0,0029	0,0942	-0,1347	0,03	-0,32	4,28	0,85	0,30

Basic Resources	0,0025	0,0035	0,0970	-0,1364	0,03	-0,30	4,08	0,83	0,28
Chemicals	0,0026	0,0063	0,1259	-0,1382	0,03	-0,42	5,53	0,70	0,28
Consumer Goods	0,0024	0,0038	0,0716	-0,1118	0,02	-0,77	6,06	0,90	0,33
Consumer Services	0,0006	0,0026	0,0716	-0,1002	0,02	-0,32	4,11	0,79	0,23
Const. & Materials	0,0027	0,0050	0,0702	-0,1193	0,03	-0,71	5,64	0,92	0,29
Financials	0,0027	0,0035	0,0736	-0,1136	0,03	-0,57	5,31	0,94	0,30
Financial Services	0,0030	0,0050	0,0773	-0,1276	0,03	-0,58	4,88	0,94	0,29
Food & Beverage	0,0020	0,0026	0,0795	-0,1160	0,02	-0,48	5,39	0,74	0,23
Health Care	0,0030	0,0045	0,0819	-0,1450	0,03	-0,95	7,27	0,76	0,18
Indust. Goods & Serv.	0,0023	0,0058	0,0794	-0,1115	0,03	-0,46	4,42	0,93	0,31
Industrials	0,0023	0,0056	0,0755	-0,1127	0,03	-0,51	4,54	0,94	0,32
Insurance	0,0029	0,0044	0,0733	-0,1075	0,02	-0,65	5,42	0,77	0,24
Media	-0,0005	0,0023	0,0760	-0,1272	0,03	-0,43	3,82	0,69	0,24
Oil & Gas	0,0042	0,0064	0,0995	-0,1304	0,04	-0,36	4,28	0,73	0,33
Pers. & Househ. Goods	0,0029	0,0035	0,0860	-0,1086	0,02	-0,52	5,66	0,85	0,30
Real Estate	0,0029	0,0054	0,0775	-0,1056	0,02	-0,56	4,99	0,81	0,26
Retail	0,0004	0,0015	0,0737	-0,1031	0,03	-0,23	3,85	0,73	0,22
Technology	0,0012	0,0014	0,1695	-0,1222	0,03	-0,03	5,22	0,75	0,21
Telecommunications	-0,0001	-0,0012	0,1085	-0,1172	0,03	-0,12	5,27	0,82	0,31
Travel & Leisure	0,0036	0,0022	0,0957	-0,1105	0,02	-0,30	5,97	0,69	0,19
Utilities	0,0005	0,0034	0,0896	-0,1418	0,03	-0,76	4,89	0,60	0,25

Figure 2 presents the development of WTI Oil price index in euros and OMX Nordic index during the sample period at the weekly frequency. Based on the development of the indices, OMX Nordic market index has performed well whereas the oil price index has decreased.

Figure 2. The development of WTI Oil price index and OMX Nordic index. The development is for the sample period at the weekly frequency.

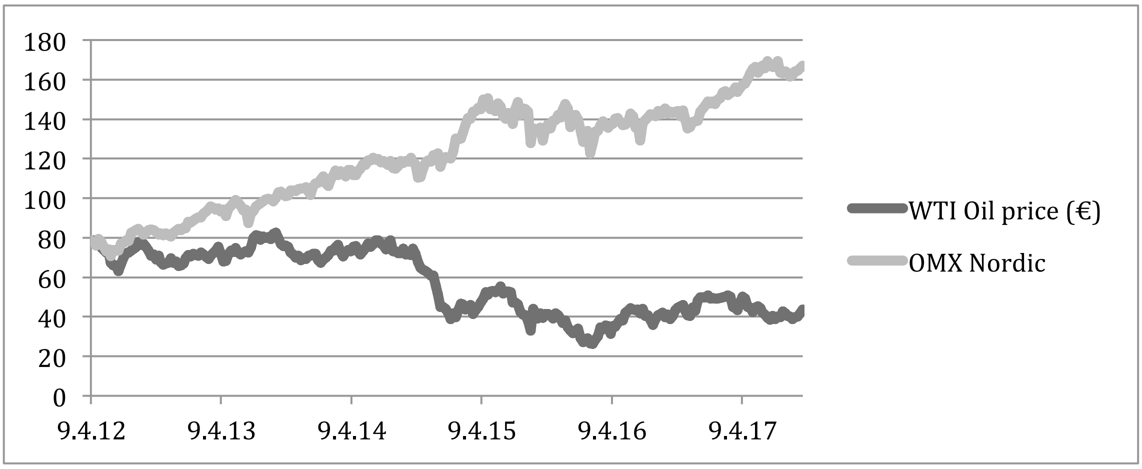


Table 4 contains the descriptive statistics for the Qatar Stock Exchange indices including the QE All Share market index and seven sector indices. The mean return of the QE All Share market index is 0,08%. The insurance sector has the highest mean return of 0,25% whereas the sector of Telecoms has the lowest mean return of 0,02% on weekly basis. However, all of the Qatari sectors have positive mean return.

The sectors of Insurance and Real Estate have the highest maximum returns of 16,27% and 13,79%. The highest minimum returns have been in the sectors of Telecoms (-17,90 %), Consumer Goods & Services (-17,03%) and Real Estate (-17,02%). The Real Estate sector has the highest standard deviation of 4 percentage points. All of the returns are negatively skewed except the Insurance sector (0,47). The most negative skewness is in the sector of Consumer Goods & Services (-1,32). The lowest kurtosis value is in Real Estate sector (6,02) whereas the highest kurtosis value is in Consumer Goods & Services (11,51).

The sector of Banks & Financial Services has the highest market correlation of 0,94 whereas the Insurance sector has the lowest market correlation of 0,69. The correlation between the QE All Share market index and oil price index is 0,35. The industrials sector has the highest correlation with oil of 0,37 whereas the sectors of Transportation (0,23) and Telecoms (0,25) have the lowest correlations with the oil price index. Similarly with the Nordic indices, the correlation between oil price index and Qatari indices is positive across all sectors.

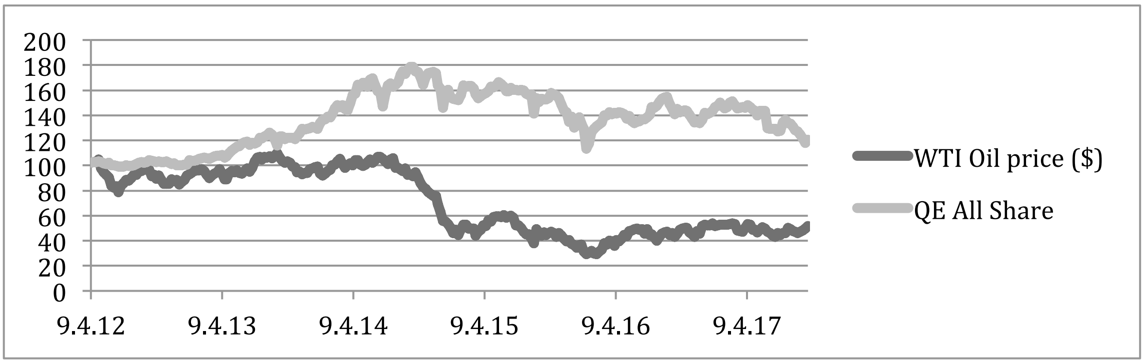
Table 4. Descriptive statistics for the Qatar Stock Exchange indices. The statistics are based on weekly returns with 286 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Market	Oil($)
QE All Share	0,0008	0,0015	0,0864	-0,1208	0,02	-0,71	8,03	1,00	0,35
Banks & Finan. Serv.	0,0012	0,0001	0,0857	-0,1106	0,02	-0,20	6,23	0,94	0,29
Cons. Goods & Serv.	0,0010	0,0011	0,0962	-0,1703	0,03	-1,32	11,51	0,77	0,32
Industrials	0,0005	0,0001	0,0810	-0,1299	0,03	-0,71	6,39	0,92	0,37
Insurance	0,0025	0,0002	0,1627	-0,1125	0,03	0,47	8,13	0,69	0,28
Real Estate	0,0009	0,0002	0,1379	-0,1702	0,04	-0,32	6,02	0,83	0,30
Telecoms	0,0002	-0,0003	0,1068	-0,1790	0,03	-0,43	6,95	0,79	0,25
Transportation	0,0009	-0,0003	0,0815	-0,1372	0,03	-0,88	8,58	0,78	0,23

Figure 3 presents the development of WTI Oil price index and QE All Share index during the sample period at the weekly frequency. Based on the figure, the QE All

Share may be influenced by the oil price index. When oil price starts to decrease, the growth of QE All Share stops and the index starts to follow the decreasing oil price.

Figure 3. The development of WTI Oil price index and QE All Share index.



6.1.5. Descriptive statistics for monthly data

In addition to weekly returns, this paper also studies the relationship between oil price changes and stock returns by using monthly data. The sample period covers 66 monthly observations. The next three tables present the descriptive statistics for the returns of the data at monthly frequency.

Table 5 presents the descriptive statistics for monthly returns of the WTI Cushing oil price index. The statistics are similar with the weekly data contributing high oil price fluctuations. During the sample period, the highest maximum return is 24,94% and the minimum return -20,80% in a month. The standard deviation is relatively high at the level of 9 percentage points. The skewness of the monthly returns is low. The skewness for the reutrns of the euro price is 0,00 whereas for the dollar price returns the same value is 0,14. The kurtosis values are notably lower for the monthly returns (3,68) in contrast to the kurtosis of weekly returns.

Table 5. Descriptive statistics for monthly returns of the WTI index. The statistics are based on 66 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Oil(€)	Oil($)
WTI (€)	-0,0055	-0,0011	0,1975	-0,2013	0,08	0,00	3,17	1,00	0,96
WTI ($)	-0,0068	-0,0133	0,2494	-0,2080	0,09	0,14	3,68	0,96	1,00

Table 6 presents the descriptive statistics for monthly returns of the Nasdaq OMX Nordic indices. On monthly basis, the Technology sector has the highest standard deviation of 7 percentage points whereas the standard deviation for the market index is 3 percentage points. The skewness values are more diversified with monthly returns than with weekly returns. With monthly data, there are 14 negative values and 11 positive values whereas the weekly data provide only negative values. The monthly data also provides lower values for kurtosis than weekly data.

Most interesting information of the descriptive statistics is that the correlation rates differ between monthly returns and weekly returns. The correlation between OMX Nordic market index and oil price index with monthly returns is 0,12 whereas it is up to 0,33 with the weekly data. In addition, in contrast to weekly returns, monthly data shows also negative correlations between oil price index and Health Care, Insurance, Real Estate, Technology and Travel & Leisure sectors. Overall, the correlations are lower with the monthly returns than with weekly returns. The highest positive correlation with oil price is in Automobiles & Parts sector (0,24) whereas the highest negative correlation is in Health Care sector (-0,10). The market correlations remain positive with the monthly data.

Table 6. Descriptive statistics for monthly returns of the Nordic indices. The statistics are based on 66 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Market	Oil(€)
OMX Nordic	0,0116	0,0119	0,0854	-0,0778	0,03	-0,18	3,07	1,00	0,12
Automobiles & Parts	0,0067	0,0044	0,1363	-0,1319	0,05	0,00	3,07	0,71	0,24
Banks	0,0111	0,0081	0,1302	-0,0967	0,05	0,16	3,27	0,73	0,14
Basic Materials	0,0103	0,0104	0,1834	-0,1451	0,06	-0,08	4,24	0,78	0,13
Basic Resources	0,0105	0,0056	0,2280	-0,1526	0,06	0,25	5,09	0,74	0,13
Chemicals	0,0109	0,0124	0,1436	-0,1816	0,06	-0,61	3,80	0,58	0,06
Consumer Goods	0,0098	0,0104	0,0988	-0,0628	0,04	0,40	3,01	0,85	0,21
Consumer Services	0,0022	-0,0008	0,1297	-0,0784	0,04	0,74	3,40	0,71	0,04
Const. & Materials	0,0110	0,0136	0,1032	-0,1031	0,04	-0,07	3,13	0,88	0,05
Financials	0,0115	0,0052	0,1032	-0,0857	0,04	0,05	3,15	0,87	0,10
Financial Services	0,0125	0,0205	0,1092	-0,1046	0,05	-0,25	2,65	0,91	0,15
Food & Beverage	0,0081	0,0064	0,1226	-0,1045	0,04	-0,02	3,11	0,72	0,15
Health Care	0,0125	0,0099	0,1181	-0,1076	0,05	0,02	3,06	0,72	-0,10
Indust. Goods & Serv.	0,0094	0,0113	0,1004	-0,1187	0,04	-0,31	3,25	0,87	0,17
Industrials	0,0095	0,0116	0,0990	-0,1166	0,04	-0,27	3,32	0,89	0,15
Insurance	0,0124	0,0140	0,1060	-0,0932	0,04	-0,34	2,83	0,65	-0,09

Media	-0,0025	-0,0013	0,1239	-0,1545	0,06	-0,30	3,14	0,59	0,13
Oil & Gas	0,0171	0,0110	0,1769	-0,1029	0,06	0,33	3,00	0,66	0,12
Pers. & Househ. Goods	0,0116	0,0110	0,1213	-0,0617	0,04	0,56	3,04	0,77	0,17
Real Estate	0,0123	0,0106	0,1156	-0,0732	0,04	0,45	3,09	0,75	-0,07
Retail	0,0012	-0,0037	0,1488	-0,0750	0,05	0,79	3,41	0,67	0,05
Technology	0,0047	0,0005	0,2308	-0,2089	0,07	-0,13	4,95	0,66	-0,04
Telecommunications	-0,0011	-0,0011	0,0832	-0,0964	0,04	-0,28	2,78	0,68	0,16
Travel & Leisure	0,0155	0,0124	0,1493	-0,1472	0,05	-0,20	5,32	0,51	-0,08
Utilities	0,0017	0,0060	0,1043	-0,1523	0,06	-0,30	2,45	0,42	0,07

Table 7 contains the descriptive statistics for monthly returns of the Qatar Stock Exchange indices. The highest standard deviation is in Real Estate and Telecoms sectors with 7 percentage points whereas the standard deviation of other indices is 5 percentage points. The most negatively skewed returns are in Telecoms sector and the most positively skewed returns in Transportation sector. The monthly data provides lower kurtosis values than weekly data. For example, the kurtosis value for Consumer Goods & Services is only 3,94 with monthly returns whereas it is up to 11,51 with weekly returns.

In general, the correlations between oil price index and Qatari indices are lower with monthly returns than with weekly data. The Industrials sector has the highest oil correlation of 0,32 whereas the lowest correlation is in Insurance sector with the correlation of 0,02. However, in contrast to Nordic indices, all of the Qatari indices have positive correlation with the oil price index. The market correlations of monthly returns differ only little when comparing to the correlations of weekly returns.

Table 7. Descriptive statistics for monthly returns of the Qatari indices. The statistics are based on 66 observations.

Index	Mean	Med	Max	Min	SD	Skew.	Kurt.	Correlation	
								Market	Oil($)
QE All Share	0,0034	0,0028	0,1080	-0,1420	0,05	-0,52	3,73	1,00	0,26
Banks & Financial Services	0,0049	-0,0015	0,1332	-0,1760	0,05	-0,58	4,69	0,95	0,19
Consumer Goods & Services	0,0039	0,0028	0,1688	-0,1253	0,05	0,30	3,94	0,70	0,25
Industrials	0,0018	0,0031	0,0837	-0,1440	0,05	-0,46	2,80	0,89	0,32
Insurance	0,0099	0,0008	0,1744	-0,1354	0,05	0,67	4,67	0,57	0,02
Real Estate	0,0038	0,0094	0,1611	-0,1807	0,07	-0,29	3,31	0,81	0,24
Telecoms	0,0013	-0,0006	0,1343	-0,2548	0,07	-0,61	4,00	0,80	0,13
Transportation	0,0038	-0,0011	0,1846	-0,1130	0,05	0,84	5,26	0,73	0,08

6.2. Methodology

The used model in the study is a standard market model that is expanded with the oil price factor. According to Nandha and Faff (2008) this model is widely used in asset pricing and is applicable especially for industries. The model assumes that the returns of industry-level indices are affected by the market sentiment and oil price. The possible remaining influences are included in the residuals. Therefore, for a sector index i the model can be written as follows:

(14) $$R_{it} = \alpha_i + \beta_i R^O_{mt} + \gamma_i R^U_{oilt} + \varepsilon_{it}, \text{ and } i = 1 \text{ to } 24,$$

where R_{it} is the return for sector index i for period t. R_{it} is defined as log ($\text{ind}_{i\,t}/\text{ind}_{i\,t-1}$) where $\text{ind}_{i\,t}$ represents the value of the ith sector index at time t. R^O_{mt} is the orthogonalised market return that is calculated as $R_{mt} - E(R_{mt})$, where $E(R_{mt}) = \alpha^* + \gamma^* R_{oilt}$, where α^* and γ^* represent the estimated values of α and γ in $R_{mt} = \alpha + \gamma R_{oilt} + \varepsilon_t$. R_{mt} and R_{oilt} are the log returns for the local market index and used oil price index and are calculated as one lag difference of log values.

R^U_{oilt} refers to the unexpected change in the oil price index which is calculated as $OP_t - E_{t-1}(OP_t)$, where $E_{t-1}(OP_t)$ is a one-period ahead expected value of the used oil price index and it is calculated as the fitted value of oil price change modeled by an AR(1) process. In the equation, ε_{it} represents the residual of the return for sector index i that is not explained by the independent variables of market index and oil price index returns. The model is estimated with an autoregressive error with one lag AR(1). The purpose for using the AR(1) term is to find out if the errors are correlated with each other.

By using this model to estimate the relationship between oil price and sector index returns, the assumption is, that the possible relationship can be revealed by estimating the sensitivity of sector index to unexpected changes in market and oil price indices. In other words, if a sector index is statistically significantly influenced by unexpected change in oil price, there is evidence of the relationship.

6.2.1. Asymmetric model

According to the studies presented in the 5th chapter of this paper, the impact of oil price changes may vary across economies, stock markets and industries. The impact may also be asymmetric. Asymmetric impact means that, for example, positive and negative oil price changes does not have equal impact on the sector index. Instead, for example a positive oil price change may effect negatively on a sector index while a negative price change does not have an influence at all.

Because the impact of oil price change may be asymmetric, this paper also examines if oil price returns have asymmetric impact on the sector indices of Nordic and Qatari stock markets. Therefore, this paper also examines the asymmetric impacts by using the following equation presented by Nandha and Faff (2008):

(15) $$R_{it} = \alpha_i + \beta_i R_{mt}^{O} + \gamma_{ui} D * R_{oilt}^{U} + \gamma_{di}(1 - D) * R_{oilt}^{U} + \varepsilon_{it},$$

where the standard market model is expanded with a dummy variable. The dummy variable D gets a value of 1 if the unexpected return of the oil price index is positive. If the unexpected oil price return is negative, the value of the dummy variable D is 0. In the equation, γ_{ui} and γ_{di} are oil price coefficients for sector index i capturing the different correlations of oil price movements. γ_{ui} captures the correlation when the unexpected oil price return is positive while γ_{di} represents the correlation for negative unexpected oil price returns. All the other terms of the equation remain the same as in the previous model. Also the asymmetric model is estimated with an autoregressive error with one lag AR(1) to find out the possible autocorrelation in the error term.

7. EMPIRICAL RESULTS

In this chapter the empirical results for the estimations are presented. The relationship between oil price changes and industry index returns are estimated on both Nordic and Qatari sector indices. The equations 14 and 15 are estimated on Eviews by using the Least Squares method separately with the data of weekly and monthly returns. The results for the estimations are presented in the tables 8–15.

Tables for the basic model results are constructed as follows. The first column show the examined sector index and the second column show the code of the sector index that is used in the equation. The third column show the value of the constant term α_i. The fourth column presents the correlation coefficient for the market index sensitivity β_i whereas the fifth column presents the correlation coefficient for the oil price sensitivity γ_i. In columns 3–5 the t-statistics are shown in the parenthesis. The sixth column of the tables show the adjusted R-squared while the seventh column show the results of the Durbin-Watson test.

Tables for the asymmetric model results are constructed as follows. As the first and second column of the tables present the examined sector index and code, the third and fourth columns show the correlation coefficients for the oil price sensitivity terms γ_{ui} and γ_{di}. The column for γ_{ui} shows the possible influence of an oil price change on a sector index when the oil price unexpectedly increases. Accordingly, the column for γ_{di} presents the possible influence of an oil price change on a sector index when the oil price unexpectedly decreases. In the third and fourth columns t-statistics are presented in the parenthesis. The fifth column presents the results for the fourth hypothesis of the paper that is estimated by using the Wald test. The results are presented in F-statistic values. The probability values are shown below the F-statistics. Finally, the two last columns of the tables show the adjusted R-squared and the results of the Durbin-Watson test.

The results for the Nasdaq OMX Nordic indices and Qatar Stock Exchange indices will be presented separately. After the results of the sector indices are presented, the differences between these two stock markets will be pointed out in the last part of this chapter under the third sub-heading.

7.1. Results for the Nordic indices

Table 8 presents the basic model results for the weekly returns of the Nordic indices. According to the results for weekly data, all of the market coefficients β_i and oil price coefficients γ_i are positive and statistically significant at the 1% level. The market coefficients are relatively close the value of one while the highest correlations are in the sectors of Basic Resources (1,1994) and Financial Services (1,1734). The lowest market correlations are in the Travel & Leisure (0,7561) and Food & Beverage (0,7823) sectors.

The oil price coefficients are lower than market coefficients. The lowest correlations with oil price returns are in Travel & Leisure (0,0888) and Health Care (0,0908) sectors while the highest correlations are in the sectors of Oil & Gas (0,2315) and Automobiles & Parts (0,2074).

The adjusted R-squared levels are at the highest in the sectors of Industrials (0,8801), Financials (0,8736) and Financial Services (0,8731) whereas the lowest levels are in the Utilities (0,3550), Media (0,4749) and Travel & Leisure (0,4783) sectors. High adjusted R-squared levels imply that the model has a good fit with the data.

The Durbin-Watson statistics are at the optimal level of 2,00 indicating that there is not autocorrelation in the residuals. In the estimations of Costruction & Materials and Technology sectors, an autoregressive error with one lag AR(1) is statistically significant implying autocorrelation in the error term.

Table 8. Basic model results for the weekly returns of the Nordic indices.

Industry	Code	αi	βi	γi	Adj. R2	DW
Automobiles & Parts	1	0,0017*	0,9393***	0,2074***	0,5573	1,9716
		(1,41)	(17,87)	(7,87)		
Banks	2	0,0026***	1,0865***	0,1585***	0,7356	2,0038
		(2,81)	(33,40)	(9,96)		
Basic Materials	3	0,0025***	1,1691***	0,1824***	0,7156	1,9989
		(2,49)	(25,12)	(8,45)		
Basic Resources	4	0,0026***	1,1994***	0,1834***	0,6808	1,9985
		(2,25)	(22,57)	(7,66)		
Chemicals	5	0,0026**	0,9835***	0,1783***	0,4887	2,0073
		(1,79)	(17,62)	(5,92)		
Consumer Goods	6	0,0024***	0,8691***	0,1457***	0,8185	2,0079
		(4,45)	(31,36)	(14,56)		

Consumer Services	7	0,0006	0,8418***	0,1075***	0,6143	1,9880
		(0,62)	(17,45)	(6,14)		
Construction & Materials	**8**	0,0027***	1,0820***	0,1499***	0,8429	2,0200
		(4,72)	(36,04)	(12,18)		
Financials	9	0,0027***	1,0486***	0,1496***	0,8736	2,0048
		(4,82)	(49,43)	(15,08)		
Financial Services	10	0,0030***	1,1734***	0,1616***	0,8731	1,9760
		(4,72)	(39,42)	(12,18)		
Food & Beverage	11	0,0021***	0,7823***	0,1074***	0,5512	2,0052
		(2,41)	(20,54)	(5,89)		
Health Care	12	0,0030***	0,9156***	0,0908***	0,5790	2,0003
		(2,93)	(23,21)	(5,01)		
Industrial Goods and Services	13	0,0023***	1,0589***	0,1597***	0,8541	1,9996
		(3,89)	(46,06)	(16,67)		
Industrials	14	0,0023***	1,0635***	0,1584***	0,8801	1,9988
		(4,41)	(48,57)	(17,17)		
Insurance	15	0,0030***	0,8299***	0,1128***	0,5826	1,9987
		(3,00)	(20,93)	(5,31)		
Media	16	-0,0005	0,9266***	0,1429***	0,4749	1,9910
		(-0,32)	(15,38)	(5,09)		
Oil & Gas	17	0,0042***	1,0738***	0,2315***	0,5323	1,9925
		(2,95)	(14,99)	(6,92)		
Personal & Household Goods	18	0,0029***	0,8919***	0,1449***	0,7172	2,0141
		(3,98)	(23,08)	(12,10)		
Real Estate	19	0,0030***	0,8477***	0,1187***	0,6496	1,9944
		(3,29)	(20,92)	(6,74)		
Retail	20	0,0004	0,8423***	0,1079***	0,5321	1,9871
		(0,32)	(14,62)	(5,49)		
Technology	**21**	0,0013	1,1614***	0,1433***	0,5620	1,9928
		(0,81)	(16,23)	(4,47)		
Telecommunications	22	0,0000	0,9058***	0,1561***	0,6700	1,9898
		(-0,04)	(24,73)	(9,43)		
Travel & Leisure	23	0,0037***	0,7561***	0,0888***	0,4783	1,9960
		(3,27)	(20,75)	(5,06)		
Utilities	24	0,0003	0,8395***	0,1632***	0,3550	1,9958
		(0,22)	(12,45)	(5,92)		

Model:

(14) $R_{it} = \alpha_i + \beta_i R^{O}_{mt} + \gamma_i R^{U}_{oilt} + \varepsilon_{it}, \text{ and } i = 1 \text{ to } 24.$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

Table 9 presents the basic model results for the monthly returns of the Nordic indices. Consistent with the results of Nandha and Faff (2008), the market coefficient is statistically significant in all of the sector indices. With the monthly data, the highest market coefficients are in the sectors of Technology (1,3432) and Financial Services (1,2552) while Travel & Leisure (0,7140), Utilities (0,7209) and Telecommunications (0,7610) have the lowest correlations with the market index.

In contrast to the results for weekly data, the results for monthly data suggest that the statistical significance of oil price coefficients vary across industries. Only 13 of the 24 industries seem to be statistically significantly correlated with oil price factor and 6 of them are statistically significant at the 1% level.

However, in contrast to the findings of Nandha and Faff (2008), all of the significant oil price coefficients of Nordic indices are positive whereas almost all of world's industry indices studied by Nandha and Faff (2008) have negative correlation with the oil price. In the Nordics, the sectors of Health Care, Insurance, Real Estate, Technology and Travel & Leisure have negative correlations for the oil price factor but none of them are statistically significant.

Consistent with the findings of the weekly data, the highest correlations with the oil price are in Automobiles & Parts (0,1747) and Oil & Gas (0,1661). The lowest statistically significant correlations are in Financials (0,0777) and Industrials (0,1016).

For the monthly returns, the highest adjusted R-squared values are in Financial Services (0,8135) and Industrials (0,7878) whereas the lowest values are in Utilities (0,1842), Travel & Leisure (0,2408) and Media (0,3131). The Durbin-Watson statistics remain close to the value of 2,00 across different industries. In the estimations of Automobiles & Parts, Chemicals and Utilities, an autoregressive error with one lag AR(1) is statistically significant implying autocorrelation in the error term.

Table 9. Basic model results for the monthly returns of the Nordic indices.

Industry	Code	αi	βi	γi	Adj. R2	DW
Automobiles & Parts	<u>1</u>	0,0058	0,9904***	0,1747***	0,5448	1,8857
		(0,82)	(7,25)	(2,74)		
Banks	2	0,0112***	0,9913***	0,1149*	0,5075	1,9971
		(2,43)	(7,70)	(1,29)		
Basic Materials	3	0,0104**	1,2363***	0,1281*	0,5848	2,0020

		(1,82)	(9,98)	(1,64)		
Basic Resources	4	0,0107*	1,2810***	0,1416*	0,5251	2,0024
		(1,61)	(8,41)	(1,63)		
Chemicals	**5**	0,0105**	0,9152***	0,0711	0,4084	1,8778
		(2,32)	(6,43)	(0,72)		
Consumer Goods	6	0,0104***	0,8469***	0,1367***	0,7386	1,9913
		(4,87)	(12,32)	(3,97)		
Consumer Services	7	0,0017	0,9025***	0,0227	0,4776	1,9780
		(0,36)	(5,73)	(0,29)		
Construction & Materials	8	0,0109***	1,0708***	0,0254	0,7808	2,0806
		(5,08)	(17,85)	(0,55)		
Financials	9	0,0115***	1,0315***	0,0777*	0,7349	1,9948
		(3,91)	(12,78)	(1,29)		
Financial Services	10	0,0123***	1,2552***	0,1141***	0,8135	1,8676
		(4,86)	(14,60)	(2,33)		
Food & Beverage	11	0,0089***	0,8554***	0,1308**	0,5059	1,9668
		(2,48)	(7,90)	(2,21)		
Health Care	12	0,0126***	0,9706***	-0,0847	0,5295	1,9663
		(2,88)	(7,63)	(-1,17)		
Indust. Goods and Serv.	13	0,0092***	1,0676***	0,1173***	0,7510	1,9847
		(3,46)	(12,54)	(2,69)		
Industrials	14	0,0093***	1,0679***	0,1016***	0,7878	1,9884
		(3,98)	(14,79)	(2,64)		
Insurance	15	0,0128***	0,8186***	-0,0611	0,4193	1,9263
		(3,30)	(5,57)	(-0,96)		
Media	16	-0,0024	0,9768***	0,1333	0,3131	1,9516
		(-0,36)	(5,93)	(1,12)		
Oil & Gas	17	0,0175***	1,0946***	0,1661**	0,4179	1,9139
		(2,70)	(5,59)	(1,79)		
Pers. & Househ. Goods	18	0,0124***	0,7912***	0,1116***	0,5935	1,9606
		(4,81)	(9,30)	(2,56)		
Real Estate	19	0,0125***	0,9636***	-0,0565	0,5700	1,9742
		(3,71)	(10,53)	(-0,75)		
Retail	20	0,0006	0,9061***	0,0222	0,4101	1,9858
		(0,12)	(4,62)	(0,25)		
Technology	21	0,0052	1,3432***	-0,0605	0,4338	1,9428
		(0,89)	(5,98)	(-0,51)		
Telecommunications	22	-0,0008	0,7610***	0,1063**	0,4510	2,0426
		(-0,25)	(6,93)	(1,90)		
Travel & Leisure	23	0,0155***	0,7140***	-0,0540	0,2408	1,9886
		(2,54)	(5,47)	(-0,56)		
Utilities	**24**	0,0003	0,7209***	0,0374	0,1842	1,9110
		(0,05)	(4,38)	(0,37)		

Model:

(14) $R_{it} = \alpha_i + \beta_i R^{O}_{mt} + \gamma_i R^{U}_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 24.$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

According to the basic model results for weekly returns of the Nordic indices, the null hypothesis can be rejected for all industries at the 1% level. With the monthly data, the null hypothesis can be rejected for 13 out of 24 industries and for 6 industries at the 1% level. Therefore, the first hypothesis can be rejected only with monthly data for 11 out of 24 industries.

The empirical results show that the correlations between oil price and sector index returns vary across industries and, therefore, the second hypothesis of the paper can be accepted. In addition, the results for the oil price coefficients are different with weekly data and with monthly data. Therefore, the third hypothesis can be rejected in the Nasdaq OMX Nordic market.

7.1.1. Results of the asymmetric model for the Nordic indices

Table 10 presents the results of the asymmetric model for weekly returns of the Nasdaq OMX Nordic sector indices. According to the results, the correlations with both positive and negative unexpected oil price returns are positive in all sectors. In all industries except Travel & Leisure, both increases and decreases in oil prices have statistically significant influence on sector index returns. Most of coefficients are statistically significant at the 1% level. Interestingly, Travel & Leisure sector correlates statistically significantly with positive unexpected oil price changes with the coefficient of 0,1197 at the 1% level while the unexpected negative changes in oil prices have no significant effect on the Travel & Leisure sector.

The coefficient for unexpected positive changes is higher than for negative changes in 14 out of 24 industries. Automobiles & Parts (0,2249) and Oil & Gas (0,2190) have the highest correlations with positive changes whereas Food & Beverage (0,0652) and Heath Care (0,0918) have the lowest correlations. Oil & Gas (0,2476) and Utilities

(0,2429) correlates the most with unexpected negative oil price changes while Health Care (0,0894) and Real Estate (0,0985) correlates the least.

Based on the results for the weekly returns of Nordic indices, Wald tests reject the fourth hypothesis of the paper only for the Utilities industry at the 10% level whereas the hypothesis can be accepted for all the other industries. These results imply that all of the industries, except Utilities, have symmetric sensitivity, instead of asymmetric, for unexpected oil price changes.

Table 10. Asymmetric model results for weekly returns of the Nordic indices.

Industry	Code	γ_{ui}	γ_{di}	H04: $\gamma_{ui}=\gamma_{di}$	Adj. R2	DW
Automobiles & Parts	1	0,2249***	0,1851***	0,2355	0,5562	1,9714
		(4,73)	(3,74)	0,6278		
Banks	2	0,1667***	0,1479***	0,1178	0,7347	2,0044
		(6,12)	(4,02)	0,7317		
Basic Materials	3	0,1522***	0,2210***	1,0004	0,7159	1,9994
		(3,59)	(5,67)	0,3181		
Basic Resources	4	0,1536***	0,2216***	0,7927	0,6809	1,9990
		(3,25)	(5,16)	0,3741		
Chemicals	5	0,1420**	0,2247***	0,5712	0,4888	2,0073
		(2,08)	(3,88)	0,4504		
Consumer Goods	6	0,1546***	0,1344***	0,3838	0,8155	2,0072
		(10,34)	(5,59)	0,5361		
Consumer Services	7	0,1104***	0,1038***	0,0135	0,6130	1,9879
		(4,40)	(2,44)	0,9077		
Const. & Materials	**8**	0,1491***	0,1510***	0,0023	0,8423	2,0199
		(7,43)	(5,43)	0,9621		
Financials	9	0,1596***	0,1368***	0,4653	0,8734	2,0057
		(9,36)	(6,14)	0,4957		
Financial Services	10	0,1774***	0,1415***	0,8391	0,8731	1,9757
		(8,35)	(5,59)	0,3605		
Food & Beverage	**11**	0,0652**	0,1615***	2,2240	0,5547	2,0082
		(1,73)	(4,06)	0,1370		
Health Care	12	0,0918***	0,0894***	0,0016	0,5775	2,0003
		(2,78)	(2,29)	0,9682		
Indust. Goods & Serv.	13	0,1461***	0,1770***	0,8850	0,8540	1,9993
		(9,01)	(7,75)	0,3476		
Industrials	14	0,1461***	0,1742***	0,8070	0,8800	1,9984
		(8,95)	(8,33)	0,3698		
Insurance	15	0,1175***	0,1069***	0,0253	0,5812	1,9987
		(3,19)	(2,50)	0,8737		

Media	16	0,1103***	0,1844***	1,0158	0,4746	1,9909
		(2,57)	(3,94)	0,3144		
Oil & Gas	17	0,2190***	0,2476***	0,0753	0,5308	1,9918
		(3,55)	(3,92)	0,7840		
Pers. & Househ. Goods	18	0,1693***	0,1138***	1,8997	0,7178	2,0129
		(9,65)	(3,63)	0,1692		
Real Estate	19	0,1344***	0,0985***	0,4290	0,6490	1,9952
		(4,17)	(3,02)	0,5130		
Retail	20	0,1094***	0,1060**	0,0027	0,5304	1,9870
		(3,98)	(2,07)	0,9587		
Technology	**21**	0,1470***	0,1384**	0,0073	0,5604	1,9928
		(2,48)	(2,28)	0,9321		
Telecommunications	22	0,1816***	0,1236***	1,0592	0,6703	1,9892
		(5,77)	(3,57)	0,3043		
Travel & Leisure	23	0,1197***	0,0492	1,4439	0,4789	1,9951
		(4,15)	(1,15)	0,2305		
Utilities	24	0,1011**	0,2429***	3,0068	0,3582	1,9939
		(2,29)	(4,42)	0,0840		

Model:

(15) $$R_{it} = \alpha_i + \beta_i R^O_{mt} + \gamma_{ui} D * R^U_{oilt} + \gamma_{di}(1-D) * R^U_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 24.$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

Table 11 presents the asymmetric model results for monthly returns of the Nordic sector indices. Based on the monthly data, the significance and magnitude of the coefficients for both positive and negative unexpected oil price changes vary a lot across industries. In contrast to the weekly data, only 8 out of 24 industries, instead of all, have statistically significant correlation with the positive unexpected change in oil prices. Only two of these industries, Consumer Goods (0,2571) and Personal & Household Goods (0,2699), have statistically significant coefficients at the 1% level. Only 6 out of 24 industries are statistically significantly correlated with the negative unexpected oil price changes. Two of these sector indices, Industrial Goods & Services (0,2467) and Industrials (0,2024), have statistically significant coefficients at the 1% level whereas the other sectors have significance at the 10% level.

In contrast to the weekly data, the results for monthly returns reveal also negative coefficients for unexpected positive oil price changes. However, only the negative coefficient for Insurance (-0,1806) is statistically significant at the 5% level. The Oil & Gas sector correlates the most with the positive unexpected oil price changes with the coefficient of 0,2851. The highest positive correlation for unexpected negative oil price changes is in the sector of Industrial Goods & Services with the coefficient of 0,2467. In contrast, the sector of Travel & Leisure correlates negatively with the unexpected negative oil price changes with the coefficient of -0,2284. Interestingly, the monthly results imply that Oil & Gas sector does not statistically significantly correlate with negative unexpected changes in oil prices.

The Wald tests reject the fourth hypothesis of the paper only for the sectors of Consumer Goods and Personal & Household Goods at the significance level of 5%. This result implies that oil price sensitivity is symmetric for all other industries.

Table 11. Asymmetric model results for monthly returns of the Nordic indices.

Industry	Code	γui	γdi	H04:γui=γdi	Adj. R2	DW
Automobiles & Parts	<u>1</u>	0,2047*	0,1470*	0,0619	0,5375	1,8853
		(1,31)	(1,34)	0,8043		
Banks	2	0,0291	0,1951	0,2129	0,5032	1,9969
		(0,18)	(0,80)	0,6462		
Basic Materials	3	0,0518	0,2001*	0,2307	0,5800	2,0048
		(0,26)	(1,37)	0,6328		
Basic Resources	4	0,0571	0,2221*	0,2097	0,5193	2,0045
		(0,24)	(1,36)	0,6487		
Chemicals	<u>5</u>	0,0297	0,1098	0,0550	0,3992	1,8773
		(0,13)	(0,62)	0,8155		
Consumer Goods	6	0,2571***	0,0240	4,8872	0,7489	1,9944
		(4,34)	(0,37)	0,0309		
Consumer Services	7	0,1323	-0,0828	0,5055	0,4767	1,9841
		(0,76)	(-0,48)	0,4799		
Const. & Materials	8	0,0489	0,0035	0,0584	0,7775	2,0932
		(0,52)	(0,03)	0,8099		
Financials	9	0,0550	0,0987	0,0316	0,7308	1,9935
		(0,47)	(0,62)	0,8594		
Financial Services	10	0,2208**	0,0150	1,4673	0,8163	1,8782
		(2,22)	(0,15)	0,2306		

Food & Beverage	11	0,1699*	0,0947	0,1485	0,4986	1,9642
		(1,64)	(0,76)	0,7013		
Health Care	12	-0,0139	-0,1557	0,3342	0,5246	1,9653
		(-0,08)	(-1,27)	0,5654		
Indust. Goods & Serv.	13	-0,0195	0,2467***	1,6165	0,7587	1,9903
		(-0,13)	(3,21)	0,2086		
Industrials	14	-0,0047	0,2024***	1,2287	0,7919	1,9868
		(-0,03)	(2,86)	0,2722		
Insurance	15	-0,1806**	0,0487	0,6251	0,4193	1,9166
		(-1,66)	(0,22)	0,4323		
Media	16	0,3280	-0,0479	0,8130	0,3146	1,9473
		(1,08)	(-0,27)	0,3709		
Oil & Gas	17	0,2851*	0,0489	0,4392	0,4132	1,9225
		(1,40)	(0,24)	0,5101		
Pers. & Househ. Goods	18	0,2699***	-0,0336	4,6036	0,6096	1,9859
		(3,14)	(-0,43)	0,0360		
Real Estate	19	0,0566	-0,1616	0,7637	0,5713	1,9765
		(0,38)	(-1,15)	0,3857		
Retail	20	0,1170	-0,0685	0,3312	0,4052	1,9879
		(0,66)	(-0,35)	0,5671		
Technology	21	-0,2626	0,1195	0,6347	0,4352	1,9364
		(-1,23)	(0,36)	0,4288		
Telecommunications	22	0,1730*	0,0444	0,3639	0,4453	2,0473
		(1,51)	(0,36)	0,5487		
Travel & Leisure	23	0,1329	-0,2284*	1,0540	0,2480	1,9966
		(0,56)	(-1,33)	0,3088		
Utilities	**24**	0,0028	0,0695	0,0280	0,1708	1,9114
		(0,01)	(0,35)	0,8676		

Model:

(15) $R_{it} = \alpha_i + \beta_i R^O_{mt} + \gamma_{ui} D * R^U_{oilt} + \gamma_{di}(1 - D) * R^U_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 24.$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

7.2. Results for the Qatari indices

Table 12 presents the basic model results for the weekly returns of the Qatari sector indices. Based on the results for the weekly data, all of the market coefficients β_i and oil price coefficients γ_i are positive and statistically significant at the 1% level for all industries. The highest market coefficient is in the Real Estate (1,2761) sector whereas the Consumer Goods & Services (0,8325) correlates the least.

In the Qatari markets, the highest correlations with the oil price returns are in the Real Estate and Industrials sectors with the coefficients of 0,2290 and 0,2039. The Transportation industry has the lowest correlation with the oil price returns with the coefficient of 0,1185.

The adjusted R-squared value is 0,8926 for Banks and Financial Services implying that the model fits good with the data of this industry. The lowest adjusted R-squared value of 0,5013 is for the Insurance sector. The Durbin-Watson statistics are close to the ideal value of 2,00 implying that there is not autocorrelation in the residuals. However, the term of autoregressive error with one lag AR(1) is statistically significant in the estimation of the Insurance sector indicating autocorrelation in the error term.

Table 12. Basic model results for the weekly returns of the Qatari indices.

Industry	Code	αi	βi	γi	Adj. R2	DW
Banks & Financial Serv.	1	0,0011**	0,9647***	0,1475***	0,8926	2,0036
		(2,26)	(50,69)	(16,07)		
Cons. Goods & Serv.	2	0,0010	0,8325***	0,1783***	0,5873	2,0003
		(1,02)	(26,85)	(8,40)		
Industrials	3	0,0004	1,0071***	0,2039***	0,8503	1,9869
		(0,64)	(36,04)	(16,93)		
Insurance	4	0,0027**	0,8351***	0,1624***	0,5013	2,0283
		(2,25)	(20,93)	(5,81)		
Real Estate	5	0,0009	1,2761***	0,2290***	0,6865	2,0096
		(0,81)	(21,38)	(7,66)		
Telecoms	6	0,0002	1,0962***	0,1717***	0,6183	1,9882
		(0,18)	(27,52)	(8,13)		
Transportation	7	0,0009	0,8488***	0,1185***	0,6084	1,9826
		(1,06)	(28,61)	(5,47)		

Model:

(14) $$R_{it} = \alpha_i + \beta_i R_{mt}^{O} + \gamma_i R_{oilt}^{U} + \varepsilon_{it}, and\ i = 1\ to\ 7.$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

Table 13 presents the basic model results for the monthly returns of the Qatari indices. Consistent with the weekly data and results of Nandha and Faff (2008), the market coefficients remain statistically significant at the 1% level with the monthly data across all industries. In contrast to the weekly data, the highest market coefficient for the monthly returns is in Telecoms (1,2831) sector instead of the Real Estate sector for the weekly data. However, the market coefficient for Real Estate is the second highest with the value of 1,2607. The lowest market correlation is in the Insurance (0,7552) sector.

In contrast to the results for the weekly data, only 5 out of 7 industries, instead of all, are statistically significantly correlated with an unexpected change in the oil price returns. Three of these industries are statistically significant at the 1% level. All of the industries have positive oil price coefficient. The results suggest the highest oil price correlation for the Real Estate (0,2505) and Industrials (0,2328) sectors. In fact, the same industries have the highest oil price correlation also with the weekly data. However, the monthly data reveal higher values for the coefficients. The Telecoms sector has the lowest correlation with the oil price with the coefficient of 0,1244.

For the monthly returns, the highest value of the adjusted R-squared is in the Banks & Financial Services with the value of 0,9001 whereas the lowest value of 0,3401 is in the Insurance sector. The Durbin-Watson statistics remain close to the value of 2,00 for all sector indices except the Insurance industry. In addition, the term of autoregressive error with one lag AR(1) is statistically significant in the estimation for the Insurance sector indicating autocorrelation in the error term.

Table 13. Basic model results for the monthly returns of the Qatari indices.

Industry	Code	αi	βi	γi	Adj. R2	DW
Banks & Financial Serv.	1	0,0049***	1,0472***	0,1309***	0,9001	1,9558
		(2,39)	(18,17)	(3,37)		
Cons. Goods & Serv.	2	0,0040	0,7914***	0,1927**	0,4776	2,0045
		(0,82)	(8,20)	(2,12)		
Industrials	3	0,0020	0,9192***	0,2328***	0,7892	1,9657
		(0,67)	(14,37)	(4,08)		
Insurance	**4**	0,0116**	0,7552***	0,0810	0,3401	1,8581

		(2,25)	(8,65)	(0,98)		
Real Estate	5	0,0035	1,2607***	0,2505***	0,6341	2,0158
		(0,58)	(9,34)	(2,55)		
Telecoms	6	0,0011	1,2831***	0,1244*	0,6324	1,9549
		(0,18)	(10,22)	(1,58)		
Transportation	7	0,0048	0,8095***	0,0825	0,5122	2,0115
		(0,96)	(9,37)	(1,00)		

Model:

(14) $$R_{it} = \alpha_i + \beta_i R^{O}_{mt} + \gamma_i R^{U}_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 7.$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

Based on the basic model results for weekly returns of the Qatari sector indices, the null hypothesis can be rejected for all industries at the 1% level. With the monthly data, the null hypothesis can be rejected for 5 out of 7 industries and for three industries at the 1% level. For this reason, the first hypothesis can be rejected only with the results of the monthly data for 2 out of 7 industries.

The results for both weekly and monthly data provide evidence that the value oil price coefficient vary across industries. Therefore, the second hypothesis can be accepted. According to the results, the oil price correlations vary between the data of weekly and monthly returns and, therefore, the third hypothesis of the paper can be rejected.

7.2.1. Results of the asymmetric model for the Qatari indices

Table 14 presents the results of the asymmetric model for the weekly returns of the Qatar Stock Exchange sector indices. According to the results, the correlations with both positive and negative unexpected oil price returns are positive and statistically significant at the 1% level for all sector indices.

The results show that the Real Estate sector correlates the most with the positive unexpected changes in oil prices with the coefficient of 0,2396 while the Transportation industry has the lowest coefficient of 0,1164. The Industrials (0,2367) sector is the most influenced by the negative unexpected changes in oil prices whereas the Transportation (0,1212) industry correlates the least with these price changes.

Based on the results for the weekly returns of the Qatari indices, the Wald tests can not reject the fourth hypothesis of the paper for any of the industries. This implies that all of the industries have symmetric sensitivity for unexpected oil price changes.

Table 14. Asymmetric model results for weekly returns of the Qatari indices.

Industry	Code	γui	γdi	H04:γui=γdi	Adj. R2	DW
Banks & Financial Serv.	1	0,1600***	0,1316***	1,0032	0,8926	2,0036
		(8,79)	(8,31)	0,3174		
Cons. Goods & Serv.	2	0,1596***	0,2021***	0,5165	0,5865	2,0007
		(4,61)	(5,39)	0,4729		
Industrials	3	0,1781***	0,2367***	2,3850	0,8511	1,9880
		(7,46)	(10,66)	0,1236		
Insurance	**4**	0,1722***	0,1504***	0,0631	0,4997	2,0273
		(3,29)	(2,94)	0,8019		
Real Estate	5	0,2396***	0,2157***	0,0799	0,6855	2,0099
		(5,04)	(3,87)	0,7776		
Telecoms	6	0,1862***	0,1535***	0,2464	0,6172	1,9883
		(4,26)	(4,38)	0,6200		
Transportation	7	0,1164***	0,1212***	0,0050	0,6070	1,9826
		(2,68)	(3,15)	0,9439		

Model:

(15) $$R_{it} = \alpha_i + \beta_i R^{O}_{mt} + \gamma_{ui} D * R^{U}_{oilt} + \gamma_{di}(1-D) * R^{U}_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 7.$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

Table 15 presents the results of the asymmetric model for monthly returns of the Qatari indices. In contrast to the weekly data, the results for monthly returns show more variety for the significances of the oil price coefficients. Instead of all industries, only the sectors of Banks & Financial Services (0,1398), Industrials (0,2067) and Real Estate (0,1917) have statistically significant correlation coefficients with positive unexpected oil price changes. In addition, the coefficient of positive changes for the Insurance sector is negative but not statistically significant. Furthermore, only 3 out of 7 industries are statistically significantly influenced by unexpected negative changes in oil prices. The highest correlations for the negative changes are in Real Estate (0,3080) and Industrials (0,2583) sectors.

Based on the results for monthly data, Wald tests can not reject the fourth hypothesis for any of the sector indices. The interpretation for this result is that the Qatari indices have symmetric correlation, instead of asymmetric, with unexpected oil price changes.

Table 15. Asymmetric model results for monthly returns of the Qatari indices.

Industry	Code	γui	γdi	H04:γui=γdi	Adj. R2	DW
Banks & Financial Serv.	1	0,1398**	0,1221	0,0139	0,8984	1,9574
		(2,22)	(1,13)	0,9067		
Cons. Goods & Serv.	2	0,2674	0,1187	0,1834	0,4732	2,0077
		(1,20)	(0,68)	0,6701		
Industrials	3	0,2067**	0,2583**	0,0651	0,7862	1,9685
		(1,77)	(2,21)	0,7995		
Insurance	**<u>4</u>**	-0,0565	0,2147*	0,9007	0,3446	1,8614
		(-0,28)	(1,63)	0,3465		
Real Estate	5	0,1917*	0,3080*	0,1795	0,6292	2,0113
		(1,45)	(1,50)	0,6734		
Telecoms	6	0,1446	0,1036	0,0290	0,6263	1,9538
		(0,88)	(0,84)	0,8654		
Transportation	7	0,1521	0,0146	0,1270	0,5078	2,0236
		(0,54)	(0,10)	0,7228		

Model:

(15) $$R_{it} = \alpha_i + \beta_i R^O_{mt} + \gamma_{ui} D * R^U_{oilt} + \gamma_{di}(1-D) * R^U_{oilt} + \varepsilon_{it}, and\ i = 1\ to\ 7.$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

Underlined and bolded codes refer to estimations with AR(1) term where it shows up as statistically significant.

T-statistics are shown in the parenthesis.

7.3. Differences between the results of the Nordic and Qatari indices

This chapter presents the differences between the results of the Nordic and Qatari indices. However, comparing the indices of these two markets can be tricky. The reason for this is the fact that the Qatari stocks are allocated only into 7 sectors whereas the Nordic stocks are allocated into 24 different sectors. Therefore, before comparing the results of these markets, it is necessary to determine the counterparts for the comparable sector indices.

As the Qatari stocks are allocated more compactly than the Nordic stocks, the sector index of Banks & Financial Services is actually included with two different industries. However, according to the Qatar Exchange (2012), most of the market capitalization of this sector index comes from the banking industry. Therefore, the chosen Nordic counterpart for this index is the Banks sector index.

Interestingly, the chosen counterpart for the Qatari sector index of Consumer Goods & Services is Oil & Gas sector from Nordic markets. The reason for this is the fact that over 60% of the market capitalization of the Qatari Consumer Goods & Services sector is contributed by the stock of Qatar Fuel Co (Qatar Exchange 2012). Because Qatar Fuel Co is the dominant stock of the index and share the same characteristics with the Nordic Oil & Gas sector, the most comparable sector is Oil & Gas.

The best counterpart for the Qatari Transportation sector index is the Nordic index of Industrial Goods & Services while Nordic markets are lacking a specific sector for Transportation industry. However, the Qatari Transportation sector index contains only industrial transportation company stocks whereas the industrial transportation is a subsector of the Industrial Goods & Services sector (Qatar Exchange 2012). Therefore, the best Nordic comparison for the Qatari Transportation sector is the sector of Industrial Goods & Services.

Tables 16 and 17 present the basic model and asymmetric model results for the comparable Nordic and Qatari indices. On the tables, the bolded coefficients imply higher correlation than the counterparts' coefficient for the same industry.

7.3.1. Differences between the basic model results

Table 16 presents the oil price coefficients of the basic model results for both Nordic and Qatari indices. On the table, γin is the oil price coefficient for Nordic sector indices whereas γiq is the oil price coefficient for Qatari indices. According to the results for weekly data, in the Nordic markets the sectors of Banks, Oil & Gas and Industrial Goods & Services have higher correlation with oil price indices than the Qatari counterparts. On the other hand, the sectors of Insurance, Real Estate and Telecoms are more influenced by oil price changes in Qatar than in the Nordics. The sector of Industrials is more sensitive for oil price changes in Qatari markets than the counterpart in the Nordic markets. All of the coefficients for weekly data are statistically significant at the 1% level.

Based on the results for monthly returns, the correlations with the oil price changes are higher in the Qatari markets for 6 out of 7 sector indices. However, the coefficient for one of these indices, Insurance sector index, is not statistically significant for these markets. The relatively greatest difference in the correlations is for the Real Estate sector. The oil price correlation for the Real Estate sector in Qatar is 0,2505 at the significance level of 1% whereas the counterpart's correlation with oil price is -0,0565 without any statistical significance. Also the oil price correlation for Industrials sector is notably higher in Qatar markets with the value of 0,2328 when comparing to the Nordic correlation coefficient of 0,1016. Both of these coefficients are statistically significant at the 1% level.

The difference in correlations between the sectors of Transportation and Industrial Goods & Services is rather interesting. The results for the monthly data suggest that the sensitivity for oil price changes is higher for the Nordic sector of Industrial Goods & Services with the correlation coefficient of 0,1173 at the statistical significance level of 1% whereas the sensitivity for Transportation without any statistical significance is 0,0825.

Table 16. Basic model coefficients for oil in Nordic and Qatari markets.

Industry	Nordic	Qatar	Difference
	γin	γiq	γin - γiq
(Weekly data)			
Banks / Banks & Financial Services	**0,1585*****	0,1475***	0,0110
	(9,96)	(16,07)	
Oil & Gas / Consumer Goods & Services	**0,2315*****	0,1783***	0,0532
	(6,92)	(8,40)	
Industrials	0,1584***	**0,2039*****	-0,0455
	(17,17)	(16,93)	
Insurance	0,1128***	**0,1624*****	-0,0496
	(5,31)	(5,81)	
Real Estate	0,1187***	**0,2290*****	-0,1103
	(6,74)	(7,66)	
Telecoms	0,1561***	**0,1717*****	-0,0156
	(9,43)	(8,13)	
Industrial Goods & Services / Transportation	**0,1597*****	0,1185***	0,0412
	(16,67)	(5,47)	
(Monthly data)			
Banks / Banks & Financial Services	0,1149*	**0,1309*****	-0,0159

	(1,29)	(3,37)	
Oil & Gas / Consumer Goods & Services	0,1661**	**0,1927****	-0,0266
	(1,79)	(2,12)	
Industrials	0,1016***	**0,2328*****	-0,1312
	(2,64)	(4,08)	
Insurance	-0,0611	**0,0810**	-0,1421
	(-0,96)	(0,98)	
Real Estate	-0,0565	**0,2505*****	-0,3070
	(-0,75)	(2,55)	
Telecoms	0,1063**	**0,1244***	-0,0181
	(1,90)	(1,58)	
Industrial Goods & Services / Transportation	**0,1173*****	0,0825	0,0348
	(2,69)	(1,00)	

Model:

(14) $$R_{it} = \alpha_i + \beta_i R^O_{mt} + \gamma_i R^U_{oilt} + \varepsilon_{it}$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

T-statistics are shown in the parenthesis.

Bolded coefficients imply higher correlation than counterpart's comparison.

7.3.2. Differences between the asymmetric model results

Table 17 presents the differences of the asymmetric model results between Nordic and Qatari indices. According to the results for weekly data, the Nordic sectors of Banks, Oil & Gas and Industrial Goods & Services are more influenced of both positive and negative unexpected changes in oil prices than Qatari counterparts. However, the sectors of Industrials, Insurance, Real Estate and Telecoms have higher sensitivity for both positive and negative movements of oil prices in Qatar than in the Nordics. All of the coefficients are statistically significant at the 1% level.

When the results for monthly returns are considered, both correlations and statistical significances differ a lot from the weekly data. For example, whereas the weekly results suggest almost similar correlations for both positive (0,1667; 0,1600) and negative (0,1479; 0,1316) unexpected oil price changes in the banking industry in both markets, the results for monthly data show different correlations. Based on the results for monthly data, the sector index of Banks & Financial Services in Qatar has a correlation of 0,1398 with positive unexpected changes in oil prices at statistical significance level of 1% whereas the Nordic comparison has a coefficient of 0,0291 without any statistical significance. Both of the sector indices for banking industry do not have statistically significant correlations with the negative unexpected oil price changes.

Interestingly, the asymmetric model results suggest that the Nordic Oil & Gas sector index has a high correlation coefficient of 0,2851 with the positive unexpected changes at the 10% significance level whereas Qatari counterpart do not have any statistical significances. However, in line with the weekly results, the sectors of Industrials and Real Estate have higher correlations with both positive and negative unexpected oil price changes in Qatar than in the Nordic markets.

According to the results for monthly data, the unexpected changes in oil prices have high effect on the Insurance industry. The correlations for both comparable Insurance sector indices for positive unexpected changes is negative while the Nordic coefficient is -0,1806 at the 5% significance level and the Qatari coefficient is -0,0565 without any statistical significance. However, while the coefficient of the Nordic Insurance sector with negative oil price changes is only 0,0487 without any statistical significance, the Qatari correlation is 0,2147 at the 10% significance level.

The results also show that in the Nordics the positive unexpected changes in oil prices have a significant influence on Telecoms (0,1730) industry at the 10% level whereas the negative unexpected changes influence on Industrial Goods & Services (0,2467) industry at the significance level of 1%. However, according to the asymmetric model results, the Qatari counterparts for these industries do not have statistically significant relationship with unexpected oil price changes.

Table 17. Asymmetric model coefficients for oil in Nordic and Qatari markets.

Industry	Change (+)		Difference	Change (-)		Difference
	Nordic	Qatar	N - Q	Nordic	Qatar	N - Q
(Weekly data)						
Banks / Banks & Finan. Serv.	**0,1667*****	0,1600***	0,0068	**0,1479*****	0,1316***	0,0163
	(6,12)	(8,79)		(4,02)	(8,31)	
Oil & Gas / Cons. Goods & Serv.	**0,2190*****	0,1596***	0,0594	**0,2476*****	0,2021***	0,0455
	(3,55)	(4,61)		(3,92)	(5,39)	
Industrials	0,1461***	**0,1781*****	-0,0320	0,1742***	**0,2367*****	-0,0625
	(8,95)	(7,46)		(8,33)	(10,66)	
Insurance	0,1175***	**0,1722*****	-0,0546	0,1069***	**0,1504*****	-0,0435

	(3,19)	(3,29)		(2,50)	(2,94)	
Real Estate	0,1344***	**0,2396***	-0,1052	0,0985***	**0,2157***	-0,1172
	(4,17)	(5,04)		(3,02)	(3,87)	
Telecoms	0,1816***	**0,1862***	-0,0046	0,1236***	**0,1535***	-0,0298
	(5,77)	(4,26)		(3,57)	(4,38)	
Indust. G. & S. / Transportation	**0,1461***	0,1164***	0,0297	**0,1770***	0,1212***	0,0557
	(9,01)	(2,68)		(7,75)	(3,15)	
(Monthly data)						
Banks / Banks & Finan. Serv.	0,0291	**0,1398**	-0,1107	**0,1951**	0,1221	0,0730
	(0,18)	(2,22)		(0,80)	(1,13)	
Oil & Gas / Cons. Goods & Serv.	**0,2851***	0,2674	0,0177	0,0489	**0,1187**	-0,0698
	(1,40)	(1,20)		(0,24)	(0,68)	
Industrials	-0,0047	**0,2067**	-0,2115	0,2024***	**0,2583**	-0,0558
	(-0,03)	(1,77)		(2,86)	(2,21)	
Insurance	**-0,1806**	-0,0565	-0,1240	0,0487	**0,2147***	-0,1660
	(-1,66)	(-0,28)		(0,22)	(1,63)	
Real Estate	0,0566	**0,1917***	-0,1352	-0,1616	**0,3080***	-0,4696
	(0,38)	(1,45)		(-1,15)	(1,50)	
Telecoms	**0,1730***	0,1446	0,0285	0,0444	**0,1036**	-0,0592
	(1,51)	(0,88)		(0,36)	(0,84)	
Indust. G. & S. / Transportation	-0,0195	**0,1521**	-0,1716	**0,2467***	0,0146	0,2321
	(-0,13)	(0,54)		(3,21)	(0,10)	

Model:

(15) $$R_{it} = \alpha_i + \beta_i R^{O}_{mt} + \gamma_{ui} D * R^{U}_{oilt} + \gamma_{di}(1 - D) * R^{U}_{oilt} + \varepsilon_{it}$$

* Statistical significance at the 10% level.

** Statistical significance at the 5% level.

*** Statistical significance at the 1% level.

T-statistics are shown in the parenthesis.

Bolded coefficients imply higher correlation than counterpart's comparison.

Based on the results of the basic and asymmetric model, the Qatar Stock Exchange market and Nasdaq OMX Nordic markets are different. Since the sector-specific correlations with unexpected oil price changes are different between Nordic and Qatari markets, it is possible to assume that these markets share different kind of characteristics and relationship with oil as a commodity. According to the fifth hypothesis of this paper, the correlations between oil price and sector index returns vary in Nordic and Qatari markets when comparing indices that represent similar industries. Therefore, with this empirical evidence, we are able to accept the last hypothesis of this paper.

8. CONCLUSIONS

The purpose of this paper was to investigate relationships between oil price changes and industry-level stock index returns. Furthermore, the paper examined the relationship in both Nordic and Qatari markets. The purpose for studying both markets was to find out possible differences in oil price sensitivity and market-specific relationships with oil as a commodity. In the study Nordic markets represent oil-importers whereas Qatari markets represent oil-exporters.

First of all, the paper presented oil as a commodity and its importance for the world economy. Secondly, the stock pricing models and the theory of market efficiency was presented. According to the stock pricing models, the expected return of a stock is one of the key factors in determining the stock price. Furthermore, the theory of market efficiency suggests that stock prices should reflect all available and relevant information. Therefore, based on the theory, if oil price changes have an influence on companies' profitability they should also have an effect to the stock prices of these companies.

The findings of previous studies suggest that oil can be considered as both macroeconomic and microeconomic factor. According to the previous studies, oil price changes can have an influence on gross domestic product, gross savings, consumer expectations and stock market returns. Furthermore, the relationship with oil varies between oil-importers and oil-exporters.

The previous studies also present empirical evidence that oil prices have sector-specific influence on stock returns. According to Nandha and Brailsford (1999), the correlation with oil is positive for energy industry whereas the paper, packaging and transportation industries correlates negatively with oil price changes. In addition, the findings of Nandha and Faff (2008) suggest that oil price changes have negative influence on all industries except mining and energy industry.

However, the findings of this paper differ from previous studies substantially while the empirical results suggest mostly positive sector-specific correlations with oil price changes for both Nordic and Qatari markets. According to the results for weekly data, all of the oil price coefficients are positive and statistically significant at the 1% level for both Nordic and Qatari industries. In the Nordics, the weekly returns of Oil & Gas and Automobiles & Parts have highest correlations with oil price changes whereas the returns of Travel & Leisure and Health Care correlates the least. In the Qatari markets, the correlations for weekly returns are highest in Real Estate and Industrials sectors and lowest in Transportation industry.

In contrast to the results for the weekly data, the monthly data results suggest that the statistical significance of oil price coefficients vary across industries in both Nordic and Qatari stock markets. Also the magnitudes of coefficients vary between weekly and monthly data. However, all of the statistically significant coefficients remain positive. With the monthly data, the highest correlation coefficients are in line with weekly results in both markets. In contrast, the lowest correlations differ. In the Nordic markets, the lowest statistically significant correlations are in Financials and Industrials sectors where as the Qatari sector of Telecoms correlates the least with oil price changes.

The asymmetric model results for weekly returns imply that all of the Nordic and Qatari sectors are positively and statistically significantly correlated with positive unexpected changes in oil prices. In addition, all sectors except Nordic Travel & Leisure are also positively and statistically significantly correlated with negative unexpected oil price changes. The weekly data findings also suggest that the oil price sensitivity is symmetric in both Nordic and Qatari markets for all sectors except Nordic sector of Utilities.

In contrast to the asymmetric model results for the weekly data, the monthly results imply that only 8 out of 24 industries in the Nordics and 3 out of 7 industries in Qatar have statistically significant correlation with positive unexpected oil price changes. In addition, only 6 out of 24 Nordic industries and 3 out of 7 Qatari industries are statistically significantly influenced by negative unexpected changes in oil prices. In the Nordics Oil & Gas sector has highest correlation with positive unexpected oil price changes while in Qatar the Industrials sector correlates the most. For negative unexpected oil price changes the highest correlations are in the Industrial Goods & Services in the Nordics and Real Estate in Qatar.

Interestingly, in the Nordic markets, two sectors have statistically significant negative coefficients while positive oil price changes have negative influence on Insurance sector whereas Travel & Leisure sector has negative correlation with negative unexpected oil price changes. The interpretation for the finding that the Nordic sector of Travel & Leisure is negatively correlated with negative unexpected oil price changes is in line with the theoretical overview. When oil prices decrease, the Travel & Leisure businesses tend to become more profitable. Therefore, the correlation is negative since the value of Travel & Leisure stocks increase when oil prices fall. Overall, the asymmetric model findings for monthly returns imply that oil price sensitivity is sector-specific and its existence varies across industries in both markets. In addition, consistent with weekly returns, the oil price sensitivity tends to be symmetric.

The findings of this paper suggest that there are notable differences in oil price sensitivities between Nordic and Qatari markets while correlations in Qatar tend to be higher. For example, the sectors of Industrials and Real Estate have much higher correlation coefficients in Qatar than in the Nordics. The interpretation of this result could be that since, according to Ulussever & Demirer (2017), the GDP of Qatar is highly influenced by oil price changes, oil price fluctuations could also have influence on construction businesses. Furthermore, Industrials and Real Estate sectors could be influenced by construction businesses and, therefore, also by oil price changes.

The most interesting finding of the paper in contrast to Nandha and Faff (2008) is the fact that most of the oil price coefficients are positive across industries in both Nordic and Qatari stock markets. The interpretation for this could be that, because of the high fluctuations during the data period, investors have used oil price as an indicator for the condition of world economy. While oil markets worry the slowing growth of oil demand, stock investors worry the condition of world economy. Low oil price levels could indicate high market uncertainty whereas high oil price levels could indicate high growth expectations. Therefore, investors could expect that oil price reflects also the information about the condition of world economy. If this interpretation is correct, the differences between the correlations of weekly and monthly returns imply that investors follow oil price fluctuations more closely on weekly basis than on monthly basis while the results for monthly returns reveal more industry-specific differences in oil price correlations.

Overall, the results of this paper imply that the statistical significance of oil price changes and magnitude of oil price coefficients vary across both industries and stock markets. The role of oil factor also differs between weekly and monthly returns. However, in contrast to previous studies, this paper presents empirical evidence that most of the industries have positive correlations with oil price changes during the examined period from April 2012 to September 2017. Therefore, the findings of this paper suggest that currently oil price changes reflect the information about the condition of world economy.

APPENDIX

Appendix 1. Nasdaq OMX Nordic indices.

Name	Code	Index type	Currency
Omx Nordic Eur Gi	OMXNORDICEURGI	Total return	Euro
N Automobiles & Parts Eur Pi	N3300EURPI	Price index	Euro
N Banks Eur Pi	N8300EURPI	Price index	Euro
N Basic Materials Eur Pi	N1000EURPI	Price index	Euro
N Basic Resources Eur Pi	N1700EURPI	Price index	Euro
N Chemicals Eur Pi	N1300EURPI	Price index	Euro
N Construction & Materials Eur Pi	N2300EURPI	Price index	Euro
N Consumer Goods Eur Pi	N3000EURPI	Price index	Euro
N Consumer Services Eur Pi	N5000EURPI	Price index	Euro
N Financial Services Eur Pi	N8700EURPI	Price index	Euro
N Financials Eur Pi	N8000EURPI	Price index	Euro
N Food & Beverage Eur Pi	N3500EURPI	Price index	Euro
N Health Care Eur Pi	N4500EURPI	Price index	Euro
N Industrial Goods & Services Eur Pi	N2700EURPI	Price index	Euro
N Industrials Eur Pi	N2000EURPI	Price index	Euro
N Insurance Eur Pi	N8500EURPI	Price index	Euro
N Media Eur Pi	N5500EURPI	Price index	Euro
N Oil & Gas Eur Pi	N0500EURPI	Price index	Euro
N Personal & Household Goods Eur Pi	N3700EURPI	Price index	Euro
N Real Estate Eur Pi	N8600EURPI	Price index	Euro
N Retail Eur Pi	N5300EURPI	Price index	Euro
N Technology Eur Pi	N9500EURPI	Price index	Euro
N Telecommunications Eur Pi	N6500EURPI	Price index	Euro
N Travel & Leisure Eur Pi	N5700EURPI	Price index	Euro
N Utilities Eur Pi	N7500EURPI	Price index	Euro

Appendix 2. Qatar Stock Exchange indices.

Name	Code	Index type	Currency
Qe All Share Index - Tot Return Ind	QEALLSH(RI)	Total return	Qatari Riyal
Qe All Share Banks & Fin Serv - Price Index	QEASBFS(PI)	Price index	Qatari Riyal
Qe All Share Cons Gds & Serv - Price Index	QEASCGS(PI)	Price index	Qatari Riyal
Qe All Share Industrials - Price Index	QEASIND(PI)	Price index	Qatari Riyal
Qe All Share Insurance - Price Index	QEASINS(PI)	Price index	Qatari Riyal
Qe All Share Real Estate - Price Index	QEASRET(PI)	Price index	Qatari Riyal
Qe All Share Telecoms - Price Index	QEASTEL(PI)	Price index	Qatari Riyal
Qe All Share Transportation - Price Index	QEASTRA(PI)	Price index	Qatari Riyal

REFERENCES

Al-Mudhaf, Anwar & Thomas H. Goodwin (1993). Oil shocks and oil stocks: Evidence from the 1970s. *Applied Economics* 25:2, 181–190.

An, Lian, Xiaoze Jin & Xiaomei Ren (2014). Are the macroeconomic effects of oil price shock symmetric? : A Factor-Augmented Vector Autoregressive approach. *Energy Economics* 45, 217–228.

Basher, Syed A. & Perry Sadorsky (2006). Oil price risk and emerging stock markets. *Global Finance Journal* 17:2, 224–251.

Björnland, Hilde C. (2009). Oil price shocks and stock market booms in an oil exporting country. *Scottish Journal of Political Economy* 56:2, 232–254.

Bodie, Zvi, Alex Kane & Alan J. Marcus (2014). *Investments*. 10th global edition. Berkshire: McGraw-Hill. 1015 p. ISBN 978-0-07-716114-9.

Boyer, Martin M. & Didier Filion (2007). Common and fundamental factors in stock returns of Canadian oil and gas companies. *Energy Economics* 29:3, 428–453

Brealey, Richard, Stewart C. Myers & Franklin Allen (2011). *Principles of Corporate Finance*. 10th global edition. New York: McGraw-Hill/Irwin. 944 p. ISBN 978-0-07-131417-6.

Chen, Nai-Fu, Richard Roll & Stephen A. Ross (1986). Economic forces and the stock market. *Journal of Business* 59:3, 383–403.

Copeland, Thomas E. & J. Fred Weston (1988). *Financial Theory and Corporate Policy.* 3rd edition. New York: Addisson-Wesley Publishing Company Inc. 946 p. ISBN 0-201-10648-5.

Driesprong, Gerben, Ben Jacobsen & Benjamin Maat (2008). Striking oil: Another puzzle? *Journal of Financial Economics* 89:2, 307–327.

El-Sharif, Idris, Dick Brown, Bruce Burton, Bill Nixon & Alex Russell (2005). Evidence on the nature and extent of the relationship between oil prices and equity values in the UK. *Energy Economics* 27:6, 819–830.

Faff, Robert W. & Timothy J. Brailsford (1999). Oil price risk and the Australian stock market. *Journal of Energy Finance and Development* 4:1, 69–87.

Fama, Eugene F. (1970). Efficient capital market: Review of theory and empirical work. *The Journal of Finance* 25:2, 383–417.

Fama, Eugene F. & Kenneth R. French (2004). The capital asset pricing model: Theory and evidence. *Journal of Economic Perspectives* 18:3, 25–46.

Fattouh, Bassam (2010). The dynamics of crude oil price differentials. *Energy Economics* 32:2, 334–342.

Hamilton, James D. (1983). Oil and the macroeconomy since World War II. *Journal of Political Economy* 91:2, 228–248.

Hammoudeh, Shawkat & Eisa Aleisa (2004). Dynamic relationship among GCC stock markets and NYMEX oil futures. *Contemporary Economic Policy* 22:2, 250–269.

Hammoudeh, Shawkat & Huimin Li (2005). Oil sensitivity and systematic risk in oil sensitivity stock indices. *Journal of Economics and Business* 57:1, 1–21.

Hammoudeh, Shawkat, Sel Dibooglu & Eisa Aleisa (2004). Relationship among U.S oil prices and oil industry equity returns. *International Review of Economics & Finance* 13:4, 427–453.

Henriques, Irene & Perry Sadorsky (2008). Oil prices and the stock prices of alternative energy companies. *Energy Economics* 30:3, 998–1010.

Herwartz, Helmut & Martin Plödt (2016). The macroeconomic effects of oil price shocks: Evidence from a statistical identification approach. *Journal of International Money and Finance* 61, 30–44.

Huang, Roger D., Ronald W. Masulis & Hans R. Stoll (1996). Energy shocks and financial markets. *The Journal of Futures Markets* 16:1, 1–27.

International Energy Agency (2014). *World Energy Outlook 2014*. Paris: International Energy Agency. 726 p. ISBN 978-92-64-20804-9.

International Monetary Fund (2016). Commodity Market Monthly: February 2016. [online]. [cited 14.2.2016]. Available in World Wide Web: <http://www.imf.org/external/np/res/commod/pdf/monthly/021116.pdf>

Jones, Charles M. & Gautam Kaul (1996). Oil and the stock markets. *The Journal of Finance* 51:2, 463–491.

Kang, Wensheng & Ronald A. Ratti (2015). Oil shocks, policy uncertainty and stock returns in China. *Economics of Transition* 23:4, 657–676.

Kendall, Maurice G. (1953). The analysis of economic time-series, Part 1: Prices. *Journal of the Royal Statistical Society Series A (General)* 116:1, 11–34.

Kesicki, Fabian (2010). The third oil price surge – What's different this time? *Energy Policy* 38:3, 1596–1606.

Kilian, Lutz & Robert J. Vigfusson (2011). Nonlinearities in the Oil Price–Output Relationship. *International Finance Discussion Papers* 1013. Board of Governors of the Federal Reserve System.

Kjärstad, Jan & Filip Johnsson (2009). Resources and future supply of oil. *Energy Policy*. 37:2, 441–464.

Knüpfer, Samuli & Vesa Puttonen (2007). *Moderni rahoitus*. 3rd edition. Helsinki: WSOYpro Oy. 244 p. ISBN 978-951-0-33995-4.

Le, Thai-Ha & Youngho Chang (2015). Effects of oil price shocks on the stock market performance: Do nature of shocks and economies matter? *Energy Economics* 51, 261–274.

Loutia, Amine, Constantin Mellios & Kostas Andriosopoulos (2016). Do OPEC announcements influence oil prices? *Energy Policy* 90, 262–272.

Maghyereh, Aktham & Ahmad Al-Kandari (2007). Oil prices and stock markets in GCC countires: new evidence from nonlinear cointegration analysis. *Managerial Finance* 33:7, 449–460.

Malkamäki, Markku & Teppo Martikainen (1989). *Rahoitusmarkkinat*. 1st edition. Jyväskylä: Weilin+Göös. 329 p. ISBN 951-35-4983-6.

Martikainen, Minna & Teppo Martikainen (2009). *Rahoituksen perusteet*. 7th edition. Helsinki: WSOYpro Oy. 205 p. ISBN 978-951-0-36391-1.

Martikainen, Teppo (1995). *Arvopaperit*. 1st edition. Juva: WSOY. 153p. ISBN 951-0-20735-7.

Martín-Barragán, Belén, Sofia B. Ramos & Helena Veiga (2015). Correlations between oil and stock markets: A wavelet-based approach. *Economic Modelling* 50, 212–227.

Matutinovic, Igor (2009). Oil and the political economy of energy. *Energy Policy*. 37:11, 4251–4258.

Miller, Isaac J. & Ronald A. Ratti (2009). Crude oil and stock markets: Stability, instability, and bubbles. *Energy Economics* 31:4, 559–568.

Mork, Knut Anton, Øystein Olsen & Hans Terje Mysen (1994). Macroeconomic responses to oil price increases and decreases in seven OECD countries. *The Energy Journal* 15:4. 19–35.

Nandha, Mohan & Robert Faff (2008). Does oil move equity prices? A global view. *Energy Economics* 30:3, 986–997.

Nandha, Mohan & Shawkat Hammoudeh (2007). Systematic risk, and oil price and exchange rate sensitivities in Asia-Pacific stock markets. *Research in international Business and Finance* 21:2, 326–341.

Nasdaq (2017). Rules for the Construction and Maintenance of the NASDAQ OMX All-Share, Benchmark and Sector Indexes. [online]. [cited 25.9.2017]. Available in World Wide Web: <https://indexes.nasdaqomx.com/docs/Methodology_NORDIC.pdf>

Nasdaq OMX Nordic (2017). [online]. [cited 8.10.2017]. Available in World Wide Web: <http://www.nasdaqomxnordic.com/indexes>

Nikkinen, Jussi, Timo Rothovius & Petri Sahlström (2002). *Arvopaperisijoittaminen*. 1st edition. Helsinki: WSOY. 244 p. ISBN 951-0-26627-2.

Organization of the Petroleum Exporting Countries (2015). *World Oil Outlook 2015*. Vienna: OPEC Secretariat. 373 p. ISBN 978-3-9503936-0-6.

Organization of the Petroleum Exporting Countries (2016). [online]. [cited 10.2.2016]. Available in World Wide Web: <www.opec.org>

Organization of the Petroleum Exporting Countries (2017). Monthly Oil Market Report: September 2017. [online]. [cited 29.9.2017]. Available in World Wide Web: <http://www.opec.org/opec_web/static_files_project/media/downloads/publications/MOMR%20September%202017.pdf>

Park, Jungwook & Ronald A. Ratti (2008). Oil price shock and stock markets in the U.S and 13 European countries. *Energy Economics* 30:5, 2587–2608.

Qatar Central Bank (2017). [online]. [cited 26.9.2017]. Available in World Wide Web: <http://www.qcb.gov.qa/English/PolicyFrameWork/ExchangeRatePolicy/Pages/ExchangeRatePolicy.aspx>

Qatar Exchange (2012). QE Index Developments. March 2012. [online]. [cited 26.9.2017]. Available in World Wide Web: <https://www.qe.com.qa/documents/20181/434999/QE+New+Indices+Presentation+ENG.pdf/fdceda6c-cfe3-3101-67bc-a0ea0dcb9bed>

Sadorsky, Perry (1999). Oil price shocks and stock market activity. *Energy Economics* 21:5, 449–469.

Sadorsky, Perry (2001). Risk factors in stock returns of Canadian oil and gas companies. *Energy Economics* 23:1, 17–28.

Tadawul (2017). [online]. [cited 27.9.2017]. Available in World Wide Web: <https://www.tadawul.com.sa/wps/portal/tadawul/knowledge-center/about/new-industry-classification>

Tuzova, Yelena & Faryal Qayum (2016). Global oil glut and sanctions: The impact on Putin's Russia. *Energy Policy* 91, 140–151.

Ulussever, Talat & Riza Demirer (2017). Investor herds and oil prices evidence in the Gulf Cooperation Council (GCC) equity markets. *Central Bank Review* 17:3, 77–89.

Varian, Hal R. (2010). *Intermediate Microeconomics: A Modern Approach*. 8th edition. New York: W. W. Norton & Company, Inc. 739 p. ISBN 978-0-393-93424-3.