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Firm Performance During Oil Price Shocks: Norwegian Oil & Shipping Family and Non-Family Firms

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Abstract

This paper is an attempt to deepen the understanding of the family firm performance compared to non-family owned companies in times of oil price shocks of 2010-2015 with period of high oil prices followed by low prices. This paper complements the already existing literature that still provides quite contradictive results as to whether family firms perform better or worse than non-family owned companies in shocks. The focus of the research are the oil and shipping companies in Norway exposed the most to the oil price volatilities. We discover that while oil and shipping companies' performance is related positively to oil price shocks, other industries on average react negatively to oil price increases. Further, we find some limited evidence that family firms in these industries are less affected by the shock and experience a less volatile performance in times of oil price shocks, which could be a result of long term horizons, lower agency problems and better relations with debt holders. However, we did not find evidence to support the hypothesis that a significant oil price fall of 2014 affected family firms differently. Overall, our study reveals that there might be a certain benefit of being a family firm when oil price shocks hit, particularly for larger firms, but the positive effects are limited and require further investigation.

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1. Introduction

In this research, we aim to estimate the effect of oil price shocks on the performance of Norwegian firms operating in oil and shipping industries and to figure out if this effect is significantly different for family firms compared to non-family owned companies. With significant oil price shocks in the recent years: high oil prices in 2010-2013 followed by low oil prices in 2014-2015 as well as 2/3 of Norwegian companies being family firms (Berzins and Bøhren, 2013), we find this topic relevant and interesting to study. Using an oil price shock as a clear shock for the economy we also hope to deepen our understanding of family firms, as the literature as to these firms perform better or worse than non-family firms in shocks is still controversial.

We approach this research in a consistent manner going from estimating a general to a more specific pattern. First, we establish a general oil price shocks effect, to see if on average companies in Norwegian economy are affected by the oil price volatilities. An oil price shock period here is defined as a time when oil spot prices significantly differ from the recent past, while oil price shock is calculated as the average annual log difference of spot prices. Thus, a price increase is a positive shock and a decrease is a negative one. Previous research has documented that there exists a negative (Sadorsky, 1999) and mostly asymmetric effect (Park and Ratti, 2008) of oil price shocks on firm performance with both direct and indirect influence through macroeconomic changes (Poghosyan and Hesse, 2016). On the other hand, Park and Ratti (2008) find an opposite effect for Norwegian companies, as one of the major oil exporters, and claim that these companies suffer when oil prices drop. While we expect a positive indirect effect through macroeconomic changes when oil prices increase, we believe that, in general, companies in Norway face a negative direct effect amid the price increase resulting in higher fuel and energy prices.

Research papers document that there exists a different effect of oil price shocks for companies of different types, industries and size (Sadorsky, 2008). We, thus, choose to focus on the firms most directly affected by the oil price volatilities, namely oil and shipping industries: represented by the supply chain of the petroleum exploration and the companies involved in the shipping business; hoping to catch the true effect of the price shocks. The significant and positive results would indicate that oil and shipping

firms, indeed, are highly exposed to the oil price volatilities and perform better by price increases. This will allow us to move on to comparing the performance of family vs non-family firms within these industries.

There is evidence that firms of different types, might experience a different effect of the shock. We, thus, strive to establish whether there is an additional effect of the oil price shocks on the family firms compared to non-family firms within oil and shipping industries. There exists contradictive evidence in the literature regarding family firms' performance presented by La Porta (1999), Berzins and Bøhren (2013), Sraer and Thesmar (2007), Villalonga and Amit (2006), etc. Family firms might be less affected by the oil price shocks due to their long-term horizons with a focus on survival, lower agency problems and better-established relations with debt holders allowing for easier raise of capital in times of crisis. On the other hand, family firms might have less experienced and less competent, low-diversified owners and management leading to a higher effect of the oil price shocks. Benefiting from extensive dataset provided by the Centre for Corporate Governance Research, we overcome the problem of lacking data using the knowledge of the family ownership in each firm. As for definition, we follow Bøhren (2011) and define the family firm as the firm where the family holds a block of more than 50% of the shares, allowing the family to remain in control.

Additionally, we investigate whether companies of different sizes within the two types of firm experience different effects of the oil price shock due to different degrees of flexibility and capital availability. As proven by Sadorsky (2008), medium firms suffer the most not having as much flexibility as small firms, and not as much capital as larger firms. This would also assure a higher degree of comparability.

Further, to exploit a considerable oil price drop of 2014, we conduct a difference-in-differences analysis using a balanced sample of companies appearing both before and after the shock to see if non-family firms' performance changed more dramatically than family firms'. We expect a lower effect of the oil price plunge on the family firm performance. We also conduct a complementary survival analysis, where we utilize the data from firms that have been crossed out for a balance data sample when running the difference-in-differences regression.

The main results show that on average there is a significant negative effect of the oil price shocks on the performance of all companies in Norway, confirming overall

world tendencies. For oil and shipping industries, we discover a significant positive effect of the oil price shocks, supporting the hypothesis that these companies benefit from the oil price increases which represents one of the main sources of their revenues.

Looking at the specific analysis of the family compared to non-family firm performance, we find limited evidence to support the hypothesis that family firms are less affected by the oil price shock. Only fixed effects model shows a significant negative additional effect at a 95 % confidence level, translated into a lower cumulative oil price shock effect on the family firm performance compared to non-family firms. Furthermore, the size-wise analysis shows that size seems to have an effect on how the shocks influence the performance, mainly for large firms of both types of firms. Interestingly, the magnitude of the coefficients for family firms is somewhat lower, possibly supporting the hypothesis of a lower exposure to the oil price shocks. The intuition could be that large firms have a higher buyer-risk (delivery times and amounts), especially in Norway with governments and large productions as customers and clients. This risk cannot be fully diversified away as could be done for smaller customers of medium and small firms (Choe, 2003 and Kramarz et al, 2016).

However, considering how limited and fragmented these results are, we conclude that overall there is not enough evidence to confirm that the oil price shock effect is different for family firms as compared to non-family firms. One possible explanation could be that there have been established common practices for coping with the oil price movements: hedging, having provisions in contracts with suppliers and customers in advance.

Moreover, we did not find evidence to support the hypothesis that a dramatic fall of prices in 2014 affected family firms differently. A possible explanation is that the price fall continued in 2015, thus 2016 would be a better time to represent “after”-crisis period. Unfortunately, the data is not available for 2016 yet. Also, a small number of observations could be a drawback of the analysis, which explains the insignificance of coefficients.

Overall, our work confirmed that all Norwegian firms on average experience a negative oil price shock effect, while oil and shipping companies face a positive effect benefitting from the price increase and suffering from the price fall. However, even if there might exist certain benefits of being a family firm in times of oil price changes,

particularly for larger sized firms, these positive effects are limited and require further investigation.

Our study is structured as follows: Section 2 presents a literature review on the oil price effects and family firm. Sections 3 describes our data sample and the filters used for the data. In Section 4, we move on to discussing our main research questions and hypotheses. In Section 5 we outline the main variables and descriptive statistics. Section 6 presents our methodology with detailed descriptions of models and tests. Section 7 and 8 illustrate our main results and sensitivity checks. We draw our final conclusions and point out remarks in Section 9. The main result of the thesis will be presented from Table 10 to 15, while the robustness test results will be presented in the Appendix (Section 12) from Table 16 -28. The detailed information about data samples, variables, industry codes can also be found in the Appendix

Motivation

Recent developments in the oil market with high prices of 2010-2013 followed by low prices of 2014-2015, a significant shock for an oil exporting economy, makes this side of the research topic interesting to investigate. Family firms represent a substantial number of companies in Norway, while the research on them is limited. With available research providing different effect of oil price changes on different types of companies, we find it increasingly interesting to research more how oil price shocks affect Norwegian companies and find out if this effect is different for family firms.

Contribution

While there exist a considerable number of studies on the oil price effects, we believe it is relevant to incorporate the recent oil price drop of 2014 and further explore the effects of oil price, specifically on firms operating in the economy of a major oil exporter. On the other hand, the literature on the family firms is quite limited due to the lack of data and difficulty of defining a family firm. However, family firms themselves represent a considerable part of the firms in the world. We, thus, strive to connect two intriguing and quite relevant topics and complement the existing literature answering the following question: how oil price shocks affect Norwegian oil and shipping family compared to non-family firm performance.

2. Literature review

Our work includes two main theoretical concepts which require a deep understanding of available research in order to investigate further the nature of the oil price shocks effect on a firm performance. The first part is a general theoretical overview of the oil price and oil price volatility effects on the companies of different types in various economies. The second part requires a review of available theory on family firms to understand why this type of firms could potentially be affected differently by the oil price shocks in Norway in the period of 2010 to 2015.

The literature review is, thus, structured as follows: firstly, we discuss previous studies on the oil price shock effects. Secondly, we underline the main features of the family owned firms to discover potential characteristics that might lead to their performance being different during oil price shocks than non-family firms.

2.1 Oil price shock effects

There has been an emphasis on incorporating oil price volatility and shocks as a determinant of macroeconomic indicators and stock prices in numerous studies. The recent papers prove that oil price shocks are not only relevant for oil industry and oil exporting countries, but also for firm performance in different industries.

As defined by Park and Ratti (2008) following Hamilton (1996) if the current oil price is higher than it has been in the recent past a positive oil price shock occurred, if it is lower, then there has been a negative one. We, additionally, add that the average annual log difference of prices should be of magnitude of above 5%, thus we chose to focus on the period of 2010-2015 with high prices in 2010-2011, a high positive shock, followed by slightly lower in magnitude but still a positive shock of 2012-2013, and finally a significant negative shock of 2014-2015.

Sadorsky's (1999) paper emphasizes a considerable negative relationship between oil price shocks and real stock returns for the US economy and a negative effect on interest rates and industrial production, which underlines an overall negative reaction of firm performance to the oil price changes. Park's and Ratti's (2008) work further proves negative and mostly asymmetric effect of oil price shocks on stock price volatility in European countries and the US. On the contrary, they find that for Norway,

the major oil exporter, there is a significant positive response to the shock. It is, thus, important to emphasize that while most economies suffer from the oil price increase, representing an increase of fuel and energy prices, companies of oil and shipping industries of Norwegian economy, using oil as a main product or a delivery freight, will most likely enjoy the consequences of the increased prices and rise in revenues. The true negative shock for them is represented by the price fall, such as the shock of 2014, where the dramatic drop took the price from over 100 USD per barrel to below 50 USD per barrel. Consequently, we believe that our research would complement the already existent evidence that companies of oil exporting contries might benefit from the oil price changes.

Narayan and Sharma (2011) once again document a strong connection between oil prices and firm returns concluding that oil prices affect returns of firms differently depending on their size, industry and regimes. Poghosyan's and Hesse's (2016) address bank profitability in connection to oil prices through introducing a two-step approach to estimating the way oil prices affect profitability. The research concludes that oil prices affect bank profitability indirectly through macroeconomic indicators, while direct impact is insignificant. As different industries seem to react differently, we believe that our analysis for the oil and shipping industries separately makes more sense, as these companies are clearly highly exposed to the oil price volatilities directly.

Sadorsky's (2008) research assesses the impact of oil prices on firms of different sizes and proves that medium sized firms suffer the most from the oil price shocks due to a lack of flexibility compared to small firms and lack of capital compared to larger firms. This research underlines the importance of our study to estimate whether companies of different sizes are affected differently, and further extend this research to family vs non-family analysis to assure a higher level of comparability. On the contrary, Choe (2003) and Kramarz et al (2016) prove that large firms could be affected the most by the shocks due to difficulty in diversifying their large buyer- and seller-risks.

Overall, the recent research proves significant effects of oil prices on the firm performance in general. Moreover, there is evidence that oil price shocks might have different effects on firms of different country of origin, size and industry. Furthermore, being a large oil exporter with a major part of the economy tied to oil production,

companies in Norway might be especially affected by the oil price shocks. These findings support the relevance of our research that goes from estimating an overall oil price shock effect to investigating a specific industry and further exploring these effects for companies of different sizes as well as different types, e.i. family vs non-family firms. We can now look more into the factors, which could make a family firm affected differently by the oil price shocks of 2010 to 2015.

2.2 Family Firms

According to La Porta et al. (1999), family firms are widespread on a worldwide basis. There is also evidence that this organizational form is the dominant type of business in Norway with around 2/3 of all Norwegian AS and ASA firms being family-owned (Berzins and Bøhren, 2013). Consequently, family firms in Norway became an intriguing topic to study. Currently, there is still no clear definition of a family-held company (Astrachan, Klein, & Smyrnios, 2002). We follow Bøhren (2011) and define the family firm as the firm where the family holds a block of more than 50% of the shares, allowing the family to remain in control of the company and potentially have an effect on the firm performance.

Ownership is the unique feature of a family firm, thus requires a special attention. According to Andersen and Reeb (2003), the relationship between the percentage of family ownership and firm performance follows a concave function. Firm's profitability increases when family ownership is about one-third of the firm's outstanding shares. Family ownership is also claimed to have a positive influence on the long-term outlook by Fama and Jensen (1983). Moreover, the close connection between families and firms lead to a higher profitability and performance (Zellweger et al., 2012). Nevertheless, Lee (2006) pointed out that the effect of family ownership is not always positive, as conflicts between members can create a negative impact on firm's profitability.

Family firm management can be categorized into two types, which are family management and professional management. The behavior of the CEO has a direct effect on the performance of the firm. Filatotchev et al. (2005) argue that the relationship between family member being the CEO and firm profitability is negative,

as family is tempted to extract private benefit for themselves at the expense of minority shareholders. In contrast, Sraer and Thesmar (2007) pointed out that descendant-run firms can manage their labor force more efficiently by paying significantly lower wages and providing insurance across the business cycle to workers as a compensation. Only managers from the family has the credibility necessary to sustain such implicit reputational contracts with workers.

In family firms, board of directors and management are closely related (Bøhren, 2011). Thus, the first agency problem between managers and shareholders can be alleviated as a result of higher monitoring incentives or having a family CEO. If the family owns the majority of shares in the company, it has greater incentives to monitor the management. Having a family member serve as a CEO provides family with an active control over firm's daily activities. However, the firm may exclude the opportunity to have a CEO from outside of the family who can offer better skills, talents and qualifications for the company. Thus, while potentially benefiting from lower agency problem, the family firm performance might suffer from the lack of knowledge and skills.

Furthermore, the agency problem between majority and minority shareholders can arise if the family as the largest shareholder have high incentives to exploit minority investors (Villalonga and Amit, 2006). On the other hand, according to Berzins and Bøhren (2013) benefits from possible future investments from the minority shareholders and long-term goals may reduce the incentive to exploit minority shareholder, making the second agency problem less severe.

The owners of family firms are also said to face higher unsystematic risk. The higher family ownership concentration is, the less diversified the owners are. By investing all their wealth and human capital into the firm, family owners become undiversified (Bøhren, 2011). According to Berzins and Bøhren (2013), low debt, diversified production and flexible cost structure are strategic tools to reduce risk for family firms. Further, because family owners are often so close to daily operations, they respond faster to negative signals and take action faster and with greater force than in companies with fragmented ownership (Berzins and Bøhren, 2013). Hence, while facing lower diversification and becoming highly risk averse, family firms might benefit from being able to respond quickly to negative signals.

Family-held firms might face both constraints and advantages while getting financing in terms of access and price of capital. Because family have incentives to sustain their controlling position in the firms, they tend to be reluctant to issue stocks to outside investors as it could threaten their control, hence restricted their access to new equity (Berzins and Bøhren, 2013). Another source of capital for operation is to retain earnings or invest more of the family's wealth. This capital constraint limits the possibility of growth and can be an explanation why family businesses are often smaller. Moreover, the cost of debt is higher for firms with a wider divergence between the largest ultimate owner's control rights and cash-flow rights, and this effect is particularly strong among family-owned firms (Lin et al., 2011). On the other hand, as family owners are viewed as having a longer investment horizon and being undiversified, it implies that the owners have greater interest in the survival of the company, thus manage its resources, investments and operations more efficiently. This is also consistent with the interest of debt holders, hence, decrease the cost of debt by around 30-40 bp. (Sraer & Thersmar, 2007). Thus, while reluctance to dilute ownership and issue debt could reduce growth potentials for family firms, these firms might be able to have a lower interest due to their reputation and long-term horizons.

Overall, the specific features of family firms could affect their behavior during shocks. Family firms might perform better during and after the oil price shocks due to their ability to react quicker to the changing environment as they have better connection to daily operations and faster decision-making process. They can also benefit by having lower cost of debt in case of additional financing needed. On the other hand, family firms could be constrained in times of oil crisis because of lower diversification, reluctance to change the ownership structure for additional capital and lack of industry specific knowledge or information as opposed to widely held companies with professional managers.

After conducting a literature review, we discovered that oil price shocks have a negative effect on most companies. This effect could vary for firms of different industries, sizes, origins and types. Consequently, we learned that family firms might perform better during oil price shocks due to longer horizons, focus on survival and flexible decision-making process. However, the literature is still quite controversial, thus, both a better and worse performance of a family firm might be possible.

3. Data sample

The data for our thesis is extracted from the Centre for Corporate Governance Research (CCGR). We get access to it through our supervisor, Bogdan Stacescu. It provides relevant data on limited liabilities companies registered in Norway. CCGR consists of accounting data from 1994 until 2015, which is essential in conducting our research (CCGR website). We will use the data from 2010 - 2015 in the study to abstract the results from the impact of the global financial crisis in 2008 and focus more on what we define as oil price shocks period with the high oil prices in 2010-2013 followed by low oil prices in 2014-2015 with the average annual log difference of prices of around ±5%, this gives us an opportunity to look at a clear effect of the oil price shock. We also gathered necessary information on the spot prices of Brent oil for the last 16 years and macroeconomics variables using database from Bloomberg terminal and OECD data. This data will play an important part in measuring the oil price shocks.

Filters

Our data consisted of **444,411** observations. The following filters will be applied on the data set:

Filter 1: All firms are independent

Filter 2: Firms with negative revenue are removed

Filter 3: Firms with negative liabilities are removed

Filter 4: Firm with negative or zero assets are removed

Filter 5: Firms with ultimate ownership held by families exceeding 100 are removed

Filter 6: Firms in the financial industry are removed

Filter 7: Firms in the utility industry are removed

Filter 8: Firms in the public administration industry are removed

Filter 9: Firms in the gambling industry are removed

Filter 10: Keep firms in oil and shipping industries

Filter 1 is set to remove conglomerates and corporate chains as we only look at private owned companies and independent business. Filter 2 to 4 are set so that we have a sample of active firms, and hence eliminate passive firms. Filter 5 is set for the consistency in values. Filter 6 is set due to special regulations in the capital structure of financial firms. Filter 7 and 8 are set because the government tend to be the majority stockholder in firms belonging to both utility and public administration industries (Berzins, Bøhren and Stacescu 2013). Finally, filter 9 is set as gambling industry is a special business. An overview of the sample size and filter can be found in Table 2 in the Appendix.

4. Research question and hypotheses

In this section we form our main research question and widen it up with presenting our sub-questions. Secondly, we present our main hypotheses which we will test to estimate the oil price shocks effect. Further, we describe our main hypotheses testing approaches. We believe that oil price shocks are clear tests for economy, and, hence, could help to answer the question whether in these stressful economic conditions family firms perform better than non-family firms after controlling for other differences between them and, hence, contribute to the literature, which today provides quite contradictive evidence regarding the family firm's ability to deal with shocks.

4.1 Research question

Our research topic is "How oil price shocks influence Norwegian Oil and Shipping family firms' compared to non-family firms' performance". In general, we aim to answer the following questions moving from a general effect of tests for an economy, oil price shocks, investigation to a specific difference between family and non-family firms:

1. Do the oil price shocks affect the firm performance over the sample period of 2010-2015?
2. Do oil price shocks affect the performance of oil and shipping firms over the sample period of 2010-2015?
3. Is there an additional impact of being a family firm on the effect of oil price shocks on the firm performance in oil and shipping industries over the sample period of 2010-2015?
4. Does size have an impact on the effect of the oil price shock on the performance of family and non-family firms over the sample period of 2010-2015?
5. Does the oil price plunge in 2014 have different effect on family firms compared to non-family firms in oil and shipping industries?
6. Do family firms in oil and shipping industries survive longer than non-family firms during the oil price shock in the period of 2013-2015?

4.2 Hypotheses

We will move from establishing a general effect the oil price shocks of 2010-2015 on the firm performance of all Norwegian companies on average to investigating a particular industry more closely. There we first establish whether the oil and shipping industries are affected by the oil price shocks and then compare whether family firms experience an additional effect of the shock from 2010 to 2015. Additionally, we also establish if size has an impact on the shock effect within family and non-family firms. Finally, we turn to a specific negative shock of 2014 to see if the effect on family firms is different. Moreover, we conduct a survival analysis to see if family firms survive longer under the oil price shocks.

H1: Oil price shocks have a negative effect on the firm performance of Norwegian companies in the period of 2010-2015

Due to Norway being a major oil exporter, we expect most of companies in various industries to be affected by the oil price changes. This is supported by the conclusions made by Park and Ratti (2008). However, considering possible indirect effects due to changes in macroeconomic indicators, we will control for the main macroeconomic variables to establish if the all the industries on average experience a true direct effect of the oil price shock. While we expect a positive indirect effect through macroeconomic changes of the oil price increases, we still believe that in general companies would face a negative direct effect amid the price increase resulting in higher fuel and energy prices.

H2: Oil price shocks have a positive effect on the firm performance in oil and shipping industries in Norway in the period of 2010-2015

Due to the higher exposure to the oil price volatility we expect the performance of companies in oil and shipping industries to be affected by the oil price shocks as documented by Narayan and Sharma (2011). Furthermore, as supported by Park and Ratti (2008) companies in Norway experience a positive effect of oil price shocks. The significant and positive results would indicate that oil and shipping firms, indeed, are

highly exposed to the oil price volatilities and are, on the contrary, affected positively by price increases.

H3: There is a negative impact of being a family firm on the oil price shock effect on the firm performance in oil and shipping industries in Norway in the period of 2010-2015

Moving on to a specific type of companies within the chosen industries we believe that due to the longer-term horizons, possible benefits in the debt financing and lower agency costs we expect family firms to be affected less by the short-term oil price shocks, thus the additional effect is negative.

H4: Medium size family and non-family firms in oil and shipping industries in Norway are more affected by the oil price shocks in the period of 2010-2015

An additional approach to estimate a true effect of the shock in the performance of family and non-family firms is to also include a size impact on the shock effect. As according to the previous research size can affect the intensity of the shock's impact on the firm performance. Sadorsky (2008) documents that medium size firms are already too big to exploit the benefit of flexible and quick decision-making process and implementation of changes under oil price shocks, but not big enough to have abundance of the resources to minimize the effect of the oil price shock. This finding by Sadorsky (2008) allows us to expect a higher effect of oil price shocks on the medium size firms in oil and shipping industries for both family and non-family firms. We can then compare the outcomes and see if similar sized companies in both types are affected differently.

H5: Oil price shock of 2014 has a significantly different effect on family firms than non-family firms in oil and shipping industries in Norway in the period of 2010-2015

We expect that the price plunge of 2014 will have a smaller effect on the family firms, as they are more focused on survival and long-term performance, which stimulate them to act quickly, have strategy prepared in advance and be less risky.

Thus, the difference in their performances should be significantly different than non-family firm's post the negative oil price shock.

H6: Family firms in oil and shipping industries survive longer than non-family firms during the oil price shock in the period of 2013-2015

Morikawa (2013) found that in Japan, the probability of survival is higher for family firms than non-family firms. As family firms are believed to focus more on survival, having long term horizons, than on a short-term value maximization, we expect that family firms are more likely to survive through the oil price shock of 2014. Hence, we expect the coefficient of family firm dummy variable will be negative.

4.3 Hypotheses testing

To estimate the oil price effects, we employ the fixed effects (FE) methodology providing the advantages of controlling for any time stable unobservable firm specific characteristics as noted by Allison (2009). Unobservable characteristics in this case can include, for example, individual characteristics of management, corporate culture, etc., which reasonably enough are time stable. This methodology allows us to not only separate the oil price effect on performance, but to also identify possible difference between the effect of oil price shocks on family and non-family firms. To support the reason why we use FE model, we run the Hausman test, which indicates that FE is more appropriate for this analysis than random effects model. However, it is important to admit the following limitations of the fixed effects model: it does not control for variables that do change over time, however, these variables, if possible, could be included as control; it can also face problems when explanatory variables are quite time persistent, as is the family firm status; thirdly, fixed effect might default some of the cross-sectional differences, so should not be used if understanding this variation is the sole purpose.

Moreover, we adopt dynamic panel methods (system GMM) to control for the persistence of profitability and endogeneity in the model, following the paper of Poghosyan and Hesse (2016). It has been discovered that some of the determinants of firm performance (such as capital structure) are likely to be endogenous variables (Johnson et al, 2011), which make static regression analysis (such as, OLS, fixed and

random effects model) unsuitable due to the incapability of overcoming heterogeneity. Our sample also consists of highly persistent variables, which makes fixed effects problematic. On the other hand, the system GMM methodology allows instrumenting for endogenous variables and is robust to the omitted variable problem, hence, produces consistent estimates. Additionally, we see that system GMM is more suited in our framework than first-difference GMM estimator developed by Arellano and Bond (1991). Many of our explanatory variables and control variables are time-invariant and persistent so first-difference GMM might suffer from weak instruments issue for lagged levels. Consequently, system GMM by adding the set of first-differenced instruments and equation in levels works more efficiently and overcomes the problem of weak instruments. However, as identified by Bun and Windmejer (2010), the weak instrument variable bias might still exist in the system GMM, which we should be aware when working with this methodology.

Further, we employ the difference-in-differences approach to test whether the oil plunge of 2014 had a significantly different effect on family firms than non-family firms. This methodology is beneficial as it eliminates any time invariant differences between the two groups of companies and differences away any time trends that both groups are exposed to (Roberts and Whited, 2013) as the group composition is identical through the experiment. This allows to estimate whether there is a statistically significant change in the performance difference of the two types of companies.

We use this methodology as the data available presents a unique opportunity to exploit a significant negative oil price shock. The negative oil price shock of 2014 represents in a clear shock to the system and is not a system of different causes and effects as the financial crisis of 2008 was. We, thus, hope to catch the true effect of a significant clear shock to the system.

The main assumption of the method is the common trend, which means that the performance of the two groups of companies has been developing with the same trend before the shock. To assure that the common trend condition is satisfied we use size and leverage to organize our sample. We find them to be appropriate measures to assure comparability as they are quite complex indicators determining the general trend of a firm's behavior and performance. In our case we pay attention to firms of medium size and leverage concentrated from 0.26 to 0.93 representing ±1 standard deviation from

the family firm's mean leverage. The performance of these companies evolved with a common trend over the period from 2010 to 2013. Thus, we believe that it is appropriate to apply the difference-in-differences analysis to estimate the elasticity of the effect of the shock on family firms compared to non-family firms.

Our supplementary analysis for the difference-in-differences is survival research, which will take into account the firms that disappeared during the shock. The main idea here is to check if family firms are more likely to survive longer than non-family companies during the oil price plunge of 2014. The methodology used is described by Cox (1972), the Proportional Hazards regression analysis, and allows us to estimate the "hazard rates", indicating the probability of each type of firms surviving at a specific time point. The main assumption of the model noted by Altman (1991) is that the hazard rates are constant within each type of firms. We will pay attention to all the companies that appear in 2013, thus while the difference-in-differences analysis uses a balanced sample of companies appearing in both 2013 and 2015, here we will look at all the companies and their post-shock status.

Overall, we strive to answer the following question: how oil price shocks affect Norwegian oil and shipping family firms compared to non-family owned companies. We move from testing a general negative effect on all companies in Norway, followed by checking a positive effect on oil and shipping companies to comparing this effect for family and non-family firms supplemented by the size wise analysis. After that we test the hypothesis of a negative effect of the oil price fall of 2014, a clear oil shock, and its magnitude for family vs non-family firms, satisfying the common trend assumption, along with the longer survival of a family firm hypothesis. We employ fixed effects methodology, system GMM method, difference-in-differences and proportional hazards regression analysis.

5. Variables

This section presents our main variables, structured as follows: first, we describe our main dependent variable, then, we list out our independent variables and briefly discuss our controls. The section will end with a summary statistics overview.

5.1 Dependent variable

5.1.1 Profitability

There are various measurements for firm performance, such as return on equity, return on assets. Here we use return on assets (ROA) as the main and the most universal measurement for the performance.

ROA indicates profitability of the business, which has been widely used as accountancy measurement in many previous studies (e.g. Ang, Cole, & Lin, 2000; Alfaraih, Alanezi, & Almujamed, 2012). ROA is calculated by dividing the net income less net interest of the business by its average total assets. A higher ROA means that the assets have been invested efficiently by the firms.

We define profitability as sum of net income and interest expense to total assets

$$ROA = \frac{Net\ income + Interest\ Expense}{Total\ current\ asset + Total\ fixed\ asset}$$

5.2 Independent Variables

5.2.1 Family ownership

We define family firms as firms with shareholders that are related through marriage or blood, ultimately owning more than 50 % of the shares in the firm, both directly and indirectly to be consistent with Bøhrens (2011) definition. This definition is a relevant proxy that accounts for family effects when the family is the majority owner in the firm. As a result, family ownership in our paper is a dummy variable that equals one if the family holds more than 50 % of the shares, and zero otherwise. We expect family ownership to have a positive influence on firm performance, supported by Fama and Jensen (1983), due to higher monitoring incentive and flexibility to react to the shock.

$$FF = \begin{cases} 1\ if\ the\ firm\ is\ a\ family\ firm \\ 0\ otherwise \end{cases}$$

5.2.2 Oil price shock

Oil price shocks are calculated as average annual growth (CH) as presented by Poghosyan and Hesse (2016). Average annual growth rate is estimated using the arithmetic mean of daily 12-month growth rate of spot prices. This simple approach shows the development of oil prices over the year.

$$CH = \frac{\sum_{t=1}^{365}[log\ (p_{t,j}) - log(p_{t-1,j})] * 100}{365}$$

Overall, we define a period as having an oil price shock if the spot price is different from the recent spot prices and additionally this estimator is around 5% representing a positive or a negative shock. Our chosen period of 2010-2015 contains the period of high oil prices (2010-2011) with volatilities of +5% followed by the periods of low oil prices (2014-2015) with volatilities of higher than –5%.

We expect CH to have a positive effect on profitability as firms in oil and shipping industries would benefit from an increase of oil price.

For the difference-in-differences we will also generate a dummy variable called *after* which takes the value of one for 2014, representing the negative oil price shock, when the prices dropped dramatically.

5.2.3 Firm size

We define firm size as the natural logarithm of total revenues. Smaller scale businesses could underperform larger corporations due to the loss of diversification, information asymmetry and market power. Hence, we would expect size to be positively related to firm performance as larger firm can utilize economies of scope and scale (Flamini et al., 2009).

$$Firm\ size = log(Total\ revenue)$$

It is important to first note that size will act as an independent variable for testing the fourth hypothesis, for the rest size acts as a control. There we introduce interaction terms between oil price shocks and firm size dummies to discover the impact size has on the effect of oil price shocks on performance.

As mentioned above, firms in different sizes might be affected differently by oil price changes. Hence, we would like to introduce three size-related dummy variables to determine which sizes of company (small, medium and large) are most

affected by changes in oil price shocks. Large (small) firms are identified as firms that have revenues in the top (bottom) 30 percentile. Medium firms are identified as those firms that have revenues falling between from 30 to 70 percentiles. These size variables can be translated into actual revenue values. Large firms are those with annual revenues larger than or equal to NOK 4. 324 million, and small firms are those with annual revenues less than or equal to NOK 0.421 million. Medium firms are those with annual revenues greater than NOK 0.421 million and less than NOK 4. 324 million.

5.3 Control Variables

5.3.1 Leverage

We define leverage as the ratio of total debt to total assets. Total debt includes long-term debts and short-term debt. According to the trade-off theory, there exists an optimal debt ratio that would balance the costs and benefits of tax shield and default risk, thus maximize firm's value. We expect leverage to have a positive effect on firm performance, as supported by Berger and Bonaccorsi di Patti (2006).

$$Leverage = \frac{Long - term\ debt + Short - term\ debt}{Total\ current\ assets + Total\ fixed\ assets}$$

One should also bear in mind a possible reverse causation from higher profitability to higher leverage. According to Jensen (1986), firms with better performance and higher profitability face lower expected costs of financial distress, hence, find interest tax benefits more valuable at a lower cost. As a result, these firm might use more debt to utilize the tax shield. For this reason, we define firm leverage as an endogenous variable in the system GMM model.

5.3.2 Tangibility

Tangible assets include fixed assets such as machinery, factory, buildings and land and current assets such as inventory. The more tangible assets firms have, the less bankruptcy cost is. Also, firm would gain more flexibility when making financing decisions as tangible assets can be used as collateral (Jensen and Meckling, 1976). On the contrary, earlier research papers claim that there is a negative relationship between a firm's profitability and tangibility (Rajan and Zingales,1995). Firms with safe tangible assets tend to use more debt financing than firms with risky, intangible assets.

We expect tangibility to have a positive effect on firm's profitability. We define tangibility as the ratio of tangible assets to total assets, which show the fraction of firm's total assets that consists of tangible assets.

$$Tangibility = \frac{Tangible\ Assets}{Total\ Assets}$$

5.3.3 Firm's age

We define firm's age as the natural logarithm of the years that it exists in the industry. As firms grow older, they usually have more experience. During their growth, they make investment in research and development, as well as accumulate human resources and figure out their strengths. Hence, we expect a positive relationship between firm's age and profitability.

$$Age = log(age)$$

5.3.4 Capital Intensity

We define capital intensity as the ratio between total assets and revenue. This ratio conveys the amount of capital needed per dollar of revenue. Capital intensity can decrease business risks as it reduces the cost that firms have to commit, especially under negative economic circumstances (Lubatkin and Chatterjee, 1994). Hence, we expect capital intensity to have a positive effect on firm performance.

$$Capital\ intensity = \frac{Total\ Assets}{Revenue}$$

5.3.5 Macroeconomic variables

Since market participants are all influenced by economic environment, macroeconomics variables will be included in our research. Oxelheim (2013) indicated that interest rate, inflation, exchange rate and political risk premium are essential macroeconomic factors that should be considered in analyzing the competitiveness of the company.

We obtain the data for macroeconomics variables from Bloomberg terminal and OECD data. As it was shown above, variation in firm performance can be attributed to the heterogeneity from macroeconomics factor. Consequently, we control for the following macroeconomics determinants of firm profitability:

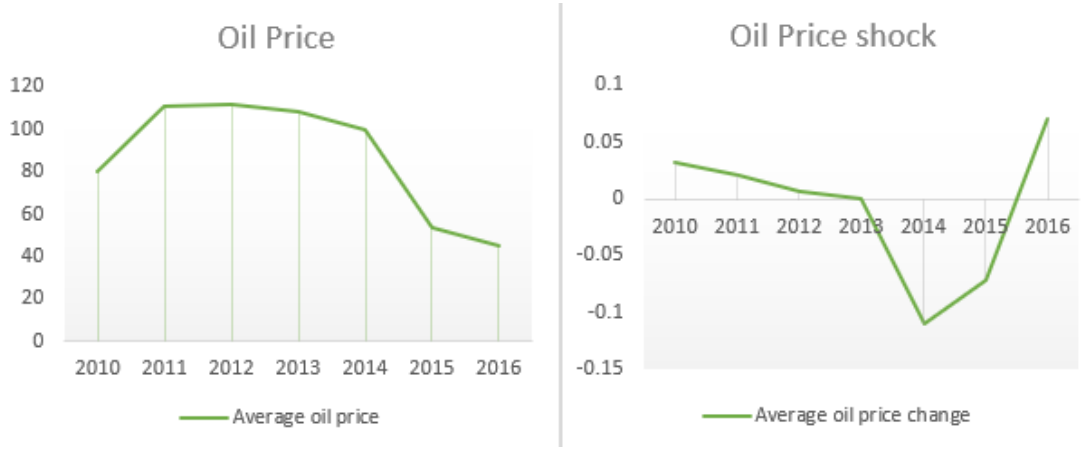
Inflation. We define inflation as CPI inflation to control for the economic uncertainty, which is expected to have a positive effect on firm performance since a higher return is expected for operating in a riskier environment (Poghosyan and Hesse, 2009)

GDP growth. We use real GDP growth as a measure for the factor. When the economy is booming, firm is expected to perform better and generate higher return. Hence, we expect GDP growth to have a positive association with firm performance.

5.4 Summary statistics

A complete overview of summary statistics can be found in Table 6 in the Appendix. To reduce the effect of spurious outliers, all ratios have been winsorized at 5% in each tail.

Figure 1. Average oil price and oil price shock in the period of 2010-2016



As an oil-exporting country, it is obviously clear that the fluctuations of oil price have a substantial effect on Norwegian economy. When it comes to oil price shock, Figure 1 depicts the sharpest negative shock in crude oil price which is in 2014-2015. After the period of high oil price in 2011-2013, from June 2014 to the end of that year, we observed a substantial decline in oil price, which is recorded to be approximately 44%. This plunge in oil prices has been driven by several factors: several years of upward surprises in the production of unconventional oil; weakening global demand; a significant shift in OPEC policy; unwinding of some geopolitical risks; and an appreciation of the U.S. dollar (Baffes et al., 2015). The plunge in oil prices affected

Norway's economy arguably more than the global financial crisis of 2008 as there was a large number of oil jobs lost and more money was taken out from Norwegian sovereign wealth fund than it put in (Financial Times, 2017). Therefore, we expect this shock to be a big hit to not only firms in oil and shipping industries but to companies in other industries as well.

We will have a closer look at company-level data. Compared to non-family firms, family firms have higher mean for ROA, family ownership, age and capital intensity. The tendencies in the differences between family and non-family firms are the same for all years and for 2013 and 2015.

Figure 2. Profitability of firms in all industry and in oil & shipping industries.

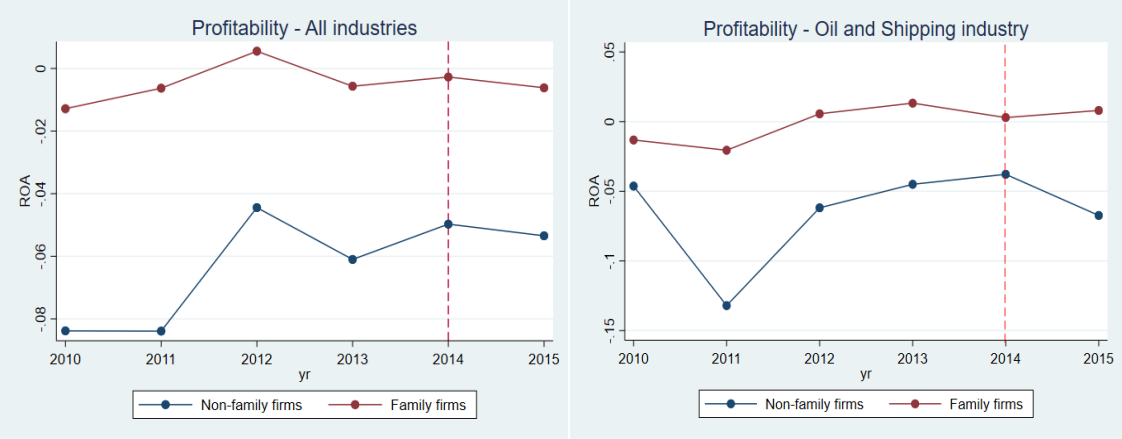
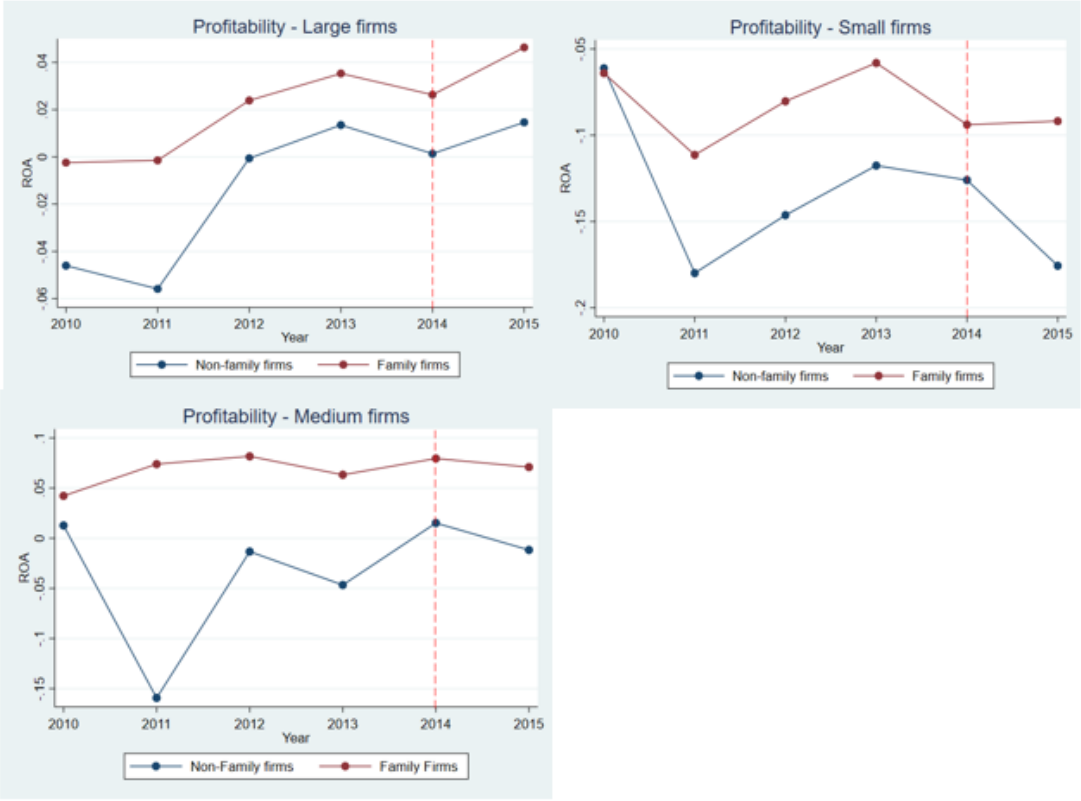


Figure 2 clearly shows that family firms tend to have significantly higher firm performance than non-family companies. For all industries, we see a quite similar trend for both types of firms, even when the oil shock in 2014 happened. However, firm performance in oil and shipping industries fluctuates more tremendously in 2011, especially non-family firms, possibly due to its exposure to oil price shock. It can also be inferred that non-family companies takes more time to recover from a shock (i.e. in the financial crisis in 2008), which leads to the differences in profitability trend in 2014. The highest mean value for ROA was about 5% for family firms and -1% for non-family firms in oil and shipping industries. Also, in 2013 and 2015, there was a substantial reduction in profitability for non-family firms while it was an increase for

family firms, which support the idea that there were differences in firm performance between before and after the oil price shocks.

Figure 3. ROA of firms in oil & shipping industries in different size

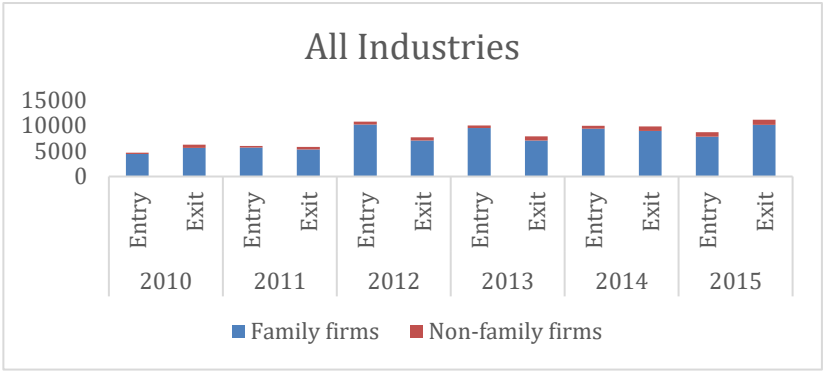


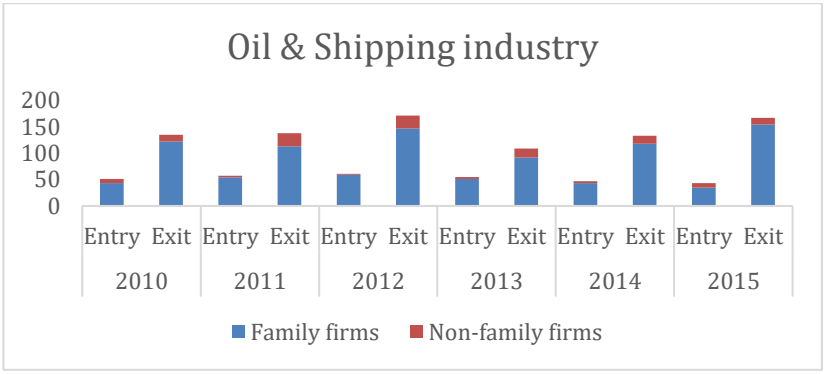
When we split the industries into different sizes, we see different trends of firm performance changes in Figure 3. Most of the time, family firms consistently have higher profitability than non-family owned firms, no matter what the size is. Also, it can be pointed out that the changes in firm performance of family firms is smoother than non-family firms and family firms experienced an increase in ROA when there was a huge plunge of oil price in 2014. Another interesting finding is that while medium and small non-family firms made a decrease in return after the plunge in oil price, large non-family firms seem to have gained some benefits with an increase in ROA as a proof.

Family ownership is quite stable for both types of firms, with a mean of 97% for family firms and 30% for non-family firms. Moreover, capital intensity, in general,

has lower mean values for family companies than non-family ones. This could mean that family firms generate more revenue per asset unit than non-family company, hence, are less capital-intense and have better growth opportunity. Non-family firms also have more substantial fluctuation in capital intensity than family firms. Lastly, non-family firms have higher tangibility and larger size, however, do not result in higher value in leverage – higher external financing capacity. Leverage of non-family firms only higher than that of family-owned firms in 2011 and 2015 and fluctuates dramatically. On the other hand, leverage of family firms gradually decreases over time, and in general higher than that of non-family. One explanation could be that non-family firms have more access to equity market due to higher diversification in ownership and lower degree of information asymmetry. Another explanation is that tangibility of both type of firms moves inversely to leverage, which leads to the fluctuations in external financing capacity. The Tax Reform in 2006 in Norway could be an alternative explanation for the decrease in leverage as it significantly increased taxes on dividends (Berzins, Bøhren and Stacescu, 2013). If firms pay less in dividends, they have more retained earnings and hence, lower leverage.

Figure 4. Distribution of Entry and Exit of Norwegian firms in all industries and Oil & Shipping industries





To utilize the data, we would have a further look into the survival of family firms and non-family firms in the economy and in oil and shipping industries. Figure 4 show us an overview of the distribution of entry and exit of firms in the period of 2010-2015. This graph illustrates the number of firms that were born and died in each year from 2010 to 2015. For a firm that has financial data in one year and no more data in the year after, we would consider it to have exited the industry in the year after. The highest number of new entry firms is in 2012: 10207 family firms and 580 non-family firms. For oil and shipping industries, there are 59 start-up family firms and only 2 non-family firms. The year with the second highest start-up firms is 2011, while 2015 is the year with the lowest number of firm establishing. The highest number of firm exiting is recorded in 2015, which is after the oil price plunge: for all industries, 10172 family firms and 990 non-family firms; for oil and shipping industries, 154 family firms and 13 non-family firms, followed by the year 2012. Since the number of firms exiting is high in the two years after the large oil price shock, it would be interesting to look further into how different it was for the survival of family firm and non-family firms.

5.5 Correlation matrix and multicollinearity

Correlation matrix analysis can give us more insight into the variables of interest, not only as separate variables but also the relation among them. If the explanatory variables in a regression are closely correlated, it might be difficult to make correct inferences as it might cause wide confidence interval and the regression becomes very sensitive to small changes in the specification (Brooks, 2008). The correlation matrix (see Table 3 in the Appendix) depicts low correlation between variables that are used in regressions. This would indicate absence of multicollinearity as all correlation are below 0.7. The absence of multicollinearity can also be confirmed by using Variance Inflation Factor, where all VIF are lower than 2.5 (see Table 4 in the Appendix)

Overall our main variables are return on assets as a dependent variable, family firm and oil price shock as independent variables. Summary statistics shows that family firms tend to have higher profitability than non-family firms, no matter which size the firms is. Furthermore, different firm types were influenced by the oil price fall in 2014 in different way. As a result, to sharpen our understanding, we will further work on empirical models in Section 6 and 7.

6. Empirical models

This section presents our empirical approach describing main regression models used to test the hypotheses. Firstly, models 1 to 4 estimate the effect of shocks, secondly, models 5 to 6 explore the family firm effect on the shock, thirdly, models 7 to 10 deal with the size analysis followed by models 11 to 15 working with the difference-in-differences and survival tests.

6.1 Model 1-4: The effect of oil price shocks on firm performance, 2010-2015

The first block of models is used to check hypotheses 1 to 4 and identify if the oil price shocks are associated with significant changes in firm performance and to further investigate possible differences in the performance of family vs non-family firms.

To test the **first hypothesis,** we run the following model for firms in all Norwegian industries:

Fixed effects model:

$$ROA_{i\ all\ industries,t} = \alpha + \beta_1 shock + \beta_x controls + u_i + \varepsilon_{i,t}$$

System GMM:

$$ROA_{i\ all\ industries,t} = \alpha + \beta_1 shock + \beta_2 ROA_{t-1} + \beta_x controls + u_i + \varepsilon_{i,t}$$

This regression tests whether oil price shocks are associated with changes of firm performance in Norway. The coefficient of interest here is β_1 shock, based on the previous research and our assumptions, we expect this coefficient to be significant and negative, demonstrating that companies in Norwegian experience a direct negative effect of oil price shock, even if the indirect effect of price increases through macroeconomic changes could be positive.

To test **the second hypothesis,** we run the following model for firms in oil and shipping industries:

Fixed effects model:

$$ROA_{i\ oil\&shipping,t} = \alpha + \beta_1 shock + \beta_x controls + u_i + \varepsilon_{i,t}$$

System GMM:

$$ROA_{i\ oil\&shipping,t} = \alpha + \beta_1 shock + \beta_2\ ROA_{t-1} + \beta_x controls + u_i + \varepsilon_{i,t}$$

This regression model is used to identify the effect of oil price shocks on the industry most closely related to the oil price volatility. The coefficient of interest is β_1. We expect the coefficient to be significant and positive as shown earlier by Park and Ratti (2008) as companies in these industries benefit from the oil price increase.

6.2 Model 5-6: Family firm impact on the oil price shock effect

The third hypothesis is tested using the following regression models for family and non-family firms in oil and shipping industries

Fixed effects model:

$$ROA_{i\ oil\&shpping,t} = \alpha + \beta_1 shock + \beta_2 FF + \beta_3 shock * FF + \beta_x controls + u_i + \varepsilon_{i,t}$$

System GMM:

$$ROA_{i\ oil\&shpping,t} = \alpha + \beta_1 shock + \beta_2 FF + \beta_3 shock * FF + \beta_4 ROA_{t-1} + \beta_x controls + u_i + \varepsilon_{i,t}$$

This regression model tests whether being a family firm is associated with a different effect of the oil price shock. The coefficient of interest is β_3, representing an interaction term between a dummy variable family firm and the oil price shock over the year. We expect the coefficient to be significant and negative, since longer term horizons, focus on survival, quicker decision-making process and opportunities to attract debt capital with beneficial terms would imply performance being less affected by the short-term oil price volatilities.

6.3 Model 7-10: Size impact on the oil price shock effect

The fourth hypothesis is tested using the following regression model for firms in oil and shipping industries:

Fixed effects model:

$$ROA_{i,t} = \alpha + \beta_1 size + \beta_2 shock * large + \beta_3 shock * medium + \beta_4 shock * small + \beta_x controls + u_i + \varepsilon_{i,t}$$

System GMM:

$$ROA_{i,t} = \alpha + \beta_1 ROA_{t-1} + \beta_2 size + \beta_3 shock * large + \beta_4 shock * medium + \beta_5 shock * small + \beta_x controls + u_i + \varepsilon_{i,t}$$

This regression model tests whether firms of different sizes are affected differently by the oil price shocks, coefficients of interest are β_3, β_4 , β_5. We run this model for both family and non-family firms to see if the size matters for the effect of the oil price shocks on the firm performance and compare the magnitude of the effect for family and non-family. This will also assure higher comparability levels.

6.4 Model 11-15: Difference-in-differences and Survival Analysis

Moving on to testing **the fifth hypothesis** if a single negative shock, a significant price drop of 2014, affected family and non-family firms differently. The regression equation for the balanced sample is as follows:

$$ROA_{i,t} = \alpha + \beta_1 FF * after + \beta_2 FF + \beta_3 after + \beta_x controls + \varepsilon_{i,t}$$

This regression models tests whether the difference in performance between a family firm and a non-family firm has changed significantly after the crisis of 2014. The advantage of this approach is that it eliminates any time trend, which both types of firms operating in the same industry are exposed to and it also removes any time invariant firm specific characteristics since we compare identical samples over time. The coefficient of interest is β_1 representing a difference-in-differences estimator, we expect this coefficient to be significant and positive, since we expect family firms to react less to the oil price drop. "After" is a dummy variable, equal to 1 in year 2015.

Further, to test **the sixth hypothesis** we use the following regression equation for all companies existing in 2013 in oil and shipping industries that entered the shock:

This regression model tests whether family firms have a higher probability of surviving through the oil price shock of 2014, i.e. through the period of 2013-2015. The coefficient of interest is Family firm. We expect it to be negative as family firms are more concentrated on a long-term survival than a short-term value maximization, hence survive longer. In this supplementary analysis, "exit" refers to death. The hazard rates of the result will indicate the probability of survival at time t for any firm with specific value of the variables in the model, such as age and profitability. Test for proportionality assumption of the Cox model has been executed and we find no violation.

7. Main results

The following section presents our main results. Firstly, we answer hypotheses 1 and 2 and present the oil price shock effect on all industries and on oil and shipping. Then, we answer the third hypothesis and investigate the family firm effect. Thirdly, we turn to the fourth hypothesis and check the size effects for family and non-family firms. After that we present the result of difference-in-differences and the survival analysis testing hypotheses 5 and 6.

7.1 Oil price shock effect, 2010-2015

Here we examine the effect of oil price shocks on firm performance during 2010-2015.

Table 10. Impact of oil price shocks on firm performance

VARIABLES	(1) All industries - FE	(2) All industries - GMM	(3) Oil & Shipping industry - FE	(4) Oil & Shipping industry - GMM
Oil price shock	-0.0298***	-0.00156	0.0692	0.127**
	(0.00957)	(0.0107)	(0.0551)	(0.0580)
Size	0.0946***	0.128***	0.0756***	0.100***
	(0.00117)	(0.00165)	(0.00913)	(0.0124)
ROA (t-1)		0.0485***		0.0788**
		(0.00423)		(0.0373)
Leverage	-0.305***	-0.148***	-0.243***	-0.0412
	(0.00564)	(0.0150)	(0.0382)	(0.0771)
Tangibility	-0.212***	-0.328***	-0.165***	-0.351***
	(0.00563)	(0.00889)	(0.0430)	(0.0521)
Capital intensity	-0.0553***	-0.0675***	-0.0311***	-0.0394***
	(0.000953)	(0.00120)	(0.00508)	(0.00636)
Age	-0.0118***	-0.0190***	0.0197*	-0.0119
	(0.00169)	(0.00210)	(0.0116)	(0.0142)
GDP growth	0.352***	0.192***	-0.0832	-0.398*
	(0.0465)	(0.0411)	(0.270)	(0.232)
Inflation	0.0707	-0.0213	0.336	-0.0117
	(0.0513)	(0.0513)	(0.299)	(0.295)
Constant	-1.150***	-1.582***	-1.027***	-1.291***
	(0.0165)	(0.0233)	(0.138)	(0.190)
Observations	334,286	312,923	5,379	5,095
R-squared	0.118		0.105	
Number of pcid	95,393	88,718	1,425	1,341

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First of all, we see that on average there exists a negative effect of oil price shocks of 2010-2015 on the performance of companies in all industries in Norway. Secondly, there is a positive effect of the oil price shocks on the oil and shipping industries. However, the effect is only statistically significant in FE model for all industries and in system GMM for oil and shipping industries at 1% and 5% level.

These findings are consistent with the graphs in summary statistics. For oil and shipping firms, a positive price shock helps to boost the profitability, while a negative oil price shock as the one that followed high prices of 2010-2013 depresses the profitability. On the other hand, for all industries on average, an increase in oil price will directly reduce the ROA of the firms. A possible explanation is that a positive oil price shock might give a rise to the firm's operating expenses, hence, lower firm performance. In brief, we find statistical support for hypothesis 1 in fixed effects model and in GMM model for hypothesis 2, and the signs of the average oil price changes are consistent with our expectation.

As determinants of firm performance, tangibility, leverage and capital intensity have negative association with firm performance, consistently in all models. Tangibility has a negative impact on return on assets possibly because investments in fixed assets generate higher return in long term than over medium and short term. A negative correlation between tangibility and profitability also indicates that firms do not use their fixed assets efficiently. Also, that leverage has a negative influence on firm performance is consistent with pecking order theory; the higher the return is, the less debt will be used. The relation between capital intensity is consistent with the findings in Shapiro & Titman (1986). Being highly capital intensive increases the business risk, which lead to a higher cost of capital that decreases firm performance. We also find that size has a statistically significant positive effect on ROA in all models at 1%. The result is consistent with what was saw in Flamini et al. (2009) paper. Size can be considered an advantage for firms to have more chances to compete with smaller firm by utilizing economic resources. However, this does not clearly show how firms in different sizes response to the oil price shocks or which sizes of firm are most affected by changes in oil prices. Consequently, we will introduce three size-related dummy variables (large, medium, small) to address the question in Table 12.

Here we confirmed a general negative effect, the 1st hypothesis, of increasing oil prices on firm performance for all companies in Norway, and a contrast positive effect, 2nd hypothesis, of increasing prices on firm performance of oil and shipping firms. Now we can move on to testing whether companies of different type within the chosen industries are affected differently.

7.2 Family firm impact on the oil price shock effect, 2010-2015

Here we establish the additional impact of being a family firm on the oil price shock effect on the firm performance in oil and shipping industries in 2010 to 2015.

Table 11. The impact of being a family firm in oil price shocks

VARIABLES	(5) Oil & Shipping industry - FE	(6) Oil & Shipping industry - GMM
Family firm*Shock	-0.452**	-0.0175
	(0.184)	(0.168)
Oil price shock	0.486***	0.145
	(0.179)	(0.162)
Family firm	0.000250	-0.00621
	(0.0225)	(0.0208)
Size	0.0760***	0.100***
	(0.00909)	(0.0124)
ROA (t-1)		0.0786**
		(0.0373)
Leverage	-0.245***	-0.0423
	(0.0379)	(0.0773)
Tangibility	-0.166***	-0.351***
	(0.0431)	(0.0522)
Capital Intensity	-0.0306***	-0.0394***
	(0.00508)	(0.00637)
Age	0.0200*	-0.0120
	(0.0116)	(0.0142)
GDP growth	-0.0926	-0.397*
	(0.271)	(0.232)
Inflation	0.340	-0.0106
	(0.299)	(0.295)
Constant	-1.036***	-1.285***
	(0.141)	(0.190)
Observations	5,379	5,095
R-squared	0.107	
Number of pcid	1,425	1,341

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

We introduce the interaction term Family firm*Shock to explore the effect of the magnitude of the shock and family firm status, which will be used to test the third hypothesis. Table 11 shows that the interaction term has a negative coefficient in both model, however, it is only statistically significant in fixed effects model. This result indicates that for companies in oil and shipping industries, oil price shock has a positive influence on firm performance but being a family firm would make the company less affected by the shock, hence, reduce the effect of the shock on the firms. The intuition here can be that a significant and unexpected hit in industries, which might not directly deal with oil price volatilities, could be better dealt with by the managers of the family firms that are concentrated on surviving than by non-family firms. However, the shock variable is not significant in GMM model, which could be due to FF*shock absorbing some of the effect due to the high correlation as the number of family firms is much larger than non-family firms. On the other hand, in the interview conducted with Øyvind Gjerde, the CEO of Wilsonship ASA, Norwegian shipping company, we find out that while family ownership allows for longer term planning, it does not significantly affect the decision-making process in times of oil price shocks.

Hence, despite some limited evidence confirming that family firms do assure a lower effect of the shock on the firm performance due to longer horizons, focus on survival and flexible decision making, we cannot confirm the effect of family firm status on magnitude of the shock effect, 3^d hypothesis, due to the lack of statistical significance. This could signify common hedging practices used by both firm types.

7.3 Size impact on the oil price shock effect, 2010-2015

In order to explore further possible differences between the effect of oil price shocks on the firm performance of family compared to non-family firms we turn to a size analysis within these two types of firms. This will allow us to see if different sizes of companies within family and non-family firms are affected similarly. We, thus, will be able to confirm the results we get testing the second hypothesis. Here we explore the impact of different firm size (small, medium, large) on the oil price shock effect in oil and shipping industries in the period of 2010-2015.

Table 12. The impact of oil price shocks on specific firm sizes in oil and shipping industries in the period of 2010-2015

VARIABLES	(7) Family firms - FE	(8) Family firms - GMM	(9) Non-family firms - FE	(10) Non-family firms - GMM
Shock*large	-0.00821	0.108*	0.518**	0.0775
	(0.0559)	(0.0563)	(0.217)	(0.211)
Shock*medium	0.158	0.0736	0.287	0.103
	(0.144)	(0.182)	(0.316)	(0.340)
Shock*small	0.454	0.484	0.708	-0.759
	(0.355)	(0.448)	(2.074)	(0.887)
Size large	0.0588***	0.0726***	0.0590	0.116***
	(0.0109)	(0.0147)	(0.0532)	(0.0406)
Size medium	0.0577***	0.0687***	0.0530	0.111***
	(0.0114)	(0.0153)	(0.0541)	(0.0420)
Size small	0.0498***	0.0579***	0.0693	0.125**
	(0.0133)	(0.0175)	(0.0637)	(0.0499)
ROA(t-1)		0.0792**		-0.0890
		(0.0384)		(0.129)
Leverage	-0.235***	-0.0615	-0.379***	-0.163*
	(0.0383)	(0.0716)	(0.110)	(0.0969)
Tangibility	-0.178***	-0.344***	-0.0649	-0.128
	(0.0469)	(0.0506)	(0.118)	(0.128)
Capital intensity	-0.0302***	-0.0401***	0.00755	-0.0230
	(0.00544)	(0.00664)	(0.0214)	(0.0185)
Age	0.0223*	-0.0118	0.0328	-0.0831*
	(0.0128)	(0.0156)	(0.0420)	(0.0476)
GDP growth	-0.189	-0.473**	0.499	0.587
	(0.287)	(0.238)	(1.017)	(1.222)
Inflation	0.280	-0.0784	0.426	0.192
	(0.305)	(0.297)	(1.537)	(1.237)
Constant	-0.752***	-0.821***	-0.917	-1.526***
	(0.169)	(0.229)	(0.803)	(0.590)
Observations	4,962	4,747	417	348
R-squared	0.121		0.115	
Number of pcid	1,311	1,256	181	142

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As we mentioned above, size does have a statistically significant positive effect on firm performance. However, it does not clearly indicate how changes in oil price influence return on assets in different firm size. Models 7 through 10 (table 12) show the impact of oil price shocks on profitability, allowing for firms to be categorized according to firm size (large, medium, or small) and family firm status. Tests for

coefficients equality or symmetry are reported in Table 13. For each model, the hypothesis of equal coefficients on each of the size dummy variable cannot be rejected (for model 7, this refers to testing 0.0588=0.0577=0.0498) even though the coefficients of the size dummies are mostly statistically significant for models 9 and 10, while it can be rejected for models 7 and 8. Having a closer look at the magnitude of estimated coefficients, we can see that on average, firms with different sizes in oil and shipping industries experienced similar return on assets in the period of 2010-2015 and size has a significant positive influence on firm performance.

Table 13. Wald tests for symmetric oil price effect controlling for type (small, medium, large) of firm size

Hypothesis	Model 7	Model 8	Model 9	Model 10
Symmetric size (s, m, l)	3.26 (0.0388)	11.57 (0.0031)	1.44 (0.2400)	2.77 (0.2506)
Shock*size (s, m, l)	1.48 (0.2283)	0.80 (0.6714)	0.21 (0.8071)	1.00 (0.6073)

When it comes to how the changes in oil price affect firms with different size, Table 12 shows that in both fixed effects and system GMM model, only the interaction terms between price shock and large dummy are statistically significant at 10% and 5% level in model 8 and 9. Changes in oil price have the largest and significant effect for large-sized firms, positive for family and non-family firms. The intuition could be that large firms often have undiversified customer base, especially in oil and shipping industries with governments and large productions as buyers in Norway, where this buyer-risk (delivery times and amounts) cannot be diversified away as could be done for smaller customers of medium and small firms (Choe, 2003 and Kramarz et al, 2016). However, the test to determine whether the estimated coefficients on the three interaction terms (in model 7, -0.00821=0.158=0.454) are the same cannot be rejected.

In brief, we conclude that in our sample, large firms are affected the most during oil price shocks, which is inconsistent with Sadorsky (2008) saying that changes in oil price have the biggest influence on medium-sized companies' performance, thus we reject the 4th hypothesis. Moreover, the magnitude of this effect is larger for non-family owned firms, possibly suggesting a lower exposure of family firms.

7.4. Difference-in-differences, oil price shock, 2014

Here we present the results of difference-in-differences analysis of the effect of the oil price shock in 2014 on family compared to non-family firm performance in oil and shipping industries.

After establishing a general effect on oil and shipping companies and investigating a difference of this effect on family and non-family firms we move on to checking if the effect of one significant negative shock of 2014 had a different effect on these two types of firms.

As we see a common trend of return on assets in family and non-family firms in oil and shipping industries from 2010-2013 (Figure 1), we try to explore if the oil plunge of 2014 has a significantly different effect on family firms than non-family firms using difference-in-differences methodology. In this regression, the sample will be balanced by excluding firms that enter or exit the industry during the period of 2013-2015. Moreover, as mentioned above, leverage can sometimes be an endogenous variable. If a firm performs poorly and make a loss, it will also result in increasing firm leverage. Thus, we will run the regression with and without leverage, and use the pre-shock leverage as a control variable. In our case, the pre-shock leverage will be the lagged value of firm leverage in time t-2 (using pre-shock leverage in year 2013 for data in 2015 and in 2011 for data in 2013)

Furthermore, to abstract the effect the firm-specific factors on profitability, we also construct a sample of comparable firms according to several criteria. The firms that we choose are medium-sized that have total leverage in a specific range. Total leverage is defined as the ratio of total assets minus equity over total assets. The rationality behind is that family firms use more debt than non-family firms due to the constraint of ownership, and most of the debt might be non-financial. As a result, we choose firms falling between greater than minus one standard deviation and less than one standard deviation in the total leverage (from 2010 to 2013 – before the oil price plunge in 2014) of family firms in oil and shipping industries. In terms of actual numbers, those firms will have total leverage between 0.26 and 0.93.

Table 14. Difference-in-differences

VARIABLES	(1) All firms without leverage	(2) All firms with leverage	(3) Selected firms
After	-0.0145	-0.0203	0.0577
	(0.0310)	(0.0291)	(0.0409)
Family Firm*After	0.0128	0.0194	-0.0484
	(0.0324)	(0.0304)	(0.0493)
Family Firm	0.0473**	0.0456**	0.0369
	(0.0201)	(0.0177)	(0.0437)
Size	0.0477***	0.0512***	0.0583
	(0.00557)	(0.00594)	(0.0361)
Age	-0.00379	-0.00947	-0.0277*
	(0.00572)	(0.00607)	(0.0153)
Capital intensity	-0.0257***	-0.0254***	-0.0348**
	(0.00307)	(0.00300)	(0.0136)
Tangibility	-0.252***	-0.143***	-0.217***
	(0.0199)	(0.0273)	(0.0802)
Leverage		-0.280***	-0.246***
		(0.0379)	(0.0659)
Leverage (t-2)		0.0764**	
		(0.0333)	
Observations	1,502	1,386	141
R-squared	0.177	0.240	0.368

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Overall, we do not find that the oil price crisis in 2014 affected two types of companies differently in oil and shipping industries. We do find that the effect of crisis is negative, and there is a positive family firm effect, statistically significant at 95% confidence level for the whole sample, with and without leverage. This means that the considerable oil-price fall of 2014 is associated with decreased profitability in oil and shipping industries. However, being a family firm throughout this crisis did not seem to have an added value to the performance. Regression in selected firms does not result in any statistical significance, possibly because of the small number of observations.

This reaction could possibly be due to the fact that oil and shipping industries in Norway have established standard ways of dealing with the price crisis, for example hedging their exposure, having provisions in contracts with suppliers and customers in advance, etc. Thus, being a family firm in this industry does not improve the

performance in times of crisis. However, those results could also be affected by the fact that the oil price plunge continued in year 2015, thus using 2016 for which the data is yet unavailable could change the results. Secondly, the number of non-family firms is 65, considerably lower than family firms, which could significantly lower our comparison abilities.

When it comes to leverage, the leverage of firm in the year has a statistically significant negative association with firm performance at 1% level. However, the pre-shock leverage as a control variable has a statistically significant positive effect on return on assets.

Overall, even though we expect longer horizons with a focus on survival leads to a higher performance compared to non-family firms during the negative oil price shock of 2014, we do not find a confirmation of this theory for the oil and shipping industries using difference-in-differences methodology, rejecting the 5th hypothesis.

7.5 Survival analysis, oil price shock, 2014

Here we present the results of the survival of family compared to non-family firms in oil and shipping industries through the oil price shock of 2014.

Table 15. Survival analysis

VARIABLES	(14) All firms		(15) Only Family firms	
	Coefficient	Hazard Ratio	Coefficient	Hazard Ratio
Family firm	0.393	1.4809		
	(0.260)			
ROA	-1.038***	0.3543	-1.006***	0.3657
	(0.342)		(0.355)	
Tangibility	-0.638*	0.1871	-0.740**	0.4773
	(0.354)		(0.375)	
Leverage	0.0869	0.4154	0.141	1.1510
	(0.381)		(0.398)	
Capital Intensity	-0.0550	0.0390	-0.0606	0.9412
	(0.0412)		(0.0435)	
Size	0.0515	0.0550	0.0481	1.0493
	(0.0522)		(0.0558)	
Observations	2,699		2,144	

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

As mentioned above, in order to utilize the data that we might have excluded when running the regression for difference-in-differences, we will have a further look into the survival of firms in the oil and shipping industries during the oil price shock. Table 15 shows that the coefficient for the family firm dummy is positive and not statistically significant. Directly affected by the oil price shock, family firms in the industry, die at a rate of 43.36% *faster* than non-family firms during the period of 2013-2015 where the oil price plunge happened. The explanation for this insignificance could be due to small-sized sample and the high number of Family firm in our subsample, hence, might end up having multicollinearity in the model. As a result, we have a further look at only family firm's survival in model 15 to see how firm-level factors affect the survival of the companies.

In model 15, only the coefficient for ROA is significant at 5% level. Profitability, tangibility and size are expected to lead to longer survival while higher leverage is associate with a higher probability of exiting. On the other hand, size and capital intensity can be considered as factors that negatively affect the survival of the firm. In oil and shipping industries higher capital intensity leads to a higher chance of firm death, however, the effect is quite small as the hazard ratio is close to 1. However, we cannot make a concrete conclusion as the coefficient is statistically insignificant.

By conducting the survival analysis, we do not find support for hypothesis 6, family firms do not have higher survival probability in oil and shipping industries in the period of 2013-2015 with a deep fall in the oil price. The idea that family firm owners have a longer investment horizon, and are undiversified, hence, have greater interest in the survival of the company is not yet confirmed in our study.

Overall, our results confirmed a negative oil price shock effect (hypothesis 1) on all companies in Norway and a positive effect (hypothesis 2) for oil and shipping firms. We found limited evidence that family firms are affected differently (hypothesis 3). Moreover, we discovered that large firms are affected the most by the shock, thus we rejected hypothesis 4. The magnitude of this effect is larger for non-family firms. Further, we did not confirm the hypothesis 5 and 6 which suggested that family firms reacted differently to the oil price fall of 2014 and tend to survive longer. We describe the results more in the Conclusions.

8. Sensitivity analysis

To test the robustness of Models (1) – (17), we will utilize alternative definitions of variables using in the regressions. All regressions are run with their set of control variables used in the regression from table 10-15. The regression results can be found in section 12.1.3 – 12.1.6 in the Appendix.

8.1 Alternative definitions of oil price shock

We use the measure suggested by Hamilton (2003) to measure the net oil price changes by estimating the amount by which the price exceeds its maximum value throughout the year. Even though the price development is not exogenous to macroeconomic indicators, this estimate shows the non-linear transformation of prices which is exogenous. Even though the original measure suggested by Hamilton is the net oil price increase, we would like to slightly adjust it as we are looking at a period where price falls and re-scale the value by taking the natural logarithm.

$$HM = \begin{cases} \log\left(\frac{\sum_{t=1}^{365}[p_{t,j} - max(p_{t-1,j})]}{365}\right) if \quad \frac{\sum_{t=1}^{365}[p_{t,j} - max(p_{t-1,j})]}{365} > 0 \\ -\log\left(-\frac{\sum_{t=1}^{365}[p_{t,j} - max(p_{t-1,j})]}{365}\right) if \quad \frac{\sum_{t=1}^{365}[p_{t,j} - max(p_{t-1,j})]}{365} < 0 \end{cases}$$

When using the net oil price changes as an alternative definition, Table 16-18 shows that the results of model 1-10 are very sensitive to the new definition. In Model 1-4, there is a change in the significance of the coefficients of Oil price shocks. The sign also changes, saying that the shocks have a negative effect on Oil and shipping firms' performance. In Model 5-6, we still see a negative effect of being a family firm during the oil price shock, however, the significance changed from 5% to 1% and the oil price shock is no longer significant. Furthermore, when looking at model 7-10, we only see significance in the interaction term of oil price shock and size dummy for large family firms and the effect switched to negative for family firms in both models. We do not think this is sufficient to draw any conclusion and still say that we lack statistical support for the effect of the oil price changes on different firm sizes.

8.2 Alternative definition of Family Firms

As stated by Astrachan et al. (2002), there is still no clear definition of a family-held company. Villalonga and Amit (2006) also emphasized the high sensitivity of the definition of family-held firms. Hence, to carry out the robustness test, we will use the definition from Villalonga and Amit (2006), which claims that a firm where the family is the blockholder of the company and own 20% of the outstanding shares will be reported as family firm. When we define family firms by family holding at least 50% of the share, we see that the number of family firms in our sample is relatively high. As a result, an alternative definition of family firms that will be used in our sensitivity analysis is family having 70% ownership stake or supermajority.

Looking at the effect of family firm status on firm's profitability during the shock, Table 19 indicates that the results are overall consistent with the results from model 5 and 6 in Table 11. When defining family firm as the family owning 20% of the shares, none of the coefficients of interest is significant. This can be explained by the high number of family firms which caused high correlation between the family firm dummy and the interaction term. On the other hand, when we defined family firm as family having supermajority, the results between fixed effects model and system GMM model are more consistent. The coefficient of interaction term and oil price shock are statistically significant at 1% whereas the coefficient of family firm dummy is still insignificant. We choose to say that that the result stating that family firms are less affected by the oil price shock during the period of 2010-2015 is sensitive to the definition of family firms.

When considering whether family firms perform different from non-family firm after the oil price plunge in 2014, Table 20 shows that the results are not completely consistent with the results in Table 14, especially when we use the definition of family firm as owning 20% ownership stake. We draw the same conclusion that due to high correlation between the family firm dummy and the interaction term, we find no significance when we use the blockholder definition. Nevertheless, the results are more consistent when the supermajority definition is applied. As we lack significance for the difference-in-differences factor, we cannot draw any conclusion on hypothesis 5, and we choose to say that the result stating difference in performance between a family firm

and a non-family firm has changed significantly after the crisis of 2014 is sensitive to the definition of family firm.

Lastly, looking at the survival of family firms, Table 21 indicates that the results are only consistent for model 15 when we change the definition of family firms. In model 15, the coefficient of ROA remains negative and statistically significant at 5%, which confirm the robustness of the results. For model 14, the coefficient of family firm changes significantly when we increase the amount of stake that a family should own to be considered as family firms from 20% to 70%. Using the definition of a family being the blockholder minority gives us the same result with model 14. However, when we change it to 70%, the coefficient becomes negative and remains insignificant. The explanation could be that by switching the definition of family firm from a family being the blockholder minority to supermajority, we increase the number of non-family firms in the sample. This draws the conclusion that the result of model 14 for the survival of firms in oil and shipping industries is highly sensitive to the definition of family firm.

8.3 Alternative definition of firm size as an explanatory variable

Another measure for firm size that we choose to test the robustness of the model is the natural logarithm of total assets.

$$Firm\ size\ 2 = log(Total\ assets)$$

When considering the effect of the oil price shock and firm size on firm performance (model 1-4), there is a change in the significance and the sign of the shock variable. For firms in oil and shipping industries, the effect of the shock is no longer significance. Size variable on the other hand is more robust to the alternative definition. The same holds for testing the effect of oil price shocks on different firm size. All firms in different sizes remain to experience the same return, however the effect of the shocks is different where we see the possibility that medium and small firms are most affected in model 7. The results are sensitive to our robustness test for alternative definition of firm size.

8.4 Alternative definition of Control Variables

All regressions are specified with alternative definitions of the control variables. Leverage is originally defined as the ratio between the sum of long-term and short-term debt to total assets or can be considered as institutional debt. However, we see that family firms might take on non-institutional debt also to maintain the operation of the company. Hence, we use Total leverage measured as total assets minus equity over total assets as an alternative definition for sensitivity analysis.

$$Total\ leverage = \frac{(Total\ assets - equity)}{Total\ Assets}$$

Table 24 shows that the significance of coefficient of Oil price shocks has changed. We only see statistical significant in fixed effects model, not in system GMM. Also, the sign of the coefficient changes for FE of all industries. Hence, model 1 to 4 is only robust for the result of size variable to the definition of leverage and this is not the case for the result of Oil price shock's effect

The alternative definition of leverage is not entirely robust when it comes to testing the effect of being a family firm (Model 5 and 6) and different firm sizes (Model 7 to 10) during the oil price shock. The significance of coefficients remains the same, hence, showing that there is additional negative effect of being a family firm dealing with the oil price shocks. However, there is a slight change in the sign of coefficient in model 6 for the interaction term. The result in Table 25 is also sensitive to the new definition with the results showing that different firm sizes experience the same performance in the period of 2010-2015 but the shocks seem to affect small firms the most and not significantly.

When looking at our difference-in-differences regression, for model 11 and 12, the result for variable After and FF*afterremains the same and insignificant. Family firm dummy also remains statistically significant at 5%. We choose to accept that the results of model 11-13 are robust to the definition of leverage. The same holds for the survival regressions (Model 14 -15).

Hence, this draw the conclusion that the results of model 11-15 are robust to the definition of firm leverage.

9. Conclusions & final remarks

9.1 Conclusions

In this work we tried to establish an effect of the oil price shocks of 2010-2015, a period of high oil prices followed by low oil prices in 2014-2015 driven by several years of upward surprises in the production of oil, weakening demand, a significant shift in OPEC policy; unwinding geopolitical risks; and an appreciation of the U.S. dollar. We chose to focus on the oil and shipping industries in Norway exposed the most to the oil price changes. We further hoped to investigate whether this effect was different for family and non-family firms following the evidence that different firm types might be affected differently by the oil price hits keeping in mind existing polar evidence on the performance of family compared to non-family firms.

After conducting our analysis, we found that a positive change in oil price is associated with a decrease in the return on assets for all firms in the economy in Norway, while it creates a positive influence on firm performance in oil and shipping industries boosting their revenue. Supported by the literature that suggests a different effect on different types of firms, we move on to investigation the effect on family firms compared to non-family firm.

According to the available research family firms could be affected less by the oil price shock due to special features associated with this type of ownership, for example: quicker decision-making mechanism, lower agency problems and long-term horizons. However, we find limited evidence to support the hypothesis that family firms are less affected by the oil price shock. The explanation for this could be in the fact that there have been established common practices for coping with the oil price movements: hedging, having provisions in contracts with suppliers and customers in advance. This was also confirmed by the CEO of a family owned shipping company Wilson Ship AS, where he agreed that while family ownership allowed for long term strategy, it did not help significantly through oil price crisis.

Further, we rejected the hypothesis that medium firms due to the lack of capital compared to larger firms and lack of flexibility compared to small firms as suggested by Sadorsky (2008) are affected the most by the oil price shocks. On the contrary we found that larger firms are affected the most, possibly due their high buyer-risk, which

difficult to diversify away when the times and amount of delivery are set. Moreover, the magnitude of the shock effect for large companies is lower for family firms, possibly supporting the evidence that family firms are affected less.

Further on, we did not find evidence to support the hypothesis that a significant oil-price fall of 2014 affected family firms differently. A possible explanation is that the price fall continued in 2015, thus 2016 would be a better time to represent "after"-crisis period. Unfortunately, the data is not available for 2016 yet. Also, a small number of observation could be a drawback of the analysis, which leads to the insignificance of the coefficients. Further, as an extension to the difference-in-differences we conducted a survival analysis for the period of 2013-2015, which also brought us to a conclusion that there is no indication that family firms in oil and shipping were more likely to survive through the oil price shock in 2014.

Overall, our study reveals that there is a negative effect on the firm performance on average for all companies in the Norwegian economy. On the contrary, there is a positive effect of increasing oil prices on companies operating in oil and shipping, while a negative shock suppresses their performance. However, even though there might be a certain benefit of being a family firm when oil price shocks hits, particularly for larger size firms, but the positive effects are limited and require further investigation.

9.2 Limitations and suggestions for further research

Firstly, we recognize the lack of previous research done on family firms due to the shortage of data. The theory on family firms does not give an exact definition of a family firm itself. Hence, we have to make our own cut off point for a family's stake in a business. A different ownership threshold could affect the results.

Secondly, the endogeneity concern which is common for any corporate governance research is present. To avoid omitting a relevant variable, we have studied the theory available to include all performance determinants. We have also chosen a methodology that could potentially mitigate the omitted variable bias. Furthermore, there is an opinion that the family ownership is preserved only under a good performance, which might point to the reverse causality issue. Finally, the last concern

regarding endogeneity is measurement error. As argued by some researchers, family firms tend to have fewer assets, leading to higher returns on assets. However, we believe that by studying companies within specific industries we can avoid the measurement error, as companies in one industry would be comparable in terms of assets and returns. Moreover, we adjust the net income for the interest expense to have a ROA created by the operating activities only.

Moreover, not equal distribution of firms within size in Norway could have potentially affected our size analysis, where there are not that many large and medium firms, while small represent a large part. Further, there are much more small family firms compared to non-family firms, affecting the comparison. Thus, investigating these industries in different economies with a different distribution within sizes could give different results.

Some of the limitations are connected to the oil price shocks and their definition. As the literature does not generally deal with very recent shocks we had to create our own cut offs for what we consider a shock with the average annual growth of around plus or minus 5%, which could be observed in our period of 2010 to 2015. Here, we also mostly operate with the average annual growth defined by Poghosyan and Hesse (2016). Different estimators of both the shock period and its size could potentially result in different outcome.

Some of the result insignificance could also be explained by the chosen methodology, with our time persistent and time dependent characteristics: family firm. Thus, trying to apply a different methodology might affect the results. However, we did find this methodology as the optimal to use.

Further on, we believe that an extensive survey of companies' management and owners might shed some more light on how family firms deal with oil price shocks compared to non-family firms. This will bring more empirical support for the statistical results. While we only conducted one interview, we believe that this could also be a potential research in the future.

Overall, we believe that there exists a potential area for further research. Firstly, in terms of exploring a true definition of a family firm, either in terms of management or ownership or some other characteristics that might mean a family control. Secondly, there might be more research done as to define and measure a significant oil price shock

to evaluate better the scale of its effect. Thirdly, to overcome a lack of relevant and similar research, we believe an extensive survey could somewhat cover the knowledge gap.

9.3 What we have learned

Working on this paper we have learned a lot both regarding the theory behind our research topic, methodological approaches and empirical results.

Firstly, we have discovered that both oil price shocks and family firms, despite being widely discussed in the literature and in the media, still require further investigation and definition as the opinions and findings are quite contradictive. Here, we relied on various studies to define the family firm as having more than 50% of shares owned by a family, while we defined an oil price shock as a period where prices differ significantly from the recent spot prices, thus focused on years 2010 to 2015 with high oil prices followed by low oil prices.

Secondly, we discover different views on both oil price shock effects and family firm impact. Generally, oil price shock effects on the firm performance are seen as being overall negative. However, the extent and the direction of this effect could vary due to the firm's origin, industry, size and type. We also discover that on one hand family firms could be expected to perform better during the oil price shocks due to their long-term horizons with a focus on survival, better relationships with debtholders and a flexible decision-making process. On the other hand, low diversified, possibly less competent owners and managers could make suboptimal decisions leading to family firms falling behind non-family owned firms. Further, we were also ready to discover that family firms do allow for longer planning horizons, but due to established hedging mechanisms in the industry, the ownership type will not affect the performance much, as supported by the interview we conducted with the CEO of a Norwegian shipping company. Additionally, we researched that medium-sized firms within both family and non-family firms might be affected the most by the crisis: due to lower resources available compared to large firms and lower flexibility present to adjust to the shock compared to small firms.

Having this theory in mind we then researched the available methodology. We employed fixed effects methodology providing the benefits of controlling for unobserved variables stable over time. We also turn to system GMM method which allows instrumenting for endogenous variables and is robust to the omitted variable problem, hence, produces consistent estimates. Moreover, for the specific oil shock of 2014 we use differences-in-differences methodology which eliminates any time invariant differences between the groups and time trends both groups are exposed to. This is also supplemented by the proportional hazards regression analysis.

Finally, after studying our results we learned that there, indeed, exists a negative effect on the performance of all Norwegian companies, while oil and shipping companies enjoy the consequences of the price rise. Thus, we have confirmed the negative effect, and also that this effect is highly dependent on the industry type. We discovered some limited evidence that family firms might perform better during the oil price shocks, possibly supporting our third option: general hedging techniques used by all companies. These possible benefits could be observed particularly for large companies, exposed to a difficult to diversify away buyer-risk, as the magnitude of the shock effect for the large family firms was lower than for large non-family owned companies. Moreover, we found no evidence to support the hypothesis that family firms performed better during the oil price fall of 2014.

Moreover, we have learned to look for alternative definition and assess critically the choices made earlier: defining a family firms as having 20% and 70% of family ownership as well as changing the definition of the oil price shock to a simpler net price change over the year.

Overall, while writing this paper we have learned to study and evaluate the available literature to draw our own hypotheses. We have also made decisions based on this knowledge and support it with evidence. Lastly, we learned to evaluate our work critically to fill in the existing knowledge gaps and look for alternative explanations of the achieved results.

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12. Appendix

12.1 Tables

12.1.1 Data from the Centre for Corporate Governance Research

Tables 1 to 5 give an overview of the data extracted from the Centre for Corporate Governance research, followed by the definition of the main variables and the filtering.

Table 1. Variables extracted from the Centre for Corporate Governance research

The following table gives an overview of the main items extracted from the database, their name in the database as well as their proxy in our research.

Item number in CCGR	Variable name in CCGR	Proxy
item_9	Revenue	Revenue
Item_39	Net Income	Net income
Item_51	Total fixed assets (tangible)	Tangible assets
Item _63	Total fixed assets	Total fixed Assets
Item_78	Total current assets	Total current Assets
Item_87	Total Equity	Total Equity
Item_94	Liabilities to financial institutions	Long term debt
Item_101	Liabilities to financial institutions (short-term)	Short-term debt
Item_15304	Largest family has CEO	Family CEO
Item_15311	Ultimate Ownership held by families	Family Ownership
Item_50109	Number of employees	Number of employees
Item_30	Interest Expense	
Item_504	Firm Address	Address
Item_11102	Industry code	Industry
Item_76	Cash holdings	Liquidity
Item_13420	Firm’s age	Age
item _ 105	Dividends	Dividends
Item_93	Bond	Debt
item_14507	Independent	

Table 2. Filter and sample overview

The following table gives an overview of the primary filters done to receive our four main samples with aggregated observations used to indicate a sample we will be working with: Sample 1 for Model 1 and 2 (general effect), Sample 2 for Model 3-10 (family vs non-family firm), Sample 4 for Model 11-13 (difference-in-differences) and Sample 3 for Model 14-15 (survival analysis). Model 14-15.

Filter/Sample	Filter criteria	Aggregated Observations
Filter 1	All firms are independent	2,281,503
Filter 2	Firms with negative revenue are removed	2,278,737
Filter 3	Firms with negative liabilities are removed	2,275,845
Filter 4	Firm with negative or zero assets are removed	2,237,944
Filter 5	Firms with ultimate ownership held by families exceeding 100 are removed	1,512,206
Filter 6-9	Firms in financial, utility, public administration, gambling industry are removed	833,556
Filter 10	Firm's financial information from 2010-2015	444,411
Sample 1	Keep all firms 2010-2015	444,411
Sample 2	Keep all oil and shipping firms 2010-2015	7,396
Sample 3	Keep all oil and shipping firms 2013-2015	3,676
Sample 4	Keep oil and shipping firms in 2013 and 2015 and balance the sample	1,502

Table 3. Estimation of main variables

The following table gives an overview of the estimation of the main variables based on the item numbers from CCGR, alternative definitions of the main variables for the sensitivity analysis are presented in the bottom of the line.

Theoretical Variables	Proxy	CCGR term
ROA	(Net income + interest expense)/Total Assets	(item_39+item_30)/(item_63+item_78)
Family firm	Family firm dummy	item_15311>50%
Oil price shock	Average log difference of spot prices	Bloomberg
Firm Size	Natural logarithm of firm's revenue	item_9
Firm Age	Natural logarithm of firm age	item_13420
Tangibility	Tangible assets/total assets	item_51/(item_63+item_78)
Leverage	Debt/Assets	(item_94+item_101)/(item_63+item_78)
Capital intensity	Total Assets/Revenue	(item_63+item_78)/ item_9
Macro variables	GDP growth, inflation	OECD
Family Firm	Family firm dummy	item_15311>20%
Family Firm	Family firm dummy	item_15311>70%
Firm Size 2	Natural logarithm of firm's assets	item_63+item_78
HM	Net oil price change	Bloomberg

Table 4. SIC Codes to filter out financial, gambling and administrative companies

The following table presents the SIC codes for the industries filtered out from the general to compose the Sample 1.

SIC code 2007	Meaning
64-69	Financial
84-89, 90-94, 99	Administrative
92.000	Gambling

Table 5. SIC Codes to filter for oil and shipping companies

The following table gives an overview of the industry codes identifying the oil and shipping industries used to create the Sample 2 and 3 partly based on the work of Sasson and Blomgren (2011).

SIC code 2007	Name of the category
Oil	
06.100	Extraction of crude petroleum
06.200	Extraction of natural gas
09.101	Drilling services for petroleum and natural gas extraction
09.109	Other support activities for petroleum and natural gas extraction
19.200	Manufacture of refined petroleum products
30.113	Building of oil-platforms and modules
30.116	Installation and completion work on platforms and modules
46.710	Wholesale of solid, liquid and gaseous fuels and related products
47.300	Retail sale of automotive fuel in specialized stores
49.500	Transport via pipeline
52.223	Offshore supply terminal
71.122	Geological surveying
Shipping	
50.201	Freight ocean transport
50.202	Freight coastal transport
50.204	Supply and other sea transport offshore services
50.400	Inland freight water transport

12.1.2 Sample overview

Tables 6-8 give an overview of the oil and shipping sample, characteristics of the variables and their relationship between each other.

Table 6. Summary Statistics for Oil & Shipping firms in Norway

The following table presents the summary statistics overview of the main variables for the oil and shipping industry within family and non-family firms. Return on assets is calculated as net income plus the interest expense divided by the total assets. Family ownership is equal to the family ownership level. Size is measured as a natural logarithm of revenue. Capital intensity is measured as revenue divided by the total assets. Tangibility is calculated as tangible assets over total assets. Leverage is

represented by the total financial debt over total assets. Age is defined as a natural logarithm of firm's age. The table gives mean, minimum and maximum as well standard deviation and median of the estimator. All ratios have been windsorized at 5% in each tail. N is the number of observations.

		2010-2015			2013			2015		
		Family Firms	Non-Family Firms	All Firms	Family Firms	Non-Family Firms	All Firms	Family Firms	Non-Family Firms	All Firms
ROA	Mean	0.0008	-0.0627	-0.0050	0.1722	-0.0429	0.0114	0.0128	-0.0705	0.0033
	St.dev	0.2165	0.2566	0.2212	0.2179	0.2042	0.2173	0.2174	0.2700	0.2255
	Min	-0.7120	-0.7120	-0.7120	-0.7120	-0.7120	-0.7120	-0.712	-0.712	-0.712
	Max	0.3890	0.3889	0.3890	0.3890	0.3890	0.3890	0.3890	0.3890	0.3890
	Median	0.0239	-0.0075	0.0211	0.0363	-0.0181	0.0314	0.0314	-0.0020	0.0278
Family Ownership	Mean	0.9643	0.3069	0.9040	0.9632	0.3205	0.9008	0.9619	0.3045	0.8868
	St.dev	0.0982	0.1605	0.2170	0.1002	0.1622	0.2186	0.1010	0.1704	0.2368
	Min	0.5001	0.0005	0.0005	0.5017	0.0008	0.0008	0.51	0.0074	0.0074
	Max	1	0.5	1	1	0.5	1	1	0.5	1
	Median	1	0.33	1	1	0.3469	1	1	0.3065	1
Size	Mean	14.766	15.918	14.872	14.721	15.778	14.823	14.678	16.008	14.829
	St.dev	1.8044	2.5350	1.9121	1.8410	2.4215	1.9294	1.8149	2.4424	1.9425
	Min	6.9078	6.9078	6.9078	6.9078	9.3056	6.9078	6.9077	8.9872	6.9077
	Max	21.831	22.755	22.755	21.669	21.055	21.669	21.139	21.623	21.623
	Median	14.754	15.967	14.795	14.706	15.562	14.7394	14.676	16.197	14.738
Capital intensity	Mean	2.479	4.183	2.636	2.521	4.036	2.666	3.591	3.962	2.751
	St.dev	3.194	3.194	3.244	3.207	3.337	3.250	3.207	3.348	3.252
	Min	0.560	0.560	0.560	0.560	0.560	0.560	0.560	0.560	0.560
	Max	7.613	7.613	7.613	7.613	7.613	7.613	7.613	7.613	7.613
	Median	0.457	4.517	0.530	0.504	4.516	0.569	0.505	2.982	0.596
Tangibility	Mean	0.1967	0.2532	0.2019	0.1904	0.2540	0.1966	0.2052	0.2585	0.2113
	St.dev	0.2492	0.3238	0.2574	0.2459	0.3114	0.2535	0.2565	0.3227	0.2652
	Min	0	0	0	0	0	0	0	0	0
	Max	0.8252	0.8252	0.8252	0.8252	0.8252	0.8252	0.8252	0.8252	0.8252
	Median	0.0824	0.0358	0.0805	0.0762	0.0522	0.0743	0.0894	0.0466	0.8702

Leverage	Mean	0.1267	0.1688	0.1306	0.1217	0.1630	0.1257	0.1177	0.1568	0.1221
	St.dev	0.2154	0.2567	0.2198	0.2103	0.2437	0.2140	0.2111	0.2427	0.2152
	Min	0	0	0	0	0	0	0	0	0
	Max	0.7155	0.7155	0.7155	0.7155	0.7155	0.7155	0.7155	0.7155	0.7155
	Median	0	0	0	0	0	0	0	0	0
Age	Mean	2.2452	1.9974	2.2225	2.2307	2.0746	2.2156	2.2576	2.1340	2.2435
	St.dev	1.0014	0.9969	1.0035	1.0187	1.0096	1.0185	1.0306	0.9529	1.0224
	Min	0	0	0	0	0	0	0	0	0
	Max	4.7621	4.7707	4.7707	4.6634	4.5643	4.6634	4.6250	4.6913	4.6913
	Median	2.3979	2.0794	2.3026	2.3979	2.0794	2.3026	2.3979	2.1972	2.3026
	N	6,718	678	7,396	1,122	119	1,241	1,067	141	1,208

Table.7 Correlation Matrix

The following table gives an overview of the correlation between variables in the main regressions in this research. Family firm is a dummy that takes on one, when family ownership is greater than 50%.

	ROA	**Capital intensity**	**Tangibility**	**Leverage**	**Age**	**Size**	**Family Firm**
ROA	1						
Capital intensity	-0.1099	1					
Tangibility	-0.1084	-0.1972	1				
Leverage	-0.2051	-0.0751	0.4687	1			
Age	0.0629	-0.1262	-0.0075	0.0198	1		
Size	0.2083	0.4040	0.0166	0.0946	0.1733	1	
Family Firm	0.0412	0.0153	0.0065	0.0043	-0.0005	-0.0254	1

Table 8. Correlation matrix of oil price shock and macroeconomic indicators

The following table gives an overview of the correlation between the oil price shock and macroeconomic estimators: GDP growth and inflation.

	Oil price shock	GDP growth	Inflation
Oil price shock	1		
GDP growth	0.4178	1	
Inflation	-0.2933	-0.6501	1

Table 9. VIF

The following table gives an overview of the variance inflation factor (VIF) between variables in the main regressions in this research. Additional variables are defined as follows. GDP growth is measured as an annual GDP change according to OECD data. Inflation is measured as an average annual price change according to the OECD data. Oil price shock is measured as an average annual log difference between spot prices.

Variables	VIF	1/VIF
Tangibility	1.38	0.724
Capital intensity	1.34	0.748
Leverage	1.32	0.756
Size	1.29	0.778
Age	1.07	0.937
GDP growth	1.27	0.790
Inflation	1.10	0.909
Oil price shock	1.17	0.909
Family Firm	1.00	0.996
Mean VIF	1.23	

12.1.3 Robustness test – Oil price shocks

Tables 16 to 18 show robustness test for our main regressions of model 1-10 in tables 1-3, with alternative definition of Oil price shocks. HM is a measure adapted from the study of Hamilton (2003) that calculate the net oil price changes by estimating the

amount by which the price exceeds its maximum value throughout the year. The definition of the variable can be found in Section 8.1. Each of the column in these table indicate separate regression result, each run with their own set of control variables. For further explanation of these regressions, see section 6.1 – 6.3

Table 16: **Impact of oil price shocks on firm performance**

VARIABLES	(1) All industries - FE	(2) All industries - GMM	(3) Oil & Shipping industry - FE	(4) Oil & Shipping industry - GMM
HM	-0.00193***	-0.000920	-0.00561	-0.0124**
	(0.000689)	(0.000903)	(0.00387)	(0.00554)
Size	0.0946***	0.127***	0.0763***	0.101***
	(0.00117)	(0.00172)	(0.00916)	(0.0136)
Observations	334,286	312,923	5,379	5,095
R-squared	0.118		0.105	
Number of pcid	95,393	88,718	1,425	1,341

Table 17: **Impact of being a family firm on firm performance in oil price shocks in oil and shipping industries in the period of 2010-2015**

VARIABLES	(5) Oil & Shipping industry - FE	(6) Oil & Shipping industry - GMM
FF*Shock	-0.0231*	-0.00432
	(0.0133)	(0.0157)
Oil price shock	0.0160	-0.00837
	(0.0137)	(0.0164)
Family firm	-0.000981	0.00215
	(0.0235)	(0.0250)
Observations	5,379	5,095
R-squared	0.107	
Number of pcid	1,425	1,341

Table 18: **The impact of oil price shocks on specific firm sizes in oil and shipping industries in the period of 2010-2015**

VARIABLES	(7) Family firms - FE	(8) Family firms - GMM	(9) Non-family firms - FE	(10) Non-family firms - GMM
Shock*large	-0.00953**	-0.0175***	0.0426**	0.0162
	(0.00389)	(0.00549)	(0.0209)	(0.0289)
Shock*medium	0.00346	0.000246	0.0369	0.0225
	(0.00698)	(0.00959)	(0.0339)	(0.0406)
Shock*small	-0.00118	0.000343	-0.0429	-0.0866
	(0.0216)	(0.0313)	(0.0612)	(0.0644)
Size large	0.0605***	0.0770***	0.0522	0.121***
	(0.0110)	(0.0165)	(0.0574)	(0.0445)
Size medium	0.0599***	0.0749***	0.0468	0.116**
	(0.0115)	(0.0172)	(0.0584)	(0.0455)
Size small	0.0511***	0.0653***	0.0586	0.129**
	(0.0134)	(0.0191)	(0.0667)	(0.0504)
Observations	4,962	4,747	417	348
R-squared	0.121		0.128	
Number of pcid	1,311	1,256	181	142

12.1.4 Robustness test – Family firm 20% and 70%

Table 19 to 21 illustrate the robustness test for our main regressions presented in Model 5- 6, 11-15, with alternative definitions of family firm. Family firm dummy will take the value one if the family owns more than 20% of the shares in the first two columns and 70% of the shares in the last two columns. The definition of the variable can be found in Section 5.2.1. Each of the column in these table indicate separate regression result, each run with their own set of control variables. For further explanation of these regressions, see section 6.1 – 6.4

Table 19: Impact of being a family firm on firm performance in oil price shocks in oil and shipping industries in the period of 2010-2015

Family firm	**20%**		**70%**	
VARIABLES	**(5)** Oil & Shipping - FE	**(6)** Oil & Shipping-GMM	**(5)** Oil & Shipping - FE	**(6)** Oil & Shipping-GMM
FF*Shock	-0.630	0.244	-0.493***	-0.255
	(0.434)	(0.597)	(0.170)	(0.168)
Oil price shock	0.689	-0.116	0.516***	0.356**
	(0.433)	(0.593)	(0.164)	(0.160)
Family firm	-0.0624	0.0697	-0.0354**	-0.00886
	(0.0632)	(0.0949)	(0.0159)	(0.0183)
Observations	5,379	5,095	5,379	5,095
R-squared	0.106		0.108	
Number of pcid	1,425	1,341	1,425	1,341

Table 20. Difference-in-differences

Family firm	**20%**			**70%**		
VARIABLES	(11) All firms (without leverage)	(12) All firms (with leverage)	(13) Selected firms	(11) All firms (without leverage)	(12) All firms (with leverage)	(13) Selected firms
After	0.0289	-0.0202	0.0886	-0.0296	-0.0269	0.0237
	(0.0761)	(0.0695)	(0.0664)	(0.0260)	(0.0258)	(0.0484)
Diff	-0.0332	0.0173	-0.0776	0.0308	0.0283	-0.00800
	(0.0768)	(0.0700)	(0.0711)	(0.0276)	(0.0273)	(0.0587)
Family Firm	0.0827	0.0144	0.0986*	0.0497***	0.0448**	0.0193
	(0.0677)	(0.0570)	(0.0563)	0.0308	0.0283	-0.00800
Observations	1,510	1,386	121	1,510	1,386	121
R-squared	0.168	0.233	0.340	0.180	0.244	0.335

Table 21. Survival analysis

Family Firm	**20%**				**70%**			
VARIABLES	(14) All firms		(15) Only family firms		(14) All firms		(15) Only family firms	
	Coefficient	Hazard Ratio	Coefficient	Hazard Ratio	Coefficient	Hazard Ratio	Coefficient	Hazard Ratio
Family firm	0.873	2.3940			-0.143	0.8669		
	(0.589)				(0.199)			
ROA	-1.042***	0.3525	-0.985***	0.3733	-0.951***	0.3864	-1.010***	0.3643
	(0.345)		(0.352)		(0.349)		(0.377)	
Tangibility	-0.667*	0.5130	-0.657*	0.5186	-0.658*	0.5179	-0.817**	0.4419
	(0.355)		(0.357)		(0.358)		(0.398)	
Leverage	0.0644	1.0664	0.0941	1.0986	0.0802	1.0835	0.233	1.2621
	(0.382)		(0.385)		(0.383)		(0.416)	
Capital Intensity	-0.0473	0.9537	-0.0421	0.9587	-0.0294	0.9709	-0.0620	0.9398
	(0.0401)		(0.0406)		(0.0416)		(0.0464)	
Size	0.0419	1.0427	0.0334	1.0339	0.0328	1.0333	0.0690	1.0714
	(0.0515)		(0.0524)		(0.0520)		(0.0606)	
Observations	2,699		2,640		2,699		2,329	

12.1.5 Robustness test – Firm size

Table 22 to 23 illustrate the robustness test for our main regressions presented in model 1-10, with alternative definitions of firm size measured as the natural logarithm of Total Assets. The definition of the variable can be found in Section 5.3.1. Each of the column in these table indicate separate regression result; each ran with their own set of control variables. For further explanation of these regressions, see section 6.1 – 6.3

Table 22. **Impact of oil price shocks and size on firm performance**

VARIABLES	(1) All industries - FE	(2) All industries - GMM	(3) Oil & Shipping industry - FE	(4) Oil & Shipping industry - GMM
Oil Price shocks	0.0211**	-0.00806	0.0222	0.0440
	(0.00868)	(0.0104)	(0.0540)	(0.0626)
Size 2	0.105***	0.198***	0.104***	0.154***
	(0.00139)	(0.00231)	(0.00980)	(0.0124)
Observations	394,563	364,468	7,082	6,616
R-squared	0.195		0.179	
Number of pcid	112,598	102,840	1,840	1,705

Table 23. The impact of oil price shocks on specific firm sizes in oil and shipping industries in the period of 2010-2015

VARIABLES	(1) Family firms - FE	(2) Family firms - GMM	(3) Non-family firms - FE	(4) Non-family firms - GMM
Shock*large	0.0306	-0.0146	0.302*	0.355
	(0.0554)	(0.0622)	(0.182)	(0.245)
Shock*medium	0.322*	0.317	-0.154	0.782*
	(0.177)	(0.211)	(0.324)	(0.405)
Shock*small	-0.0784	0.226	-0.290	-1.596**
	(0.140)	(0.167)	(0.558)	(0.773)
Size2 large	0.0988***	0.133***	0.0970***	0.125***
	(0.0107)	(0.0120)	(0.0303)	(0.0297)
Size2 medium	0.101***	0.135***	0.0886***	0.118***
	(0.0112)	(0.0122)	(0.0316)	(0.0301)
Size2 small	0.0921***	0.127***	0.0997***	0.121***
	(0.0114)	(0.0125)	(0.0319)	(0.0304)
Observations	6,433	6,076	649	540
R-squared	0.179		0.338	
Number of pcid	1,669	1,572	263	211

12.1.6 Robustness test – Leverage

Table 24 to 27show the robustness test for our main regressions presented in Tables 1-10, with alternative definitions of firm leverage measured Total Debt over Total Assets. The definition of the variable can be found in Section 8.4. Each of the column in these table indicate separate regression result, each run with their own set of control variables. For further explanation of these regressions, see section 6.1 – 6.4

Table 24. Impact of oil price shocks and size on firm performance

VARIABLES	(1) All industries - FE	(2) All industries - GMM	(3) Oil & Shipping industry - FE	(4) Oil & Shipping industry - GMM
Oil Price shocks	0.00668	-0.0243**	0.119**	0.0902
	(0.00918)	(0.0107)	(0.0528)	(0.0577)
Size	0.0812***	0.129***	0.0721***	0.0870***
	(0.00114)	(0.00175)	(0.00984)	(0.0118)
Observations	334,286	312,923	5,379	5,095
R-squared	0.208		0.186	
Number of pcid	95,393	88,718	1,425	1,341

Table 25. Impact of being a family firm on firm performance in oil price shocks in oil and shipping industries in the period of 2010-2015

VARIABLES	(5) Oil & Shipping industry - FE	(6) Oil & Shipping industry - GMM
FF*Shock	-0.330*	0.00360
	(0.175)	(0.165)
Oil price shock	0.422**	0.0900
	(0.171)	(0.160)
Family firm	0.00324	-0.0198
	(0.0207)	(0.0205)
Observations	5,379	5,095
R-squared	0.187	
Number of pcid	1,425	1,341

Table 26. The impact of oil price shocks on specific firm sizes in oil and shipping industries in the period of 2010-2015

VARIABLES	(7) Family firms - FE	(8) Family firms - GMM	(9) Non-family firms - FE	(10) Non-family firms - GMM
Shock*large	0.0664	0.0652	0.256	0.155
	(0.0546)	(0.0584)	(0.232)	(0.237)
Shock*medium	0.227	0.0662	0.259	0.284
	(0.138)	(0.178)	(0.343)	(0.333)
Shock*small	0.219	0.493	0.708	-1.085
	(0.346)	(0.424)	(1.830)	(1.058)
Size large	0.0552***	0.0559***	0.0816**	0.149***
	(0.0116)	(0.0135)	(0.0404)	(0.0434)
Size medium	0.0547***	0.0527***	0.0803**	0.146***
	(0.0121)	(0.0140)	(0.0406)	(0.0440)
Size small	0.0455***	0.0410**	0.103**	0.169***
	(0.0139)	(0.0162)	(0.0516)	(0.0508)
Observations	4,962	4,747	417	348
R-squared	0.198		0.207	
Number of pcid	1,311	1,256	181	142

Table 27. Difference-in-differences

VARIABLES	(11) All firms without leverage	(12) All firms with leverage	(13) Selected firms
After	-0.0186	-0.0155	0.0926*
	(0.0310)	(0.0263)	(0.0475)
Diff	0.0165	0.0204	-0.0804
	(0.0323)	(0.0276)	(0.0549)
Family Firm	0.0470**	0.0387**	0.0356
	(0.0201)	(0.0182)	(0.0430)
Observations	1,510	1,386	141
R-squared	0.173	0.330	0.327

Table 28. Survival Analysis

VARIABLES	(14) All firms		(15) Only Family firms	
	Coefficient	Hazard Ratio	Coefficient	Hazard Ratio
Family firm	0.380	1.4619		
	(0.261)			
ROA	-0.905**	0.4044	-0.831**	0.4355
	(0.352)		(0.361)	
Tangibility	-0.691**	0.5010	-0.713**	0.4901
	(0.311)		(0.313)	
Leverage	0.245	1.2782	0.278	1.3209
	(0.201)		(0.205)	
Capital Intensity	-0.0769*	0.9260	-0.0667	0.9355
	(0.0451)		(0.0445)	
Size	0.0671	1.0693	0.0513	1.0526
	(0.0537)		(0.0537)	
Observations	2,699		2,640	

Preliminary thesis

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-Preliminary thesis-

Firm Performance During Oil Price Shocks: Norwegian Oil & Shipping Family and Non-Family Firms

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Introduction

Despite an overall ownership dispersion tendency, at least 19 percent of listed firms worldwide are family owned (Pham, 2008), which underlines their importance as market actors and makes family firms a relevant research topic. In the literature, the family firm is defined as an entity where the founder or a member of the founder's family is a blockholder of the company (Sraer & Thesmar, 2007).

We choose to analyze how the family firm performance is affected by oil price shocks in Norway. The relevance of this research is supported by the fact that family firms are widely spread in Norway. These companies could be substantially affected by the oil price shocks, which Norway, being a large oil exporter, is prone to.

We strive to answer the following main questions: if oil prices influence family firm's performance; if these firms are more exposed to oil prices changes than non-family companies; establish if family firms outperform large corporations when oil prices change and how family firms react to oil price volatility.

The preliminary thesis is structured as follows. In the first section, we present the literature review with a focus on family firms, determinants of firm performance, oil price effects and introduce the control variables. Then we point out our research questions and the hypotheses. The third section contains the methodology that will be used in our research. The next part explains how we obtain the data and further defines the variables. Potential limitations that we encounter are discussed in the fifth section and lastly include a plan of working progress.

Motivation

Even though more than half of all Norwegian firms are family-owned, there are limited research done in this area. Furthermore, Norway is one of the world's leading oil exporter, making its economy highly dependent on the oil price volatility. In the past few years, the 2014-2015 oil price plunge was a big hit to Norway's economy and its influence is even more arguable than the global financial crisis in 2008 (Financial Times, 2017). As far as we know, how the oil price shocks affect Norwegian family firms still remains an unexplored field. Consequently, availability of data provided by the Center of Corporate Governance Research gives us an opportunity to contribute with new knowledge to this intriguing topic.

1. Literature review

1.1. Family Firms

According to La Porta et al. (1999), family firms are widespread on a worldwide basis. There is evidence that this organizational form is the dominant type of business in Norway with around 2/3 of all Norwegian AS and ASA firms being family-owned (Berzins and Bøhren, 2013). Consequently, family firms in Norway have become an intriguing topic to study. Currently, there is still no clear definition of family-held companies (Astrachan, Klein, & Smyrnios, 2002). We follow Bøhren (2011) and define the family firm as the firm where the family holds a block of more than 50% of the shares. Here we would also like to point out the features that distinguish family firms from non-family firms.

In family firms, board of directors and management are closely related (Bøhren, 2011). Thus, the first agency problem between managers and shareholders can be alleviated as a result of higher monitoring incentives or having a family CEO. If the family owns the majority of shares in the company, it has greater incentives to monitor the management. Having a family member serve as a CEO provides family with an active control over firm's daily activities. However, the firm may exclude the opportunity to have a CEO from outside of the family who can offer better skills, talents and qualifications for the company.

However, the agency problem between majority and minority shareholders can arise if the family as the largest shareholder have high incentives to exploit minority investors (Villalonga and Amit, 2006). On the other hand, according to Berzins and Bøhren (2013) benefits from possible future investments from the minority shareholders and long-term goals may reduce the incentive to exploit minority shareholder, making the second agency problem less severe.

Family-owned firms are also said to face higher unsystematic risk. The higher family ownership concentration is, the less diversified the owners are. By investing all their wealth and human capital into the firm, family owners become undiversified (Bøhren, 2011). According to Berzins and Bøhren (2013), low debt, diversified production and flexible cost structure are strategic tools to reduce risk for family firms. Also, because family owners are often so close to daily operations, they respond faster

to negative signals and take action faster and with greater force than in companies with fragmented ownership (Berzins and Bøhren, 2013)

Family-held firms might face both constraints and advantages while getting financing in terms of access and price of capital. Because family have incentives to sustain their controlling position in the firms, they tend to be reluctant to issue stocks to outside investors as it could threaten their control, hence restricted their access to new equity (Berzins and Bøhren, 2013). Another source of capital for operation is to retain earnings or invest more of the family's wealth. This capital constraint limits the possibility of growth and can be an explanation why family businesses are often smaller. Moreover, the cost of debt is higher for firms with a wider divergence between the largest ultimate owner's control rights and cash-flow rights, and this effect is particularly strong among family-owned firms (Lin et al., 2011). On the other hand, as family owners are viewed as having a longer investment horizon and being undiversified, it implies that the owners have greater interest in the survival of the company, thus manage its resources, investments and operations more efficiently. This is also consistent with the interest of debt holders, hence, decrease the cost of debt by around 30-40 bp. (Sraer & Thersmar, 2007).

Overall, the specific features of family firms could affect their behavior during shocks. Family firms might perform better during and after the oil price shocks due to their ability to react quicker to the changing environment as they have better connection to daily operations and faster decision-making process. They can also benefit by having lower cost of debt in case of additional financing needed. On the other hand, family firms could be constrained in times of oil crisis because of lower diversification, reluctance to change the ownership structure for additional capital and lack of industry specific knowledge or information as opposed to professional managers or bigger companies.

1.2. Firm performance

There are various measurements for firm performance, such as Return on Equity, Return on Assets. In this paper, ROA will be used as the main measurement for the performance of family-held firms.

ROA indicates profitability of the business, which has been widely used as accountancy measurement in many previous studies (e.g. Ang, Cole, & Lin, 2000; Alfaraih, Alanezi, & Almujamed, 2012). ROA is calculated by dividing the net income of the business by its average total assets. A higher ROA means that the assets have been invested efficiently by the firms. Bradshaw & Brooks (1996) emphasize that ROAs ratios of 5% or higher are considered as good, but there are still exceptions, depending on the type of the industry, thus to be able to compare ROA across companies, industry effects have to be taken into account.

1.3. Determinants of firm performance

In order to separate an oil price shock effect on a firm's performance, we first establish and control for the main factors, which could explain profitability.

Ownership

Ownership is the unique feature of a family firm, thus requires special attention. According to Andersen and Reeb (2003), the relationship between the percentage of family ownership and firm performance follows a concave function. Firm's profitability increases when family ownership is about one-third of the firm's outstanding shares. Family ownership is also claimed to have a positive influence on the long-term outlook by Fama and Jensen (1983). Moreover, the close connection between families and firms lead to a higher profitability and performance (Zellweger et al., 2012). Nevertheless, Lee (2006) pointed out that the effect of family ownership is not always positive, as conflicts between members can create a negative impact on firm's profitability.

Management

Family firm management can be categorized into two types, which are family management and professional management. As mentioned above, the behavior of the CEO has a direct effect on the performance of the firm. Filatotchev et al. (2005) argue that the relationship between family member being the CEO and firm profitability is negative, as family is tempted to extract private benefit for themselves at the expense

of minority shareholders. In contrast, Sraer and Thesmar (2007) pointed out that descendant-run firms can manage their labor force more efficiently by paying significantly lower wages and providing insurance across the business cycle to workers as a compensation. Only managers from the family has the credibility necessary to sustain such implicit reputational contracts with workers.

Size

Family-owned firms tend to be smaller than others type of business as the financial constraint limits the opportunity of growth (Berzins and Bøhren, 2013). This can be a drawback for family firms due to the loss of diversification, economy of scale and market power. At the same time, small size can also be an advantage as it is easier for the manager to monitor the capital and human resources.

Flamini et al (2009) argue that large corporations have more opportunities to compete with smaller firms in utilizing economic resources and transactions. On the other hand, Li (2007) argues that in exceptionally large firms, firm size has a negative effect on operating performance due to bureaucracy. The need for management and employees to maximize return increases along with the growth of firm business, thus increases agency costs.

Tangibility

Tangible assets include fixed assets such as machinery, factory, buildings and land and current assets such as inventory. It can be used as collateral and considered as protection for lenders against information asymmetry, which alleviates the agency problem between shareholders and creditors. (Jensen and Meckling, 1976). As a result, tangibility has a direct positive influence on financial leverage. Earlier research papers claim that there is a negative relationship between a firm's profitability and tangibility (Rajan and Zingales,1995). Firms with safe tangible assets tend to use more debt financing than firms with risky, intangible assets. Tangible assets are used by firms to secure their long-term debt at a much lower interest rates than intangible assets (Bradley et al., 1984).

Leverage

Financing decision can influence shareholders' benefits, risk and market value of the firm. Firms use leverage when the need for capital is high while owners' capital is not enough to finance the projects, and the firm believes that the rate of return would be higher than the rate of interest. As a result, leverage provides managers more information to monitor firm's debt and owner's capital efficiently. However, manager should be cautious as leverage is also associated with increased probability of bankruptcy and financial distress (Robb and Robinson, 2012).

Berger and Bonaccorsi di Patti (2006) claim that leverage has a positive effect on operation performance, while Gleason et al. (2000), Simerly and Li (2000) argue that the relationship between leverage and firm performance is negative. According to the trade-off theory, the optimal debt financing level would balance benefits and costs and this relationship tends to be U-shaped (Gu, 1993). The higher the debt level is, the lower corporate tax firms have to pay, but at the same time default risk increases.

Firm's age

Older firms tend to have better firm performance than smaller ones. After many years working in the industry, they will gain more experiences in developing strategies and management, easier access to capital, advantages in product orientation and customer network. Nevertheless, if a newly-established firm can locate the exact market for substitute goods, it can bring the same success or even a significant breakthrough to the firm.

Earlier research papers claim that firm's age and performance have a causal relationship. Loderer, Waelchli (2010) state that firm profitability reduces with age. Furthermore, Sørensen and Stuart (2000) point out that longer operating time can cause the employees' entrenchment in their routine and refrain from change, which lead to a negative relationship between firm's age and profitability.

Oil price effects

There has been an emphasis on incorporating oil price volatility and shocks as a determinant of macroeconomic indicators and stock prices in numerous researches.

The recent papers prove that oil price shocks are not only relevant for oil industry and oil exporting countries, but also introduce a background for estimating the influence of oil prices on firm performance in different industries.

Sadorsky's (1999) paper emphasizes a considerable negative relationship between oil price shocks and real stock returns for the US economy and a negative effect on interest rates and industrial production. Park's and Ratti's (2008) work further proves negative and mostly asymmetric effect of oil price shocks on stock price volatility in European countries and the US. On the contrary, they find that for Norway, the major oil exporter, there is a significant positive response to the shock.

A common characteristic for these studies is that they mainly focus on aggregate markets, making their analysis take a macro perspective. As we attempt to establish a relationship of oil price shocks and firm's performance, we will take a closer look at the microeconomic level.

Sadorsky's (2008) research assesses the impact of oil prices on firms of different sizes, and proves that medium sized firms suffer the most from the oil price shocks. This could prove to also be beneficial for family firms, as they tend to be smaller. Narayan and Sharma (2011) once again document strong connection between oil prices and firm returns concluding that oil prices affect returns of firms differently depending on their size, industry and regimes.

Poghosyan's and Hesse's (2009) work addresses bank profitability in connection to oil prices through introducing a two-step approach to estimating the way oil prices affect profitability. The research concludes that oil prices affect bank profitability indirectly through macroeconomic indicators, while direct impact is insignificant. While the results don't show the significance of oil price shocks for the bank performance the methodology used can be further addressed in our research.

Being a large oil exporter with a major part of the economy tied to oil production, companies in Norway might be especially affected by the oil price shocks. Oil had been a windfall that tremendously pushed Norwegian living standard far above. (Financial Times, 2015). When the windfall ended in 2013, Norwegian economy has become incredibly unbalanced and economic growth has slowed dramatically (BBC news, 2016)

Macroeconomic variables

Since market participants are all influenced by economic environment, macroeconomics variables will be included in our research. Oxelheim (2013) indicated that interest rate, inflation, exchange rate and political risk premium are essential macroeconomic factors that should be considered in analysing the competitiveness of the company. Also, it can be found that firm performance is a function of the prior year ROA, and macroeconomic variables (McNamara & Dunkan, 1995).

2. Research Question

Our research topic is "How oil market shocks influence Norwegian Oil and Shipping family firms' performance". In general, we will try to answer the following questions:

1. Does oil price influence family firm's performance directly or indirectly through macroeconomic changes?
2. Are family owned firms more exposed to oil prices changes than non-family companies?
3. Do family firms outperform large corporations when oil prices change?
4. How do family firms react to oil price volatility and what actions they take to minimize the harmful effect?

Following the research methodology from Poghosyan and Hesse, we base our research on the following hypotheses:

(1) Impact of oil price

$H1_0$: Impact of oil price shocks is significant on firm performance.

$H1_A$: Impact of oil price shocks is insignificant on firm performance.

(2) Impact of oil price adding macroeconomics variable

$H2_0$: Oil price shocks have direct impact on firm performance

$H2_A$: Oil price shocks have indirect impact on firm performance via macro variables.

(3) Firm ownership

$H3_0$: Family owned firms more exposed to oil prices changes than non-family firm.

$H3_A$: Family owned firms less exposed to oil prices changes than non-family firm

3. Methodology

As we mention before, family firm performance is poorly researched in literature due to the lack of data and information, so we base our main hypothesis and methodology on different literature regarding both family firms and oil price effect on firm's performance.

To answer the main research questions and hypothesis 1 and 2 we will follow the methodology outlined by Poghosyan and Hesse (2009) in their work on bank profitability and oil prices.

In our case the model can be summarized in the following manner:

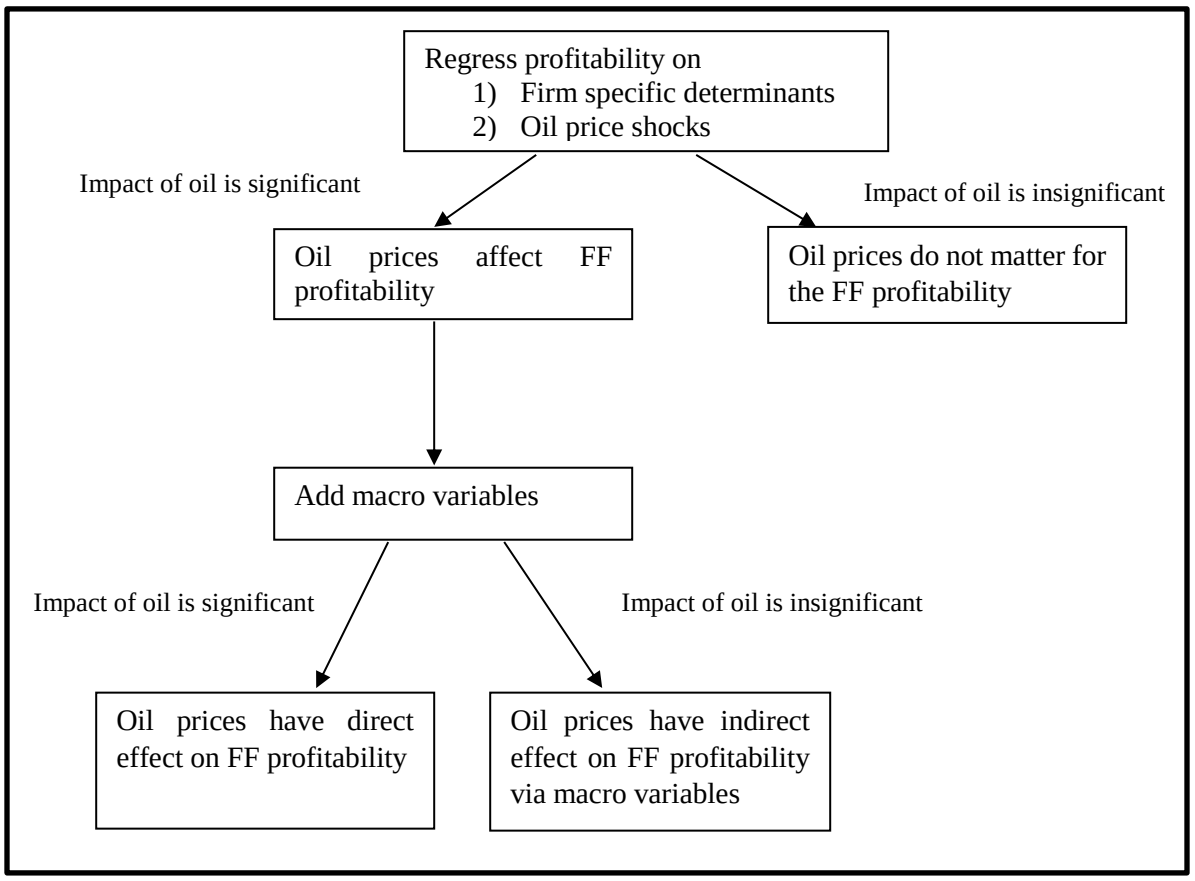

Figure.1 Model summary (based on Poghosyan and Hesse (2009))

This approach allows us to see if family firm performance is affected by oil price shocks and further distinguish the impact of changes in macroeconomic indicators and in oil prices.

Following the reviewed literature, we use the next performance determinants: size, age, leverage, tangibility, management, ownership. As macroeconomic indicators we use inflation, GDP growth, interest rate and exchange rate and we also add the geographic factor pointing at specific areas in Norway as we expect them to be facing different development. Oil price shock is determined using three different approaches, as pointed out by Poghosyan and Hesse further discussed in the data part (2009).

The main estimation method used is the system GMM, as it is also robust to omitted variable bias, which could help us deal with an endogeneity problem. This technique, as pointed out by Poghosyan and Hesse (2009), is superior to the simple GMM with first-differenced equations with suitable lagged levels as instruments. The system GMM augments the simple GMM by adding equations in levels with suitable lagged first-differences as instruments. We believe that this technique could be beneficial for our research, where our explanatory variables might be highly persistent, thus their lagged level might be weak approximation to the first-differenced equations, so adding first-differenced instruments and equation in levels might produce more reliable results.

To check the third hypothesis, we will re-run the regression for all limited liability firms adding ownership variable an interaction term between ownership and oil price shock, which will give us an indication if an oil price shock effect on performance for family firms as compared to non-family firms.

We also would like to support our findings by empirical evidence of individual family firm's performance during the oil price shocks by reviewing various news articles and interviewing company representatives. These could be helpful in determining potential financial constraints faced by family firms as well as financial opportunities due to close relations with debt holders and thus flexible capital structure during the oil price changes (Sraer & Thersmar, 2007). This will also support our conclusion on the third hypothesis.

4. Data collection and description

We have already extracted the necessary data for our thesis from the Centre for Corporate Governance Research (CCGR). We get access to it through our supervisor, Bogdan Stacescu. It provides relevant data on limited liabilities companies registered

in Norway. CCGR consists of accounting data from 1994 until 2015, which is essential in conducting our research (CCGR website). We will use the data from 2000 - 2015 in the study. We also gathered necessary information on the spot prices of Brent oil for the last 16 years and macroeconomics variables using database from Bloomberg terminal. This data will play an important part in measuring the oil price shocks.

Data description

Our main variables of interest are defined as followed (Appendix 1 ties the following formulas with our actual data items):

$$ROA = \frac{Net\ Income + Interest\ Expense}{Total\ fixed\ assets + Total\ current\ assets}$$

$$Size = \ln(Total\ fixed\ assets + Total\ current\ assets)$$

$$Age = \ln(Age)$$

$$Leverage = \frac{Long - term\ debt + Short - term\ debt}{Total\ fixed\ assets + Total\ current\ assets}$$

$$Tangibility = \frac{Tangible\ Asset}{Total\ fixed\ assets + Total\ current\ assets}$$

$$Management = \begin{cases} 1\ if\ the\ CEO\ is\ family\ CEO \\ 0\ otherwise \end{cases}$$

$$Ownership = \begin{cases} 1\ if\ the\ firm\ is\ family\ firm \\ 0\ otherwise \end{cases}$$

Oil price shocks are calculated in three different ways presented by Poghosyan and Hesse (2009). Firstly, average annual growth rate is estimated using the arithmetic mean of daily 12-month growth rate of spot prices. This simple approach shows the development of oil prices over the year.

1) **Average annual growth**

$$CH = \frac{\sum_{t=1}^{365}\left[log\left(p_{t,j}\right) - log\left(p_{t-1,j}\right)\right] * 100}{365}$$

However, it does not show if these changes are aligned with market fundamentals. Thus, the second approach strives to measure how much the realized prices differ from their expected values, using 12-month forward rate.

2) Deviation of oil prices from their expected value

$$F = \frac{\sum_{t=1}^{365}\left[log\left(p_{t,j}\right) - log\left(p_{t-1,j}^{f}\right)\right] * 100}{365}$$

Finally, we use the measure suggested by Hamilton (2003) to measure the net oil price increase by estimating the amount by which the price exceeds its maximum value throughout the year. Even though the price development is not exogenous to macroeconomic indicators, this estimate shows the non-linear transformation of prices which is exogenous.

3) Net oil price increase

$$HM = \frac{\sum_{t=1}^{365} \max[0, p_{t,j} - \max[p_{t-1,j}]}{365}$$

We chose not to incorporate oil price shock measure estimated using Hodrick-Prescott filter (Poghosyan and Hesse, 2009) since some researchers suggest this measure is not reliable and we do not want to overload our models (Hamilton, 2017).

Macroeconomic variables are collected using Bloomberg terminal, where inflation is represented by the CPI index, GDP growth is the year to year GDP increase in real prices. We will further do more research and decide how to define and obtain the data for interest rate and exchange rates

5. Limitations

As we are in the process of designing our research we can already point out potential limitations involved in discussing the chosen topic.

Firstly, we recognize the lack of previous research done on family firms due to the shortage of data. The theory on family firms does not give an exact definition of a family firm itself. Hence, we have to make our own cut off point for a family's stake in a business. A different ownership threshold could affect the results.

Secondly, the endogeneity concern which is common for any corporate governance research is present. To avoid omitting a relevant variable, we have studied the theory available to include all performance determinants. We have also chosen a methodology that could potentially mitigate the omitted variable bias. Furthermore, there is an opinion that the family ownership is preserved only under a good performance, which might point to the reverse causality issue. Finally, the last concern regarding endogeneity is measurement error. As argued by some researchers, family firms tend to have less assets, leading to higher returns on assets. However, we believe that by studying companies within specific industries we can avoid the measurement error, as companies in one industry would be comparable in terms of assets and returns. Moreover, we adjust the net income for the interest expense to have a ROA created by the operating activities only.

6. Progress

To this day we have worked somewhat on gathering preliminary data from various sources and working on literature review. We have had meeting with our supervisor to further shape our methodology direction. Thanks to the extensive help from our supervisor we managed to get the data and formulate our main methodology. We are now planning to work according to the following plan

Week	1	3	4	5 -13	14-19	20	21-24	25	26-34	35
Research										
Deliver Preliminary										
Feedback										
Model regression										
Findings description										
Deliver 1st draft										
Feedback & Revision										
Deliver 2nd draft										
Finalize thesis										
Deliver thesis										

Research and model regression	We will use approximately two months to do more background research (if necessary) and start to filter the data and running regression

Deliver Preliminary	The deadline for preliminary thesis submission is February 15th
Feedback	We expect to receive feedback from our supervisor on our Preliminary thesis one week after the date of submission.
Findings description	After we finalize our models, we will start describing the result and carry more sensitivity analysis, robustness if necessary.
Delivery 1st draft	We expect to deliver our first draft to our supervisor by mid May.
Feedback and revision	We will make improvements to our thesis after receiving his feedback
Delivery 2nd draft	We hope to be able to delivery the second draft to our supervisor by mid June.
Finalize thesis	After receiving feedback for the second draft, we will make final adjustments and revision.
Delivery Thesis	The thesis will be submitted before the submission date of September 1st

Reference

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Appendix

Appendix 1. List of variables

Theoretical Variables	**Proxy**	**CCGR term**
Dependent variables		
ROA	(Net income+interest expense) /Total Assets	(item_39+item_30)/(item_63+item_78)
Independent variables		
Family firm	Family firm dummy	item_15311>50%
Family CEO	Family CEO dummy	item_15304
Family ownership percentage	Ultimate family ownership percentage	item_15311
Firm Age	Natural logarithm of firm age	item_13420
Firm Size	Natural logarithm of firm's assets	item_63+item_78
Tangibility	Tangible assets/total assets	item_51/(item_63+item_78)
Leverage	Debt/Assets	(item_94+item_101)/(item_63+item_78)
Oil Prices		Bloomberg

Appendix 2. Item extracted from CCGR

	Item number in CCGR	**Variable name in CCGR**	**Proxy**
1	item_9	Revenue	Revenue
2	Item_39	Net Income	Net income
3	Item_51	Total fixed assets (tangible)	Tangible assets
4	Item _63	Total fixed assets	Total fixed Assets
5	Item_78	Total current assets	Total current Assets
6	Item_87	Total Equity	Total Equity
7	Item_94	Liabilities to financial institutions	Long term debt
8	Item_101	Liabilities to financial institutions (short-term)	Short-term debt
9	Item_15304	Largest family has CEO	Family CEO
10	Item_15311	Ultimate Ownership held by families	Family Ownership
11	Item_50109	Number of employees	Number of employees
12	Item_30	Interest Expense	
13	Item_504	Firm Address	
14	Item_11102	Industry code	
15	Item_76	Cash holdings	
16	Item_13420	Firm’s age	
17	item _ 105	Dividends	
18	Item_93	Bond	
19	item_14507		