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Firm Resilience During Oil Price shocks:
Norwegian Family and Non-Family Firms

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Abstract

We study resilience in Norwegian limited liability companies highly affected by the oil price shock in 2014. We analyze whether family firms are more resilient than non-family firms in terms of profitability, financial vulnerability, and investment decisions following the oil price shock in 2014. We found that family and non-family firms perform significantly different during the event window between 2014 and 2016. Our findings suggest a family firm premium of 1.5pp for ROA and 69pp for TIE, respectively. We further found that family firms are less affected by the shock than non-family firms in terms of change in profitability and financial vulnerability in the period *after* the shock. Our Difference-In-Difference regressions show that family firms have a positive and significant average treatment effect, suggesting better resilience.

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1. Introduction

Family firms are financially dominating globally. According to Zellweger (2017) family businesses contribute between 40-70% of the annual global GDP. In Europe, about 60% of all companies are family enterprises, making it the most common form of organization (Franks et al., 2008; Mehrotra et al., 2013, Botero et al., 2015). Family firms can survive and thrive for a long time, and suggestively they prevail longer than any other form of ownership worldwide (Villalonga & Amit, 2006, 2010).

Villalonga and Amit (2020) suggest unique characteristics and decisions as an explanation to the persistence and prevalence of family firms throughout the history. Bertrand and Scholar (2006) suggest that some of these characteristics make them more resilient than other firms. Some traits such as long-term orientation (Barach & Ganitsky, 1995), intent of succession (Lins, et al.,2013) and family CEO may impact their strategic decisions in times of uncertainty. Due to these traits, their decisions to invest in less risky projects (Zhou et al, 2017) and a presence of lower debt levels may benefit them during financial disruptions by increasing their resilience. In the face of an exogenous shock, companies and organizations are tested for their resilience. Our definition of resilience in its simplest form is the company's ability to cope and quickly recover from an exogenous shock, such as a financial one, that can threaten the survival and existence of the company itself (Salignac et al.,2019).

During unexpected liquidity shocks family firms are forced out of equilibrium enlarging the costs and benefits of family ownership and control (Lins et al (2019). Key characteristics such as undiversified wealth and desire for family control and succession may cause family firms to be more long-term oriented and overall, financially healthier than non-family firms making them less affected by financial uncertainties or unexpected exogenous shocks. On the flipside, the same characteristics may impose limitations on family firms such as growth impediment due to their unwillingness to invest during financially uncertain times at the expense of minority shareholders. The net cost-benefit effect of family ownership during economic turndowns remains unanswered as scholars find contradicting results (Amann & Jaussau, 2012, Bianco et al., 2012, Zhou et al,, 2017, Lins et al., 2019).

In this thesis, we investigate the resilience of Norwegian family firms compared to non-family firms during and after the oil price shock of 2014.

Similarly, to research done by Aman and Jaussaud (2012) and Ntoung et al (2019), our analysis provides insights on profitability, financial vulnerability, and investments in a context of a shock. Using a difference in difference methodology, we explore the change in Return on Assets (ROA), Times Interest Earned (TIE) and Reinvestment Rate (RR) between years 2011 and 2019. We will investigate the effects before and after the shock and examine the differences in resilience between family and non-family businesses. The effect of family ownership and control are also analyzed in the face of two different definitions of family firms: 1) majority ownership within the family, and 2) majority ownership and a family CEO.

As Norwegian oil export amounts to 60% of Norwegian export goods (SSB, 2021), it is especially interesting to capture the effect of an oil price shock in this region. Our sample mainly consists of oil, shipping, and other related industries, in addition to a selection of indirectly affected companies in the most affected geographical areas in Norway.

Our findings suggest that 3 to 4 years following the shock, family firms outperform non-family firm in terms of profitability by 1,5 pp. These findings are robust for different profitability measures, different control variables and thresholds of family ownership and control. Our initially suggested explanations for such findings are minimized agency costs, efficient cost cutting strategies and reduced information asymmetry between owners and managers with a family CEO. We find that after the shock, the change in times interest earned is significantly different for family firms meaning that family firms on average recover faster than non-family firms. Our findings correspond with statements by Lins et al, (2013) that the costs and benefits of family firms are enlarged during economic crisis.

This paper is structured as follows: section two presents academic and empirical literature review on family firms, the definition and potential measures for resilience. In section three, we present our hypotheses. In section four, the data selection process and variables are presented. In section five, the Difference-In-Difference methodology is described as well as assumptions that must hold for valid and robust models are presented. Section six and seven present our main findings, robustness checks, discussion, and conclusions respectively.

1.1 Motivation and contribution

Although research on family companies and financial performance has increased extensively over the past decades, a lot is conducted on publicly listed

firms. The access to rich microdata from the Centre for Corporate Governance research allows us to investigate private family firms, and acquiring such data is generally challenging. Further, nearly two thirds of all companies in Norway are considered family firms (Berzins et al., 2018). Therefore, in the context of a Norwegian market, insights on family firms are highly relevant.

We currently observe the importance of a company's ability to remain financially healthy and resilient to outside events as the uncertainty about the recession is growing. We believe our research provides insights to business owners, investors and employees that promote a sustainable and long-term business orientation. Our study on the relationship between family firm characteristics and the resilience during and after an economic turndown is once again becoming relevant in the face of Covid, Rus-Ukrainian War, rising inflation, and financial instability.

1.2 Background

1.2.1 The oil shock of 2014

Between the mid-2014 and early-2016, the oil price per barrel dropped by around 70%, becoming one of the largest declines since World War II (World Bank, 2018). After peaking to 107,95$ per barrel in June 2014, the oil price plunged to 44,1$ per barrel in January 2015, representing a 59% decline in mere 7 months. The unanticipated change in the oil price is referred to as an oil price shock (Baumeister & Killian, 2016). As seen in Figure 1, the oil price did not start to recover until early 2016. In this thesis, we therefore, assign the period 2014 to 2016 as the event window as the companies in our sample do not exhibit any signs of recovery until after this time. This is further confirmed with our sample in the visual analysis of figure 2, 3 and 4.

Figure 1: *Brent Crude oil price in the period 2010-2019*

Belu Mănescu and Nuño (2015) argue that the collapse in the oil price was mainly due to unexpected supply shocks. The shale oil production in the US increased by 200% between 2010 and 2013 because of favorable financing conditions after the financial crisis in 2008-2009, efficiency gains and considerably lower production costs (Baumeister & Killian, 2016). The increased supply of oil contributed to a decrease in the oil price in June 2014.

Following the pattern of the oil price, most analysts expected the Organization for Exporting Countries (OPEC) to cut production to compensate for high oil supply globally. However, in November 2014, they decided to vote against the proposal, arguably in attempt to fight the growing suppliers of shale oil in the US. Their decision arguably contributed to a further decrease of the oil price (Khan et al, 2017).

1.2.2 The 2014 oil price shock impact on Norwegian companies

Due to the nature of investments in the oil sector with capital-intensive projects and large pre-committed capital expenditure, oil companies are highly dependent on oil prices. When uncertainty about future production costs and sales prices rose in 2014, overall investments were reduced, delayed, or halted (Kilian, 2014). This pushed Norwegian oil companies to shut down exploration and drilling activities first, which led to an increased unemployment rate in the affected industries. The price fall caused a general reduction in Norwegian oil companies' investments, alongside the resignation of 25,000 employees within the sector.

(SSB, 2017). Sadorsky (1999) identify an adverse effect of the oil shock on interest rates and industrial production, highlighting an overall unfavorable reaction of firm performance to oil price changes.

As Norwegian oil export amounts to more than half of total Norwegian export goods, it is fascinating to investigate the effects of the oil price shock in Norway. The shock did not only have an impact on oil companies directly but on the entire Norwegian economy.

2. Literature review

In this section, we review previous literature on family firms and how their unique characteristics relate to resilience during financial disruptions. Further, we present empirical studies on the measures of resilience used in our analysis.

2.1 Family firms

2.1.1 Defining family firms

Family enterprises are among the most important sources of wealth and employment worldwide. They range from tiny businesses that serve their immediate surroundings to massive corporations that operate across many industries and nations (Ramadani & Hoy, 2015). As a result, defining a family business is difficult because its primary component represents the family and business systems (Chua et al., 1999). Usually, definitions include criteria such as ownership, management, directorship, self-identification, multiple generations, and intra-family succession intention (Habbershon et al., 2001, Ramadani & Hoy, 2015). Villalonga and Amit (2006, 2014) emphasize the importance of distinguishing between family ownership, control, and management when assessing financial performance, as their studies yielded positive, negative, and inconclusive results depending on the definition.

The definition of a family firm by Berzins, J., Bøhren, Ø., & Stacescu, B. (2018) stresses the importance of ownership and close family relationships. The authors define a *family firm* as a majority-owned firm by individuals related by blood or marriage, which underlies the uniqueness of the family-run business. This is especially relevant in the case for privately listed firms. Alike Berzins, Bøhren and Stacescu, we base majority ownership, and family CEO position in excess of majority ownership as the two definitions of a family firm.

2.1.2 The uniqueness of family firms

Family firms are unique as the controlling shareholders are tightly related (Berzins et al, 2018). They are often highly engaged in business operations, showing a high sense of ownership and commitment to the organization (Sieger et al, 2011, Mahto et al, 2020). Due to the close relationship between the family firm members and the firm itself, characteristics about the family may also impact characteristics and behavior of the firm (Berzins et al, 2018). The benefits and costs associated with these characteristics may better explain family firm resilience during financial shocks.

Family ownership can provide competitive advantages as most owners are closely tied together. They have incentives to minimize agency conflicts and thereby maximize firm value, as noted by Demsetz and Lehn (1985). As the family's wealth is often less diversified and closely related to the value of the family firm, they have higher incentives to monitor managers.

In Norway, family members hold the CEO position in 72% of family firms. This arguably benefits the firm for several reasons, but most importantly it reduces information asymmetry (Berzins et al. 2018). Having the family represented both on the board and CEO chair, owners will be well informed about the firm's future performance and difficulties earlier than in a traditional firm. (Berzins et al., 2018). Secondly, the traditional agency problem arising from the separation of ownership and control (Berle & Means, 1932) is minimized. The two agency conflicts described by Shleifer and Vishny (1997) concerns conflicts of interest between the firm's owners and insiders, and majority and minority shareholders respectively. For family firms with a family CEO their interests are more aligned, which alleviates the first agency problem (Bøhren, 2011). However, agency conflict number two, involving majority and minority shareholders, may be more apparent in family firms. The problem occurs when the family, as a significant investor, starts exploiting the minority shareholders (Maher & Andersson, 2000) to maintain control and extract private benefits from the firm.

It is not uncommon for family firms to be highly invested in the family firms, and therefore hold undiversified portfolios. Also, family members seek to pass the firm to their heirs. According to Anderson R.C., Mansi S.A & Reeb D.M. (2003), family firm owners regard their firms as potential inheritance to their descendants, rather than their consumable wealth. The intent of succession causes

the family firm to engage in more straightforward initiatives and strive for lower debt levels due to risk aversion. This is because a higher debt level may raise the likelihood and cost of financial distress (Hiebl. MR, 2012, González-Bravo & Mecaj, 2011). Ntoung et al. (2019) argue that family firms use less debt financing and, as such, maintain more financially healthy operations than non-family firms. A higher coverage ratio is favorable for family firms because the company presents less risk to creditors in terms of solvency. However, A. T. Kearney (2021a) argues that family promotion and low debt levels debt may undermine the performance of family businesses. The benefits and disadvantages of this behavior gives further insight to the resilience in family firms.

2.2 Resilience in family firms

Resilience is defined as the capacity to cope and quickly recover from a financial shock (Salignac et al, 2019). It generally speaks to a firm's ability to execute beneficial and transformative actions when confronted with unexpected events (Lengnick-Hall & Beck, 2009). Hence, the degree of resilience relates to the impact and recovery from the shock rather than survival.

Viallalonga and Amit (2020) explain that the persistence and prevalence of family ownership are caused by competitive advantages and private benefits of control. As noted by Lins et al (2019), family firms are pushed out of equilibrium during financial crisis which magnifies both the benefits and costs of family ownership and control. Characteristics such as risk aversion, intent of succession, long term horizons, the presence and minimization of agency conflicts and undiversified wealth of the family may have an impact on financial performance, vulnerability, and investment decisions in financial disruptions.

2.2.1 Financial performance

The relationship between family firms and profitability has been researched extensively (Villalonga & Amit, 2006, 2010, Arrondo-García et al., 2016, Berzins et al., 2022). For the purpose of this study, we focus on the family characteristics and behavior that relates to resilience, rather than superior performance in general although several explanations overlap.

During financial uncertainty, fast decision making is essential to cope with and adapt to changes in the market. Family firms are especially equipped to facilitate quick processes due to centralized decision making and the close

relationship between owners and managers. This, in turn, may lead to better performance during challenging conditions.

Cucculelli and Marchionne (2009) found that family firms in Europe between 1995 and 2004 demonstrate higher profitability, have a lower growth but are less sensitive to industry shocks. Similarly, Villalonga and Amit (2010) found that family firms are less sensitive in terms of profits to both positive and negative industry profit shocks. The reduced agency costs and reduced information asymmetry are interpreted as a sign of greater resilience and a sort of competitive advantage that family firms hold. However, family firms tend to "prop up" firms that are underperforming (Friedman et al., 2003) which paints a picture of a more stable profitability stream than reality would otherwise suggest.

Bach (2010) finds that French family firms have less volatile sales during economic disruptions and suggests that the less risky projects initiated by the family firms offer stability under unstable conditions.

The benefits of the characteristics of family-controlled firms such as centralized decision making, reduced agency costs and risk aversion may increase resilience. However, the costs associated with the desire for family control may only cause an appearance of resilience, which ultimately is more of a bailout situation.

2.2.2 Financial vulnerability

The undiversified wealth of family firm owners that leads to risk aversion may have an impact on family firm's decisions enhancing resilience during economic turndown. Škare M. et al. (2021) found evidence that family firms are less vulnerable than non-family firms during financial booms and busts. The researcher argues that, although family firms are as vulnerable to financial cycle shocks as non-family firms, their adaptability and resilience makes them more resilient to adverse shocks. Moreover, Amann & Jaussaud (2012) argue that in an economic downturn, family firms "face down reality" and make better financial decisions than highly levered companies. Therefore, robust capital structure with lower debt levels can signal better resilience. Although a low level of debt may indicate a poorly managed firm with excess cash and low efficiency, this is evidently a trait of resilience as it helps firms recover quicker from financial disruptions. The advantage of a reduced risk profile materializes in adverse

conditions. Lastly, a family firm's long-term horizon suggestively has an impact on financing conditions, which can decrease the cost of debt by 0,3 to 0,4 pp. (Sraer & Thersmar, 2007). During an economic turndown this offers a higher financial flexibility for debt financing.

2.2.3 Investment decisions

The family firm characteristics may cause two opposite investment strategies during an economic turndown: on one side, family firms may reinvest more to maintain a "portfolio of bets", so that the economic turndown does not jeopardize the company´s long term growth prospects. Research from Japan suggested that family businesses invested more than non-family companies during an economic crisis (Amann & Jaussaud, 2012), suggesting a higher willingness to look beyond the crisis and invest for the long-term.

On the other hand, studies on family firms in the US and Europe imply that family firms invested less than non-family firms during the financial crisis of 2008 (Zhou et al.,2017). Furthermore, Bianco et al (2012) finds a higher investment sensitivity for Italian family firms during uncertainty in the market and suggests this is due to characteristics such as risk aversion and undiversified wealth. Compared to more diversified investors, they decline risky projects that can potentially yield higher profitability in the future due to risk aversion. With the concern of preserving family control, they may have a bias towards the survival of the company under their control which can lead to lower investments during an economic turndown (Bertrand et al, 2008, Lins et al, 2019). Although some scholars suggest that family firms underinvest during shocks to avoid overinvestment to boost short term earnings (Zhou et al, 2017), the evidence after a financial disruption may suggest otherwise.

Lins et al (2019) finds that publicly traded family firms who underinvested during the financial crisis of 2008, financially underperformed non-family firms in the years following. Thus, the investment decisions of a firm during a financial disruption may not only impact firm performance in the short term. Further, they find that if one family subsidiary is highly affected by the crisis, the other well-performing entities reduce their investment levels. This confirms the argument that the family group provides financial support to the underperforming subsidiaries.

3 Hypotheses

The predictions below are based on existing literature on family firm characteristics and behavior during financial disruptions and how they relate to firm resilience. We divide our hypotheses into two parts (A and B) to answer dimensions of resilience, namely the ability to cope (during) and recover (after) from a financial shock.

Like previous studies from Bach (2010) we expect family firms to have a lower sales volatility during financial disruptions. As family firms are better equipped to make fast decisions, they should use this advantage to be in a position with decreased impact of the oil price shock. Therefore, we also expect to see that family firms with the CEO position outperform non-family firms especially. Followingly, we expect family firms to be less affected due to their risk aversion and less risky investments. Although the oil price shock likely has an impact on operating revenues, we expect the impact to be smaller for family firms than non-family firms.

Hypothesis 1: Family firms are less affected by the oil price shock than non-family firms in terms of profitability.

H1A: ***During*** *the event window, family firms are less affected than non-family firms in terms of changes in profitability.*

H1B: ***After*** *the event window, family firms outperform non-family firms in terms of changes in profitability.*

Following the assumption of less volatile profitability for family firms, we expect to see a smaller impact on family firms´ interest coverage ratio. Family firms' risk aversion and unique management style leaves the family firm less financially vulnerable. This is a direct result of a lower leverage level, which is a common trait in a family firm due to their long-term vision. Additionally, we expect to see a less impacted times interest earned for family firms due to family firm´s desire to keep family empires. Their "prop up" of underperforming firms may result in a favorable interest rate to subsidiaries on loans within the family firm group, which also reduces the impact of the oil shock.

Hypothesis 2: **Family firms are less financially vulnerable to the oil price shock than non-family firms**

H2A: ***During*** *the event window, family firms are less affected than non-family firms in terms of changes in financial vulnerability.*

H2B: ***After*** *the event window, family firms outperform non-family firms in terms of changes in financial vulnerability.*

In contrast, we expect family firms´ reinvestment rate to be more sensitive to the oil price shock, leaving the change in reinvestment rate negative for family firms compared to non-family firms. The main suggestions for these findings are the desire for family firm survival under family control, and risk aversion. Similar to Bianco et al., (2012) we expect family firms to underinvest compared to non-family firms also during the event window. Followingly, as the majority of companies in our sample are in capital- intensive industries, which requires high capital commitments, we anticipate family firms to decline investments opportunities also after the event window due to their risk aversion in a fairly uncertain environment.

Hypothesis 3: Family firms investment decisions are more negatively impacted than non-family firms during the oil price shock.

H3A: ***During*** *the event window, the change in reinvestment is negative for family firms compared to non-family firms*

4 Data

In the following section, we explain the data collection process. This involves extraction of data, filters as well as concluding adjustments. Finally, we present the variables included in the regressions.

4.1 Dataset

The dataset is supplied by the Centre for Corporate Governance Research (CCGR). Our panel data consists of detailed accounting and governance information for privately listed Norwegian firms from 2011 to 2019 (Attachment 1, Appendix). As we are investigating resilience over time, this information has a greater capacity for capturing the complexity of human behavior (Hsiao et al., 1995).

4.1.1 Filters

To extract companies of relevance to the research question, a set of filters have been applied to the initial dataset. As shipping is one of the main groups of focus, we used consolidated data for one entity in the group, following Berzins, Bøhren and Stacescu´s approach (2022). This reduced the sample size of about 30%. However, the grouping ensures that all subsidiaries of a parent company is included and not eliminated by the filters mentioned below.

Filter 1 keeps limited liability companies, which are the companies of interest. Furthermore, filters 2 and 3 ensures that only the companies that were greatly affected by the oil shock are included in the analysis. Finally, filters 4 to 8 excludes passive firms or inconsistent accounting (Attachment 2, Appendix).

Filter 1: Keep only limited liability companies (AS or ASA)

Filter 2: Keep only directly affected Oil & Shipping companies

Directly affected sectors:

06.1 Extraction of oil

06.2 Extraction of natural gas

09.1 Services associated with the extraction of oil and gas

19.20 Manufacture of refined petroleum products

30.113 Building of oil- platforms and modules

30.116 Installation and completion work on platforms and modules

45 Wholesale and retail trade

46.7 Wholesale of solid, liquid, and gaseous fuels and related products

47.3 Retail sale of automotive fuel

49.5 Transport via Pipeline

50 Shipping

52.223 Offshore supply terminal

Filter 3: Keep indirectly affected companies located in the most affected areas in Norway

Indirectly affected relevant sectors:

30 Manufacture of other transport equipment

55 Accommodation

56 Food and beverage service activities

Filter 4: Firms with negative operating revenue are removed

Filter 5: Firms with negative liabilities are removed

Filter 6: Firms with negative or zero assets are removed

Filter 7: Firms with no employee information or with zero employees are removed

Filter 8: Firms with no governance data for the entire period are removed.

To ensure we are following companies over time, we only included companies with at least one observation both before and after the oil shock. Total assets from the previous year are necessary to calculate an important variable in the regressions, which further reduced the sample. After applying the additional filters, the final sample consists of 8,188 observations from 1,062 firms from 2011-2019 (Attachment 3, Appendix).

In the dataset provided, several observations were missing company age and number of employees. When a company was missing data on age for one of the years in our period of interest, we would apply data from the previous year as a substitute to keep the observation. Similarly, for the years with no data on employees, we assigned the number of employees from a year before. The limitation is that this does not consider the company's growth for that specific year; however, our conclusion was that it is better to keep these observations than deleting them, as by keeping them, our data better reflects the real world. Finally, all accounting data in foreign currency was multiplied with the relevant spot rate at the end of relevant year (as of 31st of December). This is the case for 142 observations. As the sample consists of annual observations, we were not able to make a more precise conversion to NOK.

4.1.2 Geographical areas affected by the oil shock

As a result of the oil crisis, the Norwegian Ministry of Finance initiated governmental funding as a tool to address the decrease in revenue for oil and shipping companies, as well as the high unemployment rates for the highly affected municipalities. For the directly affected industries, the financial support may have reduced the effect of the oil price shock, although there is no reason to believe this had a significantly different effect for family and non-family firms.

The inclusion of the indirectly affected industries is an important contribution to the analysis as they did not receive any governmental funding in contrast to the oil and shipping industry. These companies were in some cases even more impacted as they were located in affected geographical areas.

The indirectly affected areas included in the sample are Flekkefjord, Eigersund, Sandnes, Stord, Fedje and Stavanger where the latter was chosen by

default. The areas are included based on our analysis of the governmental funding in the emergency package to increase employability. Four billion NOK was set aside for this in both short-term and long-term transition of the Norwegian economy (Ministry of Finance, 2015). The analysis is displayed in Attachment 3 (Appendix).

5 Methodology

To test the hypotheses, we will employ a univariate Difference-in-Difference (hereafter called DID) methodology. The DID model is widely used to study causal effects (Lechner, 2010) and is commonly used in impact evaluation and policy studies (Fredriksson & Oliveira, 2019). The traditional DID method compares the effect of a specific event or treatment on a group to a control group unaffected by the treatment (Lechner, 2010). In the model, the sample is broken down into four groups:

- Pre-treatment, treatment group
- Post-treatment, treatment group
- Pre- treatment, control group
- Post- treatment, control group

In our case, we define family firms as the treatment group, and non-family firms as the control group. The pre- and post-treatment is defined as before and after the oil shock of 2014. The DID model estimates the following equation:

$$Y_t = \beta_0 + \delta_0 * TREAT + \beta_1 * POST + \delta_1 * TREAT * POST + \varepsilon_t \quad (1)$$

Y represents the outcome variable of interest. TREAT is a dummy variable, taking on the value 1 for the treatment group, and zero otherwise. POST is a time dummy variable taking on the value 1 in periods after the treatment, and 0 otherwise. The interaction term δ_1 is called the *average treatment effector* or the DID estimator, as it measures the change in difference between Y_t for the two groups (Woolridge, 2012). As all companies are affected by the oil price shock, the DID method can illustrate if the change in dependent variable is significantly different for family compared to non-family firms before and after the oil price shock. If the average treatment effect is positive and significant, it indicates a higher difference between the two groups after the shock, and that family firms outperformed non-family firms.

In this study, we analyze the profitability, financial vulnerability, and investment decisions of firms before and after 2014. A benefit of the method is the use of changes, which can eliminate the time fixed effects between the groups, which again might lead to omitted variable bias (Angrist & Pischke, 2021).

Moreover, the DID method and framework is intuitive and suits the analysis well as it provides valuable insights on the change in outcome, rather than the outcome itself. Looking at the change in difference between the two groups can further highlight to what degree a group is affected financially, as well as their acting in response to the shock, in terms of strategic and financial decisions.

5.1 Parallel trend assumption

The main assumption for the DID-method is that the two groups follow a similar trend in the pre-shock period. For the causal inference to be valid, we must assume that the treatment group would have developed the same way over time as the control group, had the treatment group did not receive the treatment. (Lechner, 2010). Although the groups can have level differences in the pre-trend period, the two groups should follow the same trend (Lechner, 2010).

It is common to test the parallel trend assumption by visually examining the two groups and running regression analysis (Pischke, 2005). Also, conducting the test with more than one pre-shock period is regarded as best practice in DID studies due to the increased robustness of the test (Wing et al, 2018). Therefore, we include three years of data in the pre-shock period. The test of the parallel trend assumption is presented in section 7.

5.2 Other assumptions

As customary for other causal studies, the Stable Unit treatment Value assumption (SUTVA), Exogeneity assumption (EXOG) and No Pre-effect treatment (NEPT) assumption must hold. This is to ensure that companies don't change from a treatment to a control labeled group, that the independent variables are not affected by the treatment, and that the event date is set correctly. All assumptions have been tested and validated in Section 7.

5.3 Variables

We will run regressions for each hypothesis tested. Variables demonstrating a firm´s profitability, financial health, and reinvestment rate are dependent variables in the regressions.

5.3.1 Dependent variables

H1: Profitability

When analyzing privately listed companies, we cannot base our profitability indicator on market values. Hence, return on assets (ROA) was chosen to measure profitability of the firm during and after the oil shock. ROA as an indicator is widely used in previous research (Villalonga & Amit, 2004, Le Breton–Miller & Miller, 2006) and it illustrates how the company generates profits based on the assets available. Companies with a higher ROA are viewed as more efficient in terms of how they operate their assets. We calculate ROA as follows:

$$ROA = \frac{Net\ Income}{Average\ Total\ Assets}$$

H2: Financial vulnerability

Interest coverage ratio, sometimes called the times interest earned ratio (TIE), is widely used by accountants, investors, and lenders to evaluate whether a company has enough operating income to meet its financial obligations over time. The ratio can be used to reflect the company's liquidity (short-term) and solvency (long-term) (CFI, 2022). In our regression, we utilize TIE to evaluate the company's financial vulnerability. A sufficiently high TIE positively affects businesses' capacity to generate profits, grow and meet their short-term and long-term financial obligations. The ratio is calculated as follows:

$$Times\ interest\ earned = \frac{EBIT}{Interest\ Expense}$$

H3: Mobilization of resources

The reinvestment rate (RR) is traditionally measured as the percentage of a firm´s after-tax operating income that is reinvested in the company. In the analysis,

a different approach is implemented, using the reinvestment as a percentage of average depreciable assets. The reinvestment rate therefore measures how much was in fact reinvested in one year as the percentage of the depreciable assets in the beginning and end of the year. The reinvestment rate still acts as an indication of how the company is investing back to the company to ensure further growth.

$$RR = \frac{Depreciable\ assets_t + Depreciation + Impairment - Depreciable\ assets_{t-1}}{Average\ Depreciable\ asset}$$

5.3.2 Independent variables

Family firm's variable

(1) The company is defined as family firm if the family's ultimate ownership exceeds 50%. Therefore, we assign the value of one if the family owns half of shares or more and zero otherwise. To ensure a stable unit treatment value assumption, a company is assigned the dummy variable across time based on whether the average percentage of ultimate ownership exceeds 50%.

$$FF\_1 = \begin{cases} 1, & \text{if 50 \% or more of shares is owned by family} \\ 0, & \text{otherwise} \end{cases}$$

(2) Next, we define a family firm as a company, where the family ultimate ownership exceeds 50%, and the CEO position is held by a family member.

$$FF\_2 = \begin{cases} 1, & \text{if 50 \% or more of shares is owned by family + Family CEO} \\ 0, & \text{otherwise} \end{cases}$$

The first definition reflects ownership only, while the second definition include family ownership and control, hence is more constrained. We will perform analysis on the two groups separately to understand if there is a significant difference between our findings depending on the firm's definition.

Oil shock time variable

In the regression, a definition of an event date for the oil shock is required. We define the event based on the historical oil price of brent crude oil (Figure 1) as well as a visual analysis of the dependent variables in our regressions over time (Figure 2, 3 and 4).

As seen from Figure 1 the most dramatic fall in the oil price was between 2014 and 2015. Also, we observe that the outcome variables of interest show a reaction to the shock from 2014. This is in line with the oil price decline during 2014, which in turn indicates that the change had a direct effect on the companies of interest. In our sample, we observe that the companies were also highly impacted by the low oil price in 2016. Hence, we define *the event window* as 2014 to 2016 and *after the event window* as 2017 to 2019. We, therefore, include a time dummy variable, taking a value of 1 in 2014 and after, and zero otherwise.

5.3.3 Main control variables

Size

Another control variable we chose to include is size. Previous research points out to the relationship between company size and financial performance (Dogan, 2013). Early research has highlighted the importance of economies of scale. We control for firm size as larger companies tend to enjoy economies of scale which in turn has an impact on profitability during normal conditions (Dogan, 2013).

Sadorsky found that size has an impact on a company´s response to exogenous shocks as medium firms are too large to make rapid decisions, but too small to have an abundance of resources to mitigate the effect of the shock. This finding by Sadorsky (2008) allows us to anticipate that oil price shocks will have a more significant impact on medium-sized firms in the oil and shipping industries, for both family and non-family firms.

Lastly, larger firms may outperform smaller firms due to higher diversification and market power. We calculate the proxy for size by the natural logarithm of total assets.

$$Size = \ Ln\ (Total\ Assets)$$

We also use the number of employees and company size interchangeably and characterize the size of the company as a log of total employees working in a company.

$$Employees = \ Ln\ (Total\ Employees)$$

Age

Empirical evidence suggests that company age is related with company performance. It is argued that older firms enjoy better profitability as they learn from experience, have better access to capital and have a successful history to show leading to positive "selection effects" (Coad et al, 2013). Evidence from Turkey suggests that the effect of age on profitability is convex, indicating a decline in profitability until it becomes more and more profitable when the company matures (Selcuk, 2016). Furthermore, Serrasqueiro et al., (2016) found that the greater the age, the lesser the likelihood of bankruptcy. Serrasqueiro also found a significant relationship between firm's age and the financing decisions of family firms. Hence, we control for age by including the natural logarithm of the company´s age.

$$Company\ age = \ Ln\ (Years\ since\ establishment)$$

Leverage

The relationship between capital structure and financial performance is inconclusive as some empirical studies have shown a positive relationship between leverage and ROA (Ibqal & Usman, 2018) while others contradict these results (Salim & Yadav, 2012). As there is a relationship between leverage and ROA, we choose to control for it in our model.

$$Debt\ level = \frac{Short\ Term\ Debt + Long\ Term\ Debt}{Total\ assets}$$

Industry

There may be other unobserved characteristics influencing a company's financial performance, which can threaten the validity of the results. To control for this, we add an industry control variable to capture unobserved cofounders for the most impacted industry across time. Controlling for each industry code or for sector code, the variable is omitted due to collinearity. Hence, we differentiate between industry code 47 (retail sale of automotive fuels) as they represent a high percentage of the sample and are greatly affected by the shock. When including the industry dummy variable, we can capture effects on ROA that is due to industry specific attributes.

$$Industry = \begin{cases} 1 & if = SIC\ code = 47 \\ 0, & otherwise \end{cases}$$

Growth

To control for a growth parameter, we employ the asset turnover ratio. The variable measures growth opportunities in firms, as those with higher growth opportunities tend to operate more efficiently (Loderer et al., 2017). Many scholars identify growth opportunities as a factor that can significantly influence profitability measures (Enke, 1970, Geroski et al., 1997). In addition, companies with a higher asset turnover ratio/value companies are expected to reinvest less than companies with higher growth potential as they are more financially constrained. Therefore, we choose to control for this variable. Age and size may also capture partly the financial constraints as pointed out by Hadlock Pierce (2010).

$$Growth\ opportunities\ = \frac{Operating\ revenue}{Total\ assets}$$

Tangibility

The kind of assets a firm utilizes can affect both profitability and financial vulnerability. Researchers have found that the number of tangible assets can affect a firm's ability to issue debt (Lyandres & Palazzo, 2016). Myers (1984) suggested that this is due to information asymmetry as managers know more about their operations than do outside investors. Therefore, collateral can enable companies to issue more debt as the value of the assets is known, which reduces the information asymmetry. It is also in line with trade-off theory which predicts a positive relationship between tangibility and leverage, as it lowers bankruptcy costs (DeMarco et al., 2015). Naturally, the higher leverage level will in turn reduce the TIE ratio and have an indirect effect on profitability.

$$Tangibility\ = \frac{Fixed\ assets}{Total\ assets}$$

Capital intensity

We define capital intensity of the company as a measure of the amount of capital needed per employee. By nature, capital intensity ratio and ROA are negatively correlated. We control for capital intensity as we expect family-owned

businesses to have lower capital intensity ratio due to high labor intensity (Berzins et al, 2018) Furthermore, Tavakolnia et al. (2014) found evidence for a significant negative relationship between capital intensity and financial leverage of the company. If not controlled for, this factor could cause inflated ROA and TIE of family enterprises.

$$Capital\ Intensity = Log(\frac{Assets}{Total\ amout\ of\ employees})$$

5.3.4 Additional control variables

Profitability

Profitability measures refer to return on equity (ROE), return on assets (ROA) and EBIT margin. When testing hypotheses (2) and (3) we control for profitability as we expect that more profitable companies are less financially vulnerable and reinvest less.

5.4 Model representations

The models are structured as follows:

$$Y_t = \alpha + \beta_1 * FF + \beta_2 * SHOCK + \beta_3 * FF * SHOCK + \beta[Controls] + \varepsilon_{it} \quad (2)$$

Y_t represents the outcome variable of interest to each hypothesis. α is the intercept, FF is the family firm dummy variable which takes the value of one if the company is a family firm, and zero otherwise. SHOCK is a time dummy variable taking on the value of one from the oil shock in 2014, and zero otherwise. FF * SHOCK is the interaction term, multiplying FF and SHOCK to indicate family firms in the post-shock period. The interaction term, β_3 is called the average treatment effector or the DID estimator, as it measures the effect of the oil price shock on the dependent variable on average for family firms (Woolridge, 2012). If the average treatment effect is positive and significant, it indicates that family firms were less impacted by the shock than non-family firms.

H1: Profitability

In the model, profitability in terms of ROA is the dependent variable. β_3 explaining the change in ROA before and after the shock for the two groups. To reduce omitted variable bias, and potentially reduce residual variance, control variables size, age, leverage, industry, capital intensity, growth and tangibility are included in the model.

H2. Financial vulnerability

As in the first regression, the DID approach is implemented. Here, we use Times interest earned as a proxy for company's financial vulnerability. The main difference of the regression is the control variables. In line with Ntoung et al. (2019), we control for profitability in terms of return on assets and return on equity, company's both definitions of size, age, tangibility, growth, and capital intensity.

H3. Investment decisions

The dependent variable is the company´s reinvestment rate. Following the same methodology, we are mainly interested in the DID estimator, showing the change in reinvestment before and after the shock for family and non-family firms. In this regression we control for size, age, capital intensity and growth.

6 Results

In this section, descriptive statistics for family and non-family firms are presented, as well as a visual analysis of the dependent variables.

6.1 Summary statistics

Table 1 provides a summary of the dependent variables in the regressions. We winsorized dependent variables at 5 and 95 percentiles respectively. The descriptive statistics for ROA, TIE and RR are summarized in the table below.

Table 1. *Summary statistics of dependent variables*

Variable	Family firms			Non-family firms		
	Mean	Median	SD	Mean	Median	SD
Return on Assets	5.47%	4.91%	0.128	3.04%	3.03%	0.130
Times interest Earned	2.33	5.00	3.64	1.32	2.64	4.01
Reinvestment rate	18.24%	6.76%	0.243	18.77 %	7.39%	0.246

Note: This table shows summary statistics for variables used in the empirical tests. The population is all Norwegian firms with limited liability in 2011–2019. The definition of family firm as a is majority-owned (ultimate ownership above 50%). Ownership is measured as the sum of the owner's ultimate equity holdings in the firm, and the family is counted as one owner. "**ROA**" is company's Net Income over Total Assets. "TIE" is a firm´s EBIT to interest expenses. RR is calculated as the change in depreciable assets divided by average depreciable assets.

The mean ROA for family and non-family firms is 5,47% and 3,04% respectively. The change in profitability before and during the event window is on average 0,3pp for family firms compared to 1,52pp for non-family firms (Attachment 4, Appendix). The mean of TIE in the analyzed period for family firms is 2.33 compared to 1.32 for non-family firms. This represents that family-owned businesses on average are less risky and have a better ability to repay debt than non-family business in the whole period of interest. One could also argue from the trade-off theory perspective that non-family firms increase firm value by obtaining more debt. The reinvestment rate for the entire period (2011-2019), is similar for family firms, and non-family firms of around 18%. There is a decline in investments for both groups in the event window, although the decrease on average is larger for non-family firms.

Family firms' size in terms of assets and employees is generally smaller than non-family firms (Attachment 5, Appendix). Whereas the median non-family firm has around 71 million in assets and the family firm has around 3 million in assets. This also corresponds to typical characteristics of family firms (Berzins, et al, 2018). While the median family firm has 9 employees, a non-family firm has 16. Also, family firms are on average younger with a mean of 17,8 compared to 24,3 years of age for non-family firms. Furthermore, family firms are less capital intensive than non-family firms, suggesting that they have fewer employees operating the same amount of assets. It appears that family and non-family firms do not differ from each other in tangibility, which is natural considering the selected industries require tangible assets such as ships and rigs to operate. This is intuitively not impacted by family ownership.

We observed that most affected industries were highly levered. The average Debt/Total Assets ratio was 74% before and during the shock (2011-2016) and 68%

after the shock (2016-2019). Contrastingly, non-family firms had on average 72% debt before the shock and 71% after the shock. This indicates that Norwegian oil family firms lowered debt levels after the hit of the shock.

Overall, we observe that family firms are on average more profitable, with a higher times interest earned for the entire period. They are also smaller, younger, and less capital intensive although they have a similar debt level and tangibility as non-family firms when looking at the entire period. All these firm characteristics, which may have an impact on the profitability, financial vulnerability and reinvestment of a firm are controlled for in the regressions.

Table 2. *Descriptive statistics of sector according to the SIC 2007 standard*

SIC		**Sector**	**Non-Family**	**Family**	**% of sample**
B	06	Extraction of crude petroleum and natural gas	22	1	2.2
B	09	Mining support and service activities	40	21	5.7
C	19	Manufacture of coke and refined petroleum products	1	0	0.1
C	30	Manufacture of other transport equipment	1	7	0.7
G	45	Wholesale and Retail trade	1	55	5.3
G	46	Wholesale trade	55	125	17.0
G	47	Retail sale	8	432	41.7
H	49	Land transport via pipeline	2	0	0.1
H	50	Water transport	59	164	21.0
H	52	Warehousing and support activities for transportation	0	1	0.1
I	55	Accommodation	0	2	0.5
I	56	Food and beverage service activities	3	61	6.0
Total			192	869	1,062
In % of sample			18.1	81.9	100

Note: Distribution of industries according to SIC 2007 for the final sample.

The final sample consists of 1,062 companies within 11 industry groups. Some industries are only represented by a few companies. Retail trade is the largest industry group representing 41,7% of the companies in the sample. The sector consists of retail sale of automotive fuel which was highly affected by the drop in the oil price. Wholesale of gaseous fuels, metals, chemical products, and other intermediate products represent 17% followed by shipping that accounts for about 20%. The additional indirectly impacted companies within accommodation, service

activities and manufacturing of transport equipment in the chosen geographical areas amounts to around 5% of the sample in total.

The correlation matrix displays a low correlation between the dependent and the independent variables (Attachment 6, Appendix). We observed a low to moderate correlation between dependent and independent variables, suggesting no multicollinearity issue.

6.2 Visual analysis

Figure 2. *Average ROA by group for the period 2011-2019*

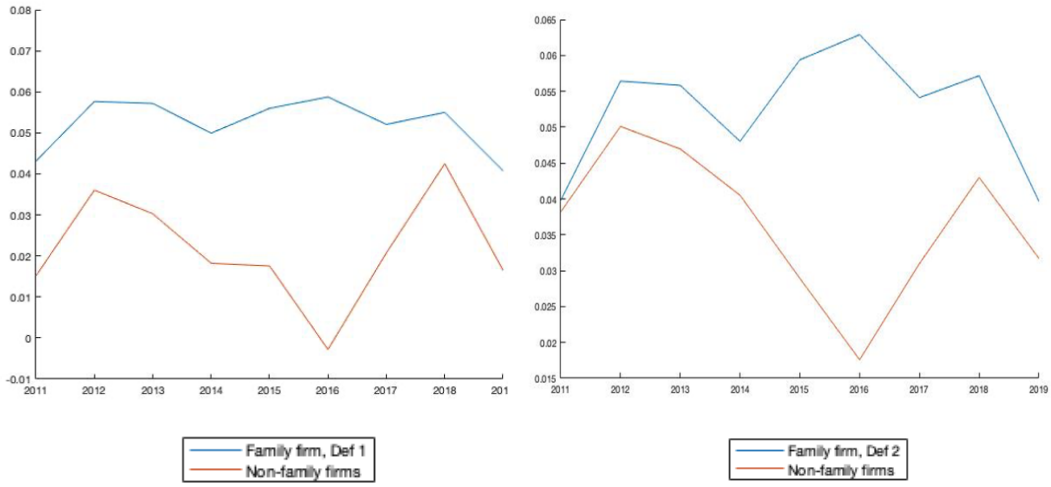


Figure 2 illustrates return on assets for family and non-family firms from 2011 to 2019. It appears that ROA for both groups follow a similar pattern in 2011 and 2012. In 2013, the two groups deviate to some extent from each other for family firms defined by ownership, and by CEO position. It is therefore unclear whether the parallel trend assumption holds simply by analyzing it visually. The assumption must be investigated further by regression analysis.

There is evidently a drop in ROA for all firms in 2014 which confirms the event date to be set in 2014 when the oil shock occurred. While the ROA of family firms remain relatively stable with small variations until 2018, ratio of non-family firms kept decreasing until 2018, following the recovery by 3pp on average.

When a family firm is defined by both ownership and control, we observe a higher variation in ROA for family firms across the period, but also a greater distance between the two groups following the shock. It appears that the difference in performance between family and non-family firms is substantially higher in the

post-shock period (2017-2019) when family firms are defined by both ownership and CEO position.

Figure 3. *Average TIE by group for the period 2011-2019*

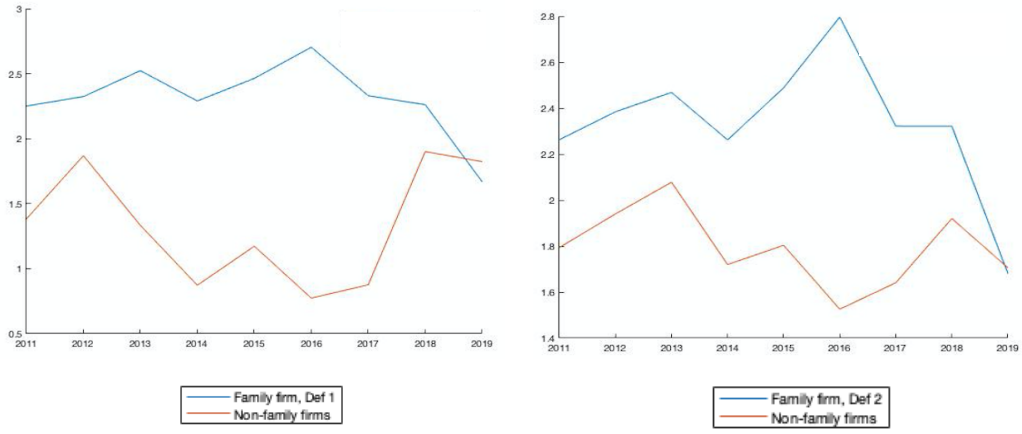
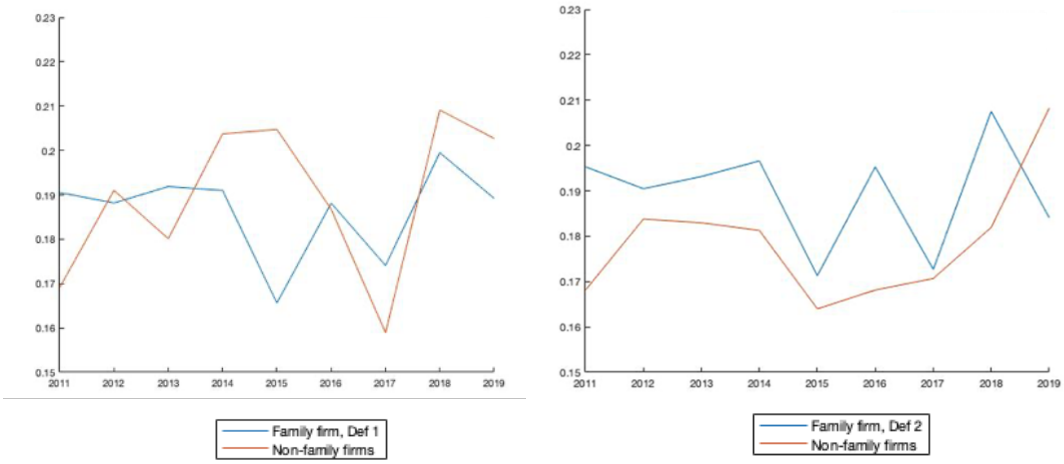


Figure 3 shows that family firms tend to have a higher interest coverage ratio than non-family companies. This indicates that family-owned businesses have higher profits available to service their existing debts. In 2016, family-owned enterprises showed a tremendous increase in the interest coverage ratio for both definitions, while the non-family group had a declining TIE ratio. The mean value of coverage ratio was 2.3 for family firms with ownership only and 2.4 for family firms with ownership and control. Across industries, non-family firms showed an average coverage ratio of 1.32 for Definition 1 and 1.8 for Definition 2.

Figure 4. *Average RR by group for the period 2011-2019*



When defined by ownership, family firms have a steady reinvestment rate before the shock of around 19%. Non-family firms are, on average, more volatile, as evident from Figure 4. During the shock, the two groups are furthest apart, where

family firms reinvest less than before the shock, while non-family firms increase their reinvestment rate by around 2pp on average. Graphically, it is difficult to examine whether the parallel trend assumption holds for the two groups and must be investigated further. Besides, Figure 4 solely displays the average value before controlling for firm characteristics that may have an impact on the investment decisions. Hence, the trend test will be further examined by regressions.

6.3 Test of the DID assumptions

6.3.1 Parallel trend test

We further test the assumption of a similar trend in the pre-shock period (2011-2013) by running a DID regression, as the validity and robustness of the DID model require the assumption to hold. The event is defined in 2012 and 2013 in the two regressions. The variable of interest is the interaction term's coefficient FF*SHOCK. If the variable is not statistically significant, we assume the parallel trend assumption holds.

Within the DID framework, the standard errors are estimated under the assumption of independence across observations. However, this can lead to a downwards bias, which can lead to over-rejection of the null hypothesis. To solve this, we implement clustered standard errors on a firm level, which Bertrand has proven to be efficient (Bertrand et al., 2004).

Table 3. *Testing for a parallel pre trend for profitability*

ROA	**Ownership Definition 1**		**Ownership and control Definition 2**	
	(1) SHOCK = 2012	(2) SHOCK = 2013	(3) SHOCK = 2012	(4) SHOCK = 2013
FF*SHOCK	**-0,00527**	**0.00148**	**0,0064**	**0,0054**
	(0,01089)	(0.01023)	**(**0,00886)	**(**0,0084)
Number of observations	2,792	2,792	2,791	2,791
Number of firms	1,062	1,062	1,062	1,061
T-statistic	-0.48	0.15	0.72	0.65

The dependent variable is ROA for regressions (1) to (4). For regression (1), the independent variables are SHOCK taking on the value of one for observations in 2012 and 2013, and zero otherwise. For regression (2), the independent variables are taking on the value of one in 2013, and zero otherwise. The coefficient of the average treatment effect FF*SHOCK is the difference in trends of the dependent variable for family and non-family firmsRobust Standard Errors - YES, Year Fixed Effects - YES, Firm Fixed Effects - YES. *, ** and *** specify that the coefficient is statistically significant at the 10%, 5%, and 1% level.

Table 3 displays the two regressions assigning 1 to the time dummy in 2012 and 2013, respectively. The regression results support a parallel trend before the shock and the no pre-treatment trend assumption. Furthermore, the interaction term is neither statistically significant in regression (1) nor (2). This suggests that although the treatment and control groups differ in level, the difference between the two groups before and after the event date does not significantly differ. Overall, the visual analysis and our regression results support the assumption of two parallel trends for family and non-family firms.

Table 4. *Testing for a parallel pre trend for financial vulnerability*

TIE	**Ownership Definition 1**		**Ownership and control Definition 2**	
	(1)	(2)	(3)	(4)
	SHOCK = 2012	SHOCK = 2013	SHOCK = 2012	SHOCK = 2013
FF*SHOCK	**-0.514**	**0.391**	**-0.194**	**-0.172**
	(0.517)	(0.528)	(0.344)	(0.325)
Number of observations	1,956	1,956	1,956	1,956
Number of firms	831	831	831	831
T-statistic	-1.00	0.74	-0.56	-0.53

The dependent variable is TIE for regressions (1) to (4). For regression (1), the independent variables are SHOCK taking on the value of one for observations in 2012 and 2013, and zero otherwise. For regression (2), the independent variables are taking on the value of one in 2013, and zero otherwise. The coefficient of the average treatment effect FF*SHOCK is the difference in trends of the dependent variable for family and non-family firms. The time periods in regression (1) and (2) are 2011-2013. Robust Standard Errors - YES, Year Fixed Effects - YES, Firm Fixed Effects - YES. *, ** and *** specify that the coefficient is statistically significant at the 10%, 5%, and 1% level.

Table 4 displays the parallel trend test for TIE. We observed visually that family and non-family firms shared similar trends before the oil shock in 2014. Therefore, we test for parallel trends in financial vulnerability similarly to profitability. The interaction coefficient FF*SHOCK is not significantly different from zero in two regressions for both definitions.

The visual analysis of Figure 2 and 3 and results from regressions displayed in Table 4 and 5 strongly indicate that the assumption of parallel pre-trends hold for our sample. Based on this, we can further proceed with our analysis using the DID model to investigate whether the leverage in terms of times interest earned for family and non-family firms differed after the oil shock in 2014.

Table 5. *Testing parallel pre trend for reinvestment*

RR	**Ownership Definition 1**		**Ownership and control Definition 2**	
	(1)	(2)	(3)	(4)
	SHOCK = 2012	SHOCK = 2013	SHOCK = 2012	SHOCK = 2013
FF*SHOCK	**-0.035**	**-0.089**	**-0.0019**	**0.002**
	(0.262)	(0.033)	(0.278)	(0.256)
Number of observations	2,004	2,004	2,004	2,004
Number of firms	890	890	890	890
T-statistic	-0.00	-0.00	-0.00	-0.00

The dependent variable is RR for regressions (1) to (4). For regression (1), the independent variables are SHOCK taking on the value of one for observations in 2012 and 2013, and zero otherwise. For regression (2), the independent variables are taking on the value of one in 2013, and zero otherwise. The coefficient of the average treatment effect FF*SHOCK the difference in trends of the dependent variable for family and non-family firms. The time periods in regression (1) and (2) are 2011-2013. Robust Standard Errors - YES, Year Fixed Effects - YES, Firm Fixed Effects - YES. *, ** and *** specify that the coefficient is statistically significant at the 10%, 5%, and 1% level.

Initially, the parallel trend assumption did not hold for the reinvestment rate. However, this may be due to aspects that influence the change in reinvestment rate that are not controlled for in the model. Following Michaely and Jacob (2017), the parallel trend test is therefore conducted on the residuals from the initial parallel trend test. As the residuals capture the variation in the reinvestment rate that is not explained by the confounder, we will get sufficient reassurance of whether the two groups follow a similar trend.

Table 5 displays the four regressions, assigning the event date for 2012 and 2013. Again, the residuals of family and non-family firms do not deviate significantly from each other. We, therefore, argue that they still follow a similar trend, and that the assumption is satisfied.

6.3.2 Stable Unit Treatment Value (SUTVA)

The Stable Unit Treatment Value assumption refers to the importance of no interaction between the treatment and control group. Our analysis likely satisfies the assumption as the ownership structure is highly stable over time. 2,02% of the sample changed the definition between family and non-family firms in the investigated period. To ensure stable units, we assign the family firm definition when the average ultimate ownership exceeds 50%. Most often, firms who move between the two categories have only a few observations that deviate from the original definition. The assumption is further verified by excluding the interacting

companies, which yielded very similar results. This suggests that the family effect does not evaporate from one period to another.

6.3.3 Exogeneity assumption (EXOG)

The exogeneity assumption is common for causality studies, which requires that the treatment does not influence the independent variables. Lechner (2008a) later suggested that this assumption is too strong and that it is sufficient to rule out that any influence of the treatment on the control variables does not affect the potential outcomes (Lechner, 2010). In this case, the oil shock cannot affect the control variables, affecting the dependent variable in the regression. Table 7 displays the correlation between each regression's treatment variable, SHOCK, and control variables. All variables show a low correlation under 15% except age, which naturally increases after the treatment effect appeared in 2014 as a result of passing the time. The result shows no noticeable impact on the independent variables and that the exogeneity assumption holds.

Table 6: *Correlation table between the treatment variable and the independent variables.*

	ROA	**TIE**	**RR**
	SHOCK	SHOCK	SHOCK
SHOCK	1.0000	1.0000	1.0000
Age	0.1151	0.1312	0.2015
Size (assets)	0.0020	-0.0134	0.0139
Size (employees)		0.0047	
Capital intensity	-0.0487	-0.0879	-0.0606
Growth	-0.0803	-0.1232	-0.141
Industry	-0.0088	0.0245	
Tangibility	-0.0134	-0.0065	

6.3.4 No effected pre- treatment (NEPT)

This no pre-treatment effect assumes that there is no treatment effect before the event date stated in the regression. This rule out any behavioral changes in anticipation of the treatment (Lechner, 2010). Naturally, the oil shock was unexpected. Even if some companies anticipated the event and followingly changed behavior, this is likely already captured in 2014 as the oil price did not decline until

June 2014. However, testing this assumption also ensures the model's robustness to capture the shock's full effect. From the parallel trend assumption test in Tables 3, 4 and 5, the event date is set to 2013 in regression (2). As the interaction term, FF*SHOCK is statistically insignificant, we can rule out any anticipation of the oil shock in 2013, and the no-effect pre-treatment assumption is not violated

6.4 Main results

In this section, we present the findings of the DID regressions related to hypotheses 1, 2, and 3. Our findings show whether the shock impacted family firms less during and after the event window. Lastly, we will discuss how our results relate to resilience.

6.4.1 Financial performance

Table 7 displays the results of DID regressions on ROA, where we add a year one by one to the post-shock period to see when the effect is the most visible. The variable of interest is the interaction term FF*SHOCK which explains the difference in financial performance for family and non-family firms after the oil price shock compared to the pre-shock period.

Table 7. *Regression results for ROA with Definition 1*

	Ownership					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**0.0049**	**0.0117**	**0.0151****	**0.0149****	**0.0102**	**0.0082**
	(0.0109)	(0.0093)	(0.0088)	(0.0085)	(0.0083)	(0.0081)
SHOCK	-0.0084	-0.1614	-0.0136*	-0.0125	-0.0059	-0.0021
	(0.00103)	(0.0087)	(0.0083)	(0.0081)	(0.0080)	(0.0077)
Size	0.0258*	0.0266***	0.0305***	0.0282***	0.0225***	0.0239***
	(0.0138)	(0.0099)	(0.0083)	(0.0077)	(0.0072)	(0.0068)
Age	0.0165	0.02799*	0.0023	-0.0153	-0.0243**	-0.0372***
	(0.0175)	(0.01559)	(0.0083)	(0.0127)	(0.0113)	(0.0098)
Leverage	-0.1134***	-0.0961***	-0.0741***	- 0.0680***	- 0.1606***	-0.0615***
	(0.0121)	(0.0134)	(0.0123)	(0.0107)	(0.0097)	(0.0090)
Industry	Omitted	-0.1639***	-0.1743***	-0.1738***	-0.1641***	-0.0392
		(0.0079)	(0.0078)	(0.0071)	(0.0072)	(0.0865)
Tangibility	-0.2143***	-0.2164***	-0.2047 ***	-0.2064***	-0.1926***	-0.1795***
	(0.0259)	(0.0006)	(0.0175)	(0.0162)	(0.0161)	(0.0148)
Capital Intensity	0.0210*	0.0128*	0.0072	0.0079***	0.0106***	0.0090***

	(0.0121)	(0.0071)	(0.006)	(0.01623)	(0.0053)	(0.0148)
Growth	-0.0022*** (0.0007)	-0.0179*** (0.0006)	-0.0019*** (0.0007)	-0.0025*** (0.0006)	-0.0024*** (0.0006)	-0.00229*** (0.0006)
Number of observations	3.785	4.782	5.743	6.614	7.428	8.188

The sample consists of 1062 companies, from which 872 are family firm with ownership above 50%. The dependent variable is ROA. The independent variables include the 2014-year shock, taking a value of zero from 2011 to 2013 and one from 2014 to 2019. The regression consists of a family firm dummy taking value one if 50% or more of ultimate ownership belongs to a family and 0 otherwise. The numbers in parenthesis are heteroscedasticity-robust standard errors clustered at the firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients are statistically significant at the 10%, 5% and 1% levels, respectively.

Our results show that the average treatment effect FF*SHOCK becomes statistically significant at a 5% level when we include 2016 and 2017 in the regressions. This suggests that family firms outperform non-family firms in terms of ROA by around 1,5pp for two to three years after the shock in 2014. These findings support our visual analysis in Figure 2, where the average ROA for non-family firms was substantially lower than family firms in during these years.

The average treatment effect, FF*SHOCK, is statistically insignificant in regressions (1) and (2). This suggests that the decrease in ROA in 2014 and 2015 for family firms is not statistically different from non-family firms. The difference in performance again becomes insignificant when including years after 2017, as the non-family firms experienced a high ROA in 2018.

The findings partly confirm Hypothesis 1A, as regression (3) indicates that the shock less impacted family firms during the event window. Although family and non-family firms experience a decline in profitability, it appears that the negative effect continues for non-family firms. The difference in profitability for family and non-family firms in 2016 contributes to these findings. Similar to Bach (2010) and Villalonga and Amit (2010), the results suggest that family firms are less impacted by adverse profit shocks. However, we cannot rule out the possibility that family firm groups distribute profits to underperforming entities to ensure the survival of these companies. This would explain how family firms are less affected in 2016 where the oil price was still at a low level. Another explanation can be the lower risk level in family firm´s projects which yields a more stable return. In our sample, family firms experienced a 13 % decline in earnings from 2014 to 2016, whereas non-family firms suffered a 60% decline on average. The reduced risk can better explain the lower volatility over time and thus higher resilience for family firms.

The average treatment effect during in the recovery period (2017-2019) is only significant in regression (4). This suggests that non-family firms already recovered quite well by 2018 and 2019. This partly contradicts Hypothesis 1B as the change in profitability is no longer different for family and non-family firms five years after the shock. This finding is not surprising as the oil price had already recovered to 70-80$ per barrel in 2018, suggesting that all firms operated in a more financially favorable environment.

Table 8. *Regression results for ROA with Definition 2*

Ownership and Control						
	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
FF_CEO*SHOCK	**0.0070**	**0.0161****	**0.0193*****	**0.01688*****	**0.014****	**0.0118****
	(0.0082)	(0.0071)	(0.0068)	(0.0068)	**(**0.0066)	**(0.0065)**
SHOCK	-0.0091	-0.0137**	-0.0140***	-0.0114**	-0.0068	-0.0032
	(0.0072)	(0.0062)	(0.0059)	(0.0057)	(0.0057)	(0.0056)
Size	0.0261*	0.0271***	0.0309***	0.0286***	0.0227***	0.0240***
	(0.0139)	(0.0099)	(0.0083)	(0.0077)	(0.0072)	(0.0069)
Age	0.0163	0.0175	0.0020	-0.0156	-0.0246**	-0.0376***
	(0.0173)	(0.0156)	(0.0139)	(0.0128)	(0.0114)	(0.0099)
Leverage	-0.1134***	-0.0957***	-0.0734***	-0.0674***	-0.0633***	-0.0611***
	(0.0212)	(0.0134)	(0.0123)	(0.01076)	(0.0097)	(00090)
Industry	Omitted	-1.1617***	-0.1717***	-0.1716***	-0.1584***	-0.0388
		(0.0079)	(0.0123)	(0.0071)	(0.0072)	(0.0854)
Tangibility	-0.2145***	-0.2167***	-0.2046***	-0.2099***	-0.1923***	-0.1792***
	(0.0259)	(0.0201)	(0.0176)	(0.0163)	(0.0161)	(0.01479)
Capital Intensity	0.02085**	0.0127*	0.0073	0.0079	0.0107**	0.0092*
	(0.0121)	(0.0071)	(0.0060)	(0.0057)	(0.0052)	(0.0049)
Growth	-0.0022***	-0.0026***	-0.0018***	-0.0024***	-0.0023***	-0.0022***
	(0.0008)	(0.0006)	(0.0007)	(0.0006)	(0.0006)	(0.0006)
Number of observations	3,785	4,782	5,743	6,614	7,428	8,188

The sample consists of 1062 companies from 719 family firms with ownership and control. The dependent variable is the ROA. The independent variables include the 2014-year shock, taking a value of 0 between 2011-2013 and 1 between 2014-2019. The regression consists of a family firm dummy taking value 1 if 50% or more of ultimate ownership and the CEO position belongs to a family firm. The numbers in parenthesis are heteroscedasticity-robust standard errors, clustered at firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients statistically significant at the 10%, 5% and 1% levels, respectively.

Table 8 displays the same regression for family and non-family firms defined by family CEO in addition to majority ownership. Apart from regression (1), the average treatment effect (FF_CEO*SHOCK) is positive and statistically

significant across all regressions at a 5% level and a 1% for regressions (9) and (10), respectively. Similar to the regressions in table 7, the same control variables are negative and significant at a 1% level for all regressions in table 8. Unsurprisingly, we observe that the SHOCK coefficient was negative and significant at a 5% level until 2017, suggesting that the oil price shock had a negative impact on profitability over time for the selected companies.

It appears the additional element of control contributes to higher resilience for family firms. Both during the event window and after, family firms outperform non-family firms by 1,1pp to 1,9pp, depending on the years included in the regression. As regression (2) is statistically significant compared to regression (2) in table 7, we suspect that family firms with a family CEO benefit from lower information asymmetry between management and owners. When the family firm also has a family member as the CEO, they may have a greater ability to adjust and make quick strategic or operational decisions that enables the firm to resist than non-family firms in terms of profitability.

Our findings can also be explained by the lower agency cost, as the separation between ownership and control is minimized, and the family owners and CEO´s incentives are more aligned (Fama & Jensen, 1983). Our findings follow research from Fahlenbrach (2009) and Villalonga and Amit (2006), although earlier studies show contradicting results on the impact of a family CEO on performance.

To summarize, we find significant results to support Hypothesis 1A for both family firm definitions, concluding the shock less impacted Norwegian family firms than the non-family group in terms of profitability. This does not mean that family firms did not experience a decrease in ROA but were less impacted than non-family peers. Moreover, when including one year after the event window, the change in profitability is significantly different for family and non-family firms, where the average treatment effect is between 1,1pp and 1,9pp depending on the definition. For family firms with a family CEO, the effect maintains significant and positive for the entire period of investigation, confirming Hypothesis 1B. This suggests that family firms show a higher resilience in terms of profitability.

6.4.2 Times Interest Earned

In Figure 3, we identified that family firms, on average, tend to have a higher interest coverage ratio than non-family firms. However, to understand the pre- and post-shock period dynamics, we analyze the year-on-year changes in trends with

control variables. In this model, we chose to control for profitability using the ROE ratio and ROA for the robustness testing.

Tables 9 and 10 present the results from multiple regressions for both definitions of family firms. For the definition 1, where we define a family firm as the one with the ultimate ownership of above 50%, we were not able to find significant results in regressions (1) and (2), concluding that there was no difference in change of the ability to finance debt obligations between family and non-family in 2014 and 2015, respectively. However, regressions (3) and (4) show a significant average treatment effect of 56pp and 69pp, at 10% and 5% levels. In regressions (5) and (6) our findings do not suggest that family businesses continue to display a substantial change in TIE.

In 2016 we observed that family firms decreased their level of debs by around 3pp on average. Naturally, this decreased their debt interest payments. However, the interest expense to companies within the group did not decrease (Attachment 8, Appendix), but rather increased. This contradicts our initial thought that family firms "prop up" under-performing entities to secure the firm's survival, at least not through favorable interest rates (Friedman et al., 2003). In addition, family firms secured a stable EBIT across the years. This is consistent with our findings on ROA for Hypotheses 1, suggesting that family's risk aversion leads to less risky projects and more stable profitability. Contrastingly, non-family firms experienced a drop in EBIT while remaining the same level of debt and interest payments.

Table 9: *Regression results for TIE with Definition 1*

	Ownership					
TIE	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**0.196**	**0.231**	**0.565***	**0.693****	**0.453**	**0.2187**
	(0.463)	(0.359)	(0.336)	(0.325)	(0.317)	(0.298)
SHOCK	-0.464	-0.554	-0.816**	-0.696**	-0.325	0.1505
	(0.444)	(0.361)	(0.335)	(0.3269)	(0.318)	(0.3046)
ROE	7.439***	6.11***	5.341***	5.317***	5.01***	4.94***
	(0.781)	(0.578)	(0.490)	(0.448)	(0.404)	(0.395)
Size	1.080***	0.823***	0.68***	0.680***	0.679***	0.599***
	(0.394)	(0.298)	(0.242)	(0.233)	(0.211)	(0.215)
Employees	-0.009	-0.0028	0.001**	0.0046**	0.0038	0.003
	(0.005)	(0.0037)	(0.003)	(0.0023)	(0.0024)	(0.0024)

Age	0.061	0.1489**	0.1187	-0.009	-0.0714*	-0.1603
	(0.083)	(0.073)	(0.0593)	(0.049)	(0.041)	(0.036)
Tangibility	-5.28***	-5.24***	-4.98***	-4.935***	-4.44***	-4.305***
	(0.712)	(0.574)	(0.507)	(0.479)	(0.444)	(0.4318)
Capital Intensity	0.627**	0.4029**	0.4316***	0.398***	0.282**	0.2709**
	(0.2959	(0.178)	(0.162)	(0.1517)	(0.143)	(0.138)
Growth	-0.009	-0.029	-0.0106	-0.017	-0.0308	-0.039*
	(0.031)	(0.0236)	(0.022)	(0.0204)	(0.019)	(0.0198)
Number of observations	2,610	3,254	3,852	4,390	4,885	5,337

The sample consists of 831 companies, from which 717 is a family firms with ownership only. The dependent variable is times interest earned. The independent variables include 2014-year shock, taking value 0 between 2011-2013 and value 1 between 2014-2019.The regression includes family firm dummy taking value 1 if 50% or more of ultimate ownership belongs to a family, and 0 otherwise. The numbers in parenthesis are heteroscedasticity-robust standard errors, clustered at firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients statistically significant at the 10%, 5% and 1% levels, respectively.

Table 10: *Regression results for TIE with Definition 2*

Ownership and Control						
TIE	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
FF_CEO*SHOCK	**0.029**	**0.123**	**0.374**	**0.293**	**0.118**	**-0.031**
	(0.322)	(0.249)	(0.239)	(0.234)	(0.227)	(0.218)
SHOCK	-0.312	-0.444	-0.6007**	-0.307	-0.0159	0.3648
	(0.304)	(0.269)	(0.246)	(0.2385)	(0.231)	(0.225)
ROE	7.45***	6.122***	5.355***	5.33***	5.02***	4.958***
	(0.782)	(0.578)	(0.488)	(0.448)	(0.685)	(0.395)
Size	1.079***	0.830***	0.6949***	0.694***	0.685***	0.599***
	(0.395)	(0.298)	(0.243)	(0.233)	(0.2116)	(0.2157)
Employees	-0.01**	-0.003	0.0008	0.004*	0.003	0.003
	(0.005)	(0.003)	(0.0034)	(0.0023)	(0.002)	(0.002)
Age	0.062	0.149**	0.120**	-0.0097	-0.072*	-0.1608***
	(0.083)	(0.073)	(0.059)	(0.049)	(0.041)	(0.036)
Tangibility	-5.27***	-5.23***	-4.977***	-4.912***	-4.42***	-4.296***
	(0.712)	(0.572)	(0.5063)	(0.479)	(0.445)	(0.432)
Capital Intensity	0.624**	0.396**	0.418***	0.3787**	0.269*	0.263*
	(0.295)	(0.177)	(0.1628)	(0.152)	(0.143)	(0.138)
Growth	-0.009	-0.029	-0.010	-0.0185	-0.032*	-0.041**
	(0.0312)	(0.023)	(0.022)	(0.0204)	(0.019)	(0.019)
Number of observations	2,610	3,254	3,852	4,390	4,885	5,337

The sample consists of 831 companies from 595 family firms with ownership and control. The dependent variable is the times interest earned. The independent variables include the 2014-year shock, taking a value of 0 between 2011-2013 and 1 between 2014-2019. The regression consists of a family firm dummy taking value 1 if 50% or more of ultimate ownership and the CEO position belongs to a family firm. The numbers in parenthesis are heteroscedasticity-robust standard errors,

clustered at firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients statistically significant at the 10%, 5% and 1% levels, respectively.

When we include the element of control in the definition of the family firm, the significance of the average treatment effect disappears, implying that the family firm effect is mainly due to family ownership. This is not surprising as a trait of risk aversion in family firms is primarily related to protecting the family's wealth rather than a management approach.

In summary, we find evidence that family firms were less impacted in terms of TIE when defined by ownership only. Therefore, we found partial support for Hypothesis 2.

6.4.3 Investment decisions

Table 11 summarizes the regressions for the reinvestment rate. For the variable of interest, we observe that the interaction term FF*SHOCK is negative and insignificant for the entire period.

Table 11: *Regression results for RR with Definition 1*

Ownership						
RR	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**-0.0136**	**-0.0168**	**-0.0162**	**-0.0085**	**-0.00469**	**-0.00379**
	(0.0312)	(0.0285)	(0.0250)	(0.0243)	(0.0232)	(0.0226)
SHOCK	0.0156	0.0088	0.0029	-0.0051	-0.0106	-0.0131
	(0.0292)	(0.0269)	(0.0234)	(0.0231)	(0.0222)	(0.0215)
Size	0.0821**	0.0395*	0.0450***	0.0486***	0.0448***	0.0432***
	(0.0324)	(0.0233)	(0.0173)	(0.1249)	(0.0131)	(0.0116)
Age	-0.0099	-0.0111	-0.0009	-0.0181	-0.01052	-0.00275
	(0.0352)	(0.0291)	(0.0242)	(0.0218)	(0.0201)	(0.0188)
Capital Intensity	0.00549	0.0185	0.0115	0.0051	-0.00533	-0.00014
	(0.0182)	(0.0126)	(0.0101)	(0.0231)	(0.0076)	(0.0073)
Growth	-0.0041	-0.0027	-0.0034*	-0.0027*	-0.00333	-0.00241*
	(0.0027)	(0.0021)	(0.0018)	(0.0017)	(00016)	(0.0015)
Constant	-1.1055**	-0.8532***	-0.9371***	-0.8206***	-0.4387**	-0.4524***
	(0.4437)	(0.322)	(0.2530)	(0.2182)	(0.1943)	(0.1772)
Number of observations	2,709	3,401	4,132	4,709	5,281	5,829

The sample consists of 975 companies from 853 family firms with family ultimate ownership above 50%. The dependent variable is the RR. The independent variables include the 2014-year shock, taking a value of 0 between 2011-2013 and 1 between 2014-2019. The regression consists of a family firm dummy taking value 1 if 50% or more of ultimate ownership. The numbers in parenthesis are heteroscedasticity-robust standard errors, clustered at firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients statistically significant at the 10%, 5% and 1% levels, respectively.

The results in table 11 point toward an adverse change in reinvestment for family firms compared to non-family firms after the shock. Our findings point in the same direction as Lins et al. (2013) study, suggesting that family firms underinvest relative to other firms during and after the crisis. As resilience is defined by the ability to cope and recover from a financial shock, we would argue that a decrease in reinvestment to ensure survival under family control demonstrates weaker resilience.

However, we cannot make any conclusions based on these results as the regressions did not provide significant estimates. The reasons for the insignificant findings may be high variations within the family firm category. As mentioned in section 2.2.3, being a family firm can motivate two different investment strategies during financial uncertainty. Family firms may invest more to sustain long-term growth or decline investment opportunities because of risk aversion and the desire to ensure survival under family control. As both strategies resonate with the typical characteristics of family firms, the coefficient predicting the change in reinvestment for family firms after the oil price shock produces inconclusive results.

Furthermore, there does not appear to be a consistent change in the reinvestment rate after the shock for neither group. From Figure 4, we observe high variation in the reinvestment rate for both family and non-family firms over the period between 2011 and 2019. This further suggests that there may be opposite or inconsistent investment strategies for different family firms in our sample.

We further hypothesize that there may be evidence of underinvestment in family firms with family control.

Table 12: *Regression results for RR with Definition 2*

Ownership and Control						
RR	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
FF_CEO*SHOCK	**0.0084**	**0.0003**	**-0.0031**	**-0.00427**	**0.0032**	**0.00178**
	(0.0217)	(0.0190)	(0.0167)	(0.0162)	(0.0156)	(0.0156)
SHOCK	-0.0029	-0.0064	0.0090	-0.0095	-0.0167	-0.0177
	(0.0185)	(0.0164)	(0.0145)	(0.0144)	(0.0142)	(0.0142)
Size	0.0864**	0.0392*	0.0447***	0.04855***	0.0449***	0.0432***
	(0.0325)	(0.0233)	(0.0173)	(0.0148)	(0.0132)	(0.0116)
Age	-0.0091	-0.0117	-0.0015	-0.0183	-0.01071	-0.00289
	(0.0351)	(0.0290)	(0.0241)	(0.0217)	(0.0188)	(0.0188)

Capital Intensity	0.0066	0.0189	0.0115	0.0050	-0.00003	-0.00003
	(0.0181)	(0.0126)	(0.0101)	(0.0087)	(0.0076)	(0.0073)
Growth	-0.0041	-0.0027	-0.0034*	-0.00274*	-0.00333**	-0.00230*
	(0.0027)	(0.0021)	(0.0019)	(0.0017)	(0.0016)	(0.0014)
Constant	-1.1187**	-0.8523***	-0.9350***	-0.8192***	-0.4367**	-0.4542***
	(0.4450)	(0.322)	(0.2530)	(0.218)	(0.1722)	(0.1722)
Number of observations	2,709	3,401	4,132	4,709	5,281	5,829

The sample consists of 975 companies from 714 family firms with family ultimate ownership above 50% and a family CEO. The dependent variable is the RR. The independent variables include the 2014-year shock, taking a value of 0 between 2011-2013 and 1 between 2014-2019. The regression consists of a family firm dummy taking value 1 if 50% or more of ultimate ownership. The numbers in parenthesis are heteroscedasticity-robust standard errors, clustered at firm level. Robust Standard Errors- YES, Year Fixed Effects- YES, Firm Fixed Effects - YES. *, ** and *** indicate that the associated coefficients statistically significant at the 10%, 5% and 1% levels, respectively.

Like the findings from regressions in Table 11, the treatment effect FF_CEO*SHOCK is insignificant for the entire period. However, when a family firm is defined by ownership and control, we observe that the interaction term changed signs for regression (7), (8), (11) and (12) respectively. The results can be due to a lower decline in reinvestment among companies with family CEO in 2014 and 2015. However, we cannot conclude due to insignificant results. Graphically, we observe that family firms still vary from year to year on average, while the change for firms in the non-family category does not change substantially. This can be the reason for the change in result from regression (1) - (6), and why the regressions still do not produce significant estimates. To ensure the reason for insignificant results is not related to the methodology employed, we conducted additional regressions in a firm fixed effects model framework. Neither the interaction term for majority owned family firms nor with family CEO are statistically significant. However, the coefficients follow the same pattern as shown in Table 11 and 12. The additional model can be found in Attachment 7 in the Appendix. Based on the results presented, we cannot confirm nor reject Hypothesis 3 in our sample.

7 Sensitivity analysis

To ensure robustness of our findings, we conduct sensitivity analysis on the regressions related to Hypothesis 1 and 2. Firstly, we utilize different definitions of family firms. Secondly, we replace the most significant control variables, and lastly, we run regressions on an alternative explanatory variable for Hypothesis 1.

7.1 Alternative definition of family firm

Villalonga and Amit (2006) found positive, negative, and insignificant results depending on their definition of family firms. Therefore, we expect our findings to be sensitive to the change in the family firm definition. Consequently, we stress our results by defining family firm as (1) a firm owned by the family with a minimum threshold of 20% (Villalonga & Amit, 2006) and (2) owned by the family with a minimum threshold of 80%.

7.1.1 Profitability

With 20% and 80% ultimate ownership, the percentage of family firms in the sample changed to 85,44% and 75,6%, respectively. In addition, we replaced the family CEO with a chair position to illustrate family control, where the percentage of family firms is equal to 68,4% and 61,9% for different ownership restrictions. The parallel trend assumption holds for both thresholds; the results can be found in table Attachment 9 in the appendix.

Table 13. *Profitability sensitivity analysis for the Definition 1*

ROA	**Ownership**					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
20% Threshold						
FF*SHOCK	**0.00633** (0.0115)	**0.0121** (0.0097)	**0.0133** (0.0093)	**0.0139** (0.0090)	**0.0117** (0.0087)	**0.0101** (0.0086)
80% Threshold						
FF*SHOCK	**0.0066** (0.008)	**0.0137** (0.0089)	**0.0154*** (0.0076)	**0.0151*** (0.0075)	**0.0124** (0.0073)	**0,0033** (0.0071)
Number of observations	3,785	4,782	5,743	6,614	7,428	8,188

When utilizing the 20% threshold, the significant results previously found in regression (3) and (4) disappear. This suggests that the family firm effect requires a higher family ownership stake to be present. With a more restricted definition of 80%, the change in profitability for family and non-family firms is statistically significant at a 5% level for regression (3) and (4). Similarly to the initial regression with majority ownership, family firms outperform by around 1.5pp in this period.

Table 14. *Profitability sensitivity analysis for the Definition 2*

ROA	**Ownership and Control**					
	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
20% Threshold						
FF_Chair* SHOCK	**0.00745** (0.0083)	**0.0169**** (0.0073)	**0.0158**** (0.0070)	**0.0165**** (0.0069)	**0.0147**** (0.0067)	**0.0137** (0.0066)
80% Threshold						
FF_Chair* SHOCK	**0,0005** (0,0092)	**0.0168**** (0.0069)	**0.0197***** (0.0066)	**0.0186**** (0.0065)	**0.0159**** (0.0064)	**0,0134** (0,0062)
Number of observations	3,785	4,782	5,743	6,614	7,428	8,188

When defining a family firm with the 20% and 80% threshold and family chair position rather than CEO, we also find similar results with the FF_Chair*SHOCK coefficient being significant at a 5% level. Family firms outperform non-family firms for the entire period, except in regression (12). Similarly to the family CEO firm definition, the average treatment effect with a family chair position is between 1,6pp and 2pp, depending on the ownership threshold. This suggests that the support for Hypothesis 1A depends on majority ownership within the family. In addition, our findings including the element of control are robust for both chair and CEO position.

7.1.2 Financial vulnerability

The parallel trend test is validated in Attachment 10. When defining a family firm by an (1) an ultimate ownership above threshold of 20%, (2) ultimate ownership above 20% and a family chair position (Tables 15 and 16), we find a significant and positive DID coefficient supporting our main findings. However, the effect disappears with the more constrained ownership threshold of 80%.

Table 15. *Financial vulnerability sensitivity analysis for Definition 1*

TIE	**Ownership**					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
20% Threshold						
FF*SHOCK	**0.356** (0.555)	**0.388** (0.423)	**0.630*** (0.374)	**0.738**** (0.357)	**0.509** (0.347)	**0.234** (0.324)
80% Threshold						
FF*SHOCK	**0.242** (0.339)	**0.159** (0.266)	**0.257** (0.245)	**0.273** (0.246)	**0.125** (0.242)	**0.045** (0.232)
Number of observations	2,610	3,254	3,852	4,390	4,885	5,337

Table 16. *Financial vulnerability sensitivity analysis for Definition 2*

TIE	**Ownership and Control**					
	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
20% Threshold						
FF_Chair* SHOCK	**0.177** (0.324)	**0.437*** (0.254)	**0.427*** (0 .241)	**0.558**** (0.237)	**0.403*** (0.230)	**0.273** (0.223)
80% Threshold						
FF_Chair* SHOCK	**0.239** (0.294)	**0.278** (0.231)	**0.286** (0.218)	**0.337** (0.216)	**0.217** (0.211)	**0.132** (0.204)
Number of observations	2,610	3,254	3,852	4,390	4,885	5,337

The sensitivity analysis confirms that family control regardless of CEO position or chair does not make the firm resilient in terms of financial vulnerability.

7.2 Alternative definitions of control variables

To ensure the robustness of the model, we also change the definition for a selection of control variables.

Table 17: *Alternative control variables*

	Initial variable	**Alternative variable**
Size	Log (assets)	Log (operating revenue)
Capital intensity	Log (assets/employees)	Log (assets/revenue)
Leverage	Debt/assets	Debt/equity
Profitability	ROE	ROA

7.2.1 Profitability

The parallel trend assumption holds for the regressions with differently defined control variables and can be found in Attachment 11. When regressing with different control variables, the average treatment effect becomes insignificant for all regressions with definition 1, indicating that the alternative control variables capture more of the variation in the sample (Attachment 12). For the second definition of family firms, the findings are similar to the main findings as all regressions demonstrate a statistically significant treatment effect for family firms in all regression except regression (7). Family firms, therefore, outperform non-family firms when the family has a control position during the shock.

7.2.2 Times interest earned

The pre-trend results are summarized in Attachment 13. Here, the parallel trend assumption holds. Attachment 14 summarizes robustness test results for TIE. We confirmed our initial findings by employing an alternative definition of controlled variables.

In line with previous findings, we observed a significant difference in the change of TIE ratio after the shock only for the first definition of the family firm.

7.3 Alternative definition on the explanatory variable

The development over time looks somewhat different when utilizing ROE as the dependent variable rather than ROA. Family and non-family firms followed a similar trend from 2011 to 2013, which is confirmed by a parallel direction DID regression found in the Attachment 15 in the Appendix.

Table 18: *Regression results for alternative explanatory variable ROE*

ROE	**Ownership**					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**0.0188** (0.0150)	**0.0232** (0.0159)	**0.0315**** (0.0160)	**0.0321**** (0.0162)	**0.0333**** (0.0164)	**0.0358**** (0.0169)
SHOCK	-0.0161 (0.0139)	-0.0169 (0.0149)	-0.0200 (0.0150)	-0.0190 (0.015)	-0.0167 (0.0153)	-0.0171 (0.0159)
Ownership and Control						
FF_CEO* SHOCK	**0.0013** (0.0102)	**0.0070** (0.0107)	**0.0170** (0.0111)	**0.0215*** (0.0116)	**0.0243**** (0.0121)	**0.0256**** (0.0125)
SHOCK	-0.0013 (0.0086)	-0.0024 (0.0093)	-0.0056 (0.0097)	-0.0072 (0.0099)	-0.0056 (0.0102)	-0.0049 (0.0205)
Number of observations	3,785	4,782	5,743	6,614	7,428	8,188

Table 18 shows a statistically significant difference in performance for family and non-family firms at a 5% level for regression (3), (4), (5) and (6). Furthermore, family firms outperform non-family firms by around 3pp in the post-shock period, which is naturally higher than for ROA.

With family ownership and control, the average treatment effect for ROE remains significant at the 10% level for regression (4) and at a 5% level for regression (5) and (6). However, the statistical significance declines –This implies that companies run by family CEOs have a much higher variance in financial performance with respect to ROE and a slightly lower average treatment effect. Nevertheless, we find these results to support our initial findings that family firms outperform non-family firms in the period after the shock. However, the robustness test with another profitability measure suggests that we should not overestimate the additional positive effect of family control that was found for ROA.

8 Limitations

Due to hardly accessible data on privately listed firms, there is little to no previous research on the resilience of privately held family firms. Because of that, our research paper has several limitations. First, the theory on family firms does not

give an exact and correct definition of a family firm. The definitions that we chose are based on high-quality and well-recognized studies. However, it is still unknown if such definitions can separate the family firms from non-family firms in the best possible manner, implying that a different ownership threshold could affect the findings.

Further, in this research paper, we performed data management and adjusted for inaccuracies to the best of our ability. However, due to the lack of data available on governance, we had to exclude many companies from our research. In addition, we had to deal with inconsistent accounting data and missing data in some specific years, which could also impact the final findings.

The endogeneity problem is common in corporate governance research. We studied multiple available research papers to avoid omitting relevant variables to include all performance determinants. The Difference-In-Differences methodology helps mitigate omitted variable bias problems, but the risk of leaving relevant factors outside the model still exists. In addition to omitted variable bias, we see a selection bias concern. When identifying the most affected geographical areas for our analysis, we implemented our research to select the most affected areas based on financial support provided by the Norwegian government. However, we believe that the sample of most affected areas could be improved when performing a proper in-depth analysis which is difficult to do due to the lack of publicly available information.

Some limitations are concerning the annual data we used. Given that the shock happened in July 2014, our analysis is not granular enough to investigate the monthly changes in the fields of interest. Finally, ROA would look different if we used the market value of equity rather than the book value, which is the only available value for firms that are not listed on the stock exchange.

9 Future research suggestions

The effect of family control on resilience deserves further investigation. Although we did not include family characteristics about whether the CEO is a founder or a descendant, there is existing research on the effect of a founder CEO on firm performance from other countries (Villalonga & Amit, 2006, Saidat et al., 2020). Barontini & Caprio (2006) only found a positive effect of a family CEO on performance if the founding CEO was present. Hence, it would bring nuances to investigate the difference in resilience with incumbent and inherited CEO positions.

In addition, it would give valuable insight to research what family characteristics that may increase firm resilience. Using proxies for agency conflicts, information asymmetry and additional risk aversion measures would provide deeper insight and more detailed data than obtained for our analysis. Another suggestion for future research on this topic, is to use propensity score matching. The steps involve matching a family firm with a non-family firm of similar characteristics The main goal of this method is to produce an accurate estimate of the treatment effect without relying on potentially biased information about confounding factors. This may provide a more robust and consistent control sample.

10 Conclusion

In this thesis, we analyze the resilience of Norwegian family firms and non-family firms during and after economic turndown. We investigated a period from 2011 to 2019, capturing the impact of the oil price shock of 2014. Our sample consists of directly affected oil, shipping, and related service industries, in addition to a selection of indirectly affected sectors in the most affected geographical areas. The concept of resilience, here defined as the ability to cope with and recover quickly from financial shocks, was analyzed using profitability, financial health, and investment decisions.

Using a Difference- in- Difference methodology, our findings show that family firms outperform non-family firms in terms of profitability during the event window of 2014 to 2016 by 1,5pp. When the family firm is defined as majority ownership and family CEO, family firms significantly outperform non-family firms by 1,1pp to 1,9pp for the entire period. This is in line with previous research by B. Amann and J. Jaussaud (2012) and Ntoung et al (2019). These findings are robust for different profitability measures, control variables and thresholds of family ownership and control. We suggest this is due to reduced information asymmetry between owners and managers and aligned incentives, resulting in quicker decision-making. In addition, we suggest the less impacted ROA for family firms is due to risk aversion, as family firms normally invest in less risky projects, which yields a more stable return during financial uncertainty.

Furthermore, when looking at financial health, we found a positive and significant treatment effect of 65pp for family firms during and after the event

window. However, the effect is only significant when family firms are defined by ownership. We found that family firms enjoy a more stable EBIT for the entire period and reduced their leverage and followingly interest expenses in the three years after the shock. Our findings are, however, more sensitive to the definition of family firms and control variables included in the analysis.

Additionally, we investigated whether family firms´ investment decisions during and after the oil shock differed from non-family firms. Our findings suggested that the change in investment for family firms was negative although we did not find significant confirmation of the hypothesis.

Overall, our research indicates that family firms in our sample demonstrate a higher resilience than non-family firms in terms of profitability and financial vulnerability. The results provide further insights into the cost-benefit effect of family ownership during economic turndowns.

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12 Appendix

Attachment 1. *Items extracted from CCGR data base*

#	**Item number in CCGR**	**Variable name in CCGR**
1	Item_ 15311	Ultimate ownership
2	Item_11	Operating Revenue
3	Item_13405	Total number of employees
4	Item_13420	Company age
5	Item_15	Depreciation
6	Item_15304	Largest family has a CEO
7	Item_15305	Family has a chair
8	Item_16	Impairment
9	Item_29	Interest Expense Paid to Company's in the same group
10	Item_30	Other Interest Expense
11	Item_33	Income Before Tax
12	item_39	Net Income
13	Item_45	Deferred Tax Assets
14	Item_46	Total intangible assets
15	Item_50108	Industry code
16	Item_501110	Organization form
17	Item_51	Total Fixed Assets (Tangible)
18	item_63	Total Fixed Assets
19	item_78	Total Current Assets
20	item_87	Total Equity

Attachment 2. *Filter and sample overview*

Original data consists of 5 819 873 observations in the period of 1994-2020. The following will provide data cleaning steps and an overview of the filters that were applied to the initial dataset.

Name of the filter/ Sample	Filter Criteria	Aggregated Observations
Adjusting years of interest	Time range 2010-2019	*2 951 582*
Filter 1	All firms are independent	*2 550 430*
Filter 2	Keep directly affected companies and indirectly affected from the most affected areas in Norway	*121 510*
Filter 3	Keep consolidated companies	*96 474*
Filter 4, 5 & 6	Firms with negative operating revenue, liabilities and assets are removed	*93 474*
Filter 7	Firms with no employees are removed	*69 978*
Filter 8	Firms with no governance data are removed	*62 375*
	Create lagged assets variable	*27 276*
Filter 9	Keep companies with observations before and after the 2014 shock, remove companies with only one observation	*8 188*

The total number of observations resulted to 8 188 in the period of 2011-2019. Total number of unique companies are 1062.

Attachment 3. *Geographical areas included in the sample*

The areas that were selected based on governmental funding to the municipalities in the period. Based on employability rate and financial aid, the top 5 municipalities with the highest financial support per capita was selected. In addition, Stavanger was chosen by default as it is a well- known oil city in Norway, which also received a substantial amount of governmental support.

Municipality Number	Municipality Name
1101	Flekkefjord
1102	Eigersund
1103	Sandnes
1104	Stavanger
1121	Stord
1265	Fedje

Attachment 3.1. *Municipalities which received governmental support*

Municipality	Employability loss	Support in thousands of NOK	Inhabitants	Support per capita
Fedje	5,7	376	576	653
Flekkefjord	5,6	6 030	9096	663
Eigersund	5,5	10 571	14942	707
Sandnes	5,5	53 886	74820	720
Stord	5,5	12 958	18775	690
Kristiansund	5,5	16 896	24526	689
Haugesund	5,4	24 318	36951	658
Strand	5,4	8 059	12464	647
Hareid	5,4	3 378	5189	651
Selje	5,3	1 702	2774	614
Sola	5,2	16 256	26096	623
Herøy	5,2	5 278	8972	588
Stavanger	5	76 976	132644	580
Froland	4,8	2 595	5618	462
Sund	4,7	3 091	6975	443
Sokndal	4,6	1 373	3313	414
Ulstein	4,6	3 674	8430	436
Tvedestrand	4,4	2 035	6014	338
Fjell	4,4	9 437	24870	379
Øygarden	4,4	1 762	4852	363
Hyllestad	4,4	501	1395	359
Arendal	4,3	14 590	44313	329
Gjerstad	4,3	778	2473	315
Randaberg	4,3	3 800	10737	354
Flora	4,3	4 045	11923	339
Kristiansand	4,2	27 730	88447	314
Songdalen	4,2	1 962	6419	306
Klepp	4,2	6 360	18970	335
Bremanger	4,2	1 160	3846	302
Austrheim	4,1	814	2858	285
Karmøy	4	10 816	42187	256
Kvinnherad	4	3 285	13271	248
Rauma	4	1 907	7492	255

Risør	3,9	1 446	6920	209
Grimstad	3,9	4 880	22550	216
Time	3,8	3 970	18572	214
Gjesdal	3,8	2 598	11853	219
Meland	3,8	1 541	7812	197
Lindås	3,8	3 032	15607	194
Vågsøy	3,8	1 158	6046	192
Vennesla	3,7	2 368	14308	166
Søgne	3,7	1 853	11260	165
Bømlo	3,7	1 970	11778	167
Granvin	3,7	160	920	174
Radøy	3,6	722	5077	142
Sande	3,6	379	2559	148
Rennesøy	3,5	587	4856	121
Fræna	3,5	1 138	9717	117
Hægebostad	3,4	149	1702	88
Bergen	3,4	24 712	277391	89
Ålesund	3,4	4 160	46747	89
Haram	3,4	778	9200	85
Nesset	3,4	256	2970	86
Midsund	3,4	170	2088	81
Bjerkreim	3,3	176	2825	62
Sveio	3,3	309	5593	55
Askøy	3,3	1 574	28380	55
Stordal	3,3	56	1020	55
Mandal	3,2	421	15529	27
Farsund	3,2	250	9705	26
Lindesnes	3,2	131	4943	27
Bokn	3,2	24	865	28
Samnanger	3,2	67	2443	27
Os	3,2	558	19742	28

Attachment 4. *Extended Summary statistics of dependent variables*

To study financial vulnerability, in addition to the initial filters applied to the dataset (see section 4.1.1), we excluded no interest-paying companies. Furthermore, TIE ratio was winsorized at 5% level, as many family firms appear to have low leverage, and hence pay significantly lower interests compared to non-

family firms. This resulted into a total number of observations of 5337, from which 717 (86,2%) where family firms, and 114 (13,7%) non-family firms.

Variable	Family firms			Non-family firms		
	Mean	Median	SD	Mean	Median	SD
ROA	**5,47%**	**4,91%**	**0,128**	**3,04%**	**3,03%**	**0,130**
Before (2011-2013)	5,97%	5,11%	0,125	3,68%	3,41%	0,125
During (2014-2016)	5,67%	5,72%	0,127	2,16%	2,92%	0.151
After (2017-2019)	4,89%	4,84%	0,13	3,53%	3,37%	0,150
TIE	**2,33**	**5,00**	**3,64**	**1,32**	**2,64**	**4,01**
Before (2011-2013)	2,37	5,00	3,51	1,52	2,66	3,82
During (2014-2016)	2,48	5,00	3,57	0,94	2,14	4,16
After (2017-2019)	2,1	5,00	3,89	1,48	3,68	4,08
RR	**18,24%**	**6,76%**	**0,243**	**18,77 %**	**7,39%**	**0,246**
Before (2011-2013)	19,03%	7,31%	0,249	21,46%	10,02%	0,258
During (2014-2016)	18,21%	6,90%	0,241	19,33 %	7,63%	0,253
After (2017-2019)	18,73%	6,97%	0,248	18,89%	8,43%	0,240

Note: This table shows summary statistics for variables used in the empirical tests. The population is all limited liability Norwegian firms in the period of 2011 to 2019. The definition of a family firm is a majority family-owned company with ultimate ownership above 50%. Ownership is measured as the sum of the owner's ultimate equity holdings in the firm, and the family is counted as one owner. "**ROA**" is company's Net Income over Total Assets. **"TIE"** is a firm´s EBIT to Interest Expenses. "**RR"** rate is the change in depreciable assets divided by the average depreciable assets.

Attachment 5. *Summary statistics on firm characteristics and control variables*

Variable	Family firms			Non-family firms		
	Mean	Median	SD	Mean	Median	SD
Total assets (MNOK)	35.44	3.40	242	3.183,69	70,95	8.608,12
Employees	13.32	9	22.76	118.85	16	248.89
Age	17.80	15	11.87	24.33	18	20.9
Capital intensity	13.145	12.877	1.590	15.388	15.002	2.264
Tangibility	0.3217	0.2446	0.2734	0.378	0.279	0.347
Leverage	0.709	0.681	0.495	0.738	0.708	0.495
Growth	4.921	3.583	5.141	2.146	1.311	3.041
EBIT Ratio	0.0539	0.0206	0.1398	0.0648	0.0279	0.2029

Note: "**Age**" is the number of years since the firm was founded, ", **Growth opportunities**" is the ratio of Op. Revenues over Total Assets. "**Employee**s" is the number of employed labors. '**Leverage'** is the debt to assets ratio, and '**Tangibility'** is the fixed assets to total assets ratio. **Capital intensity**" is the ratio of assets to employees. "**EBIT ratio"** is EBIT divided by revenues.

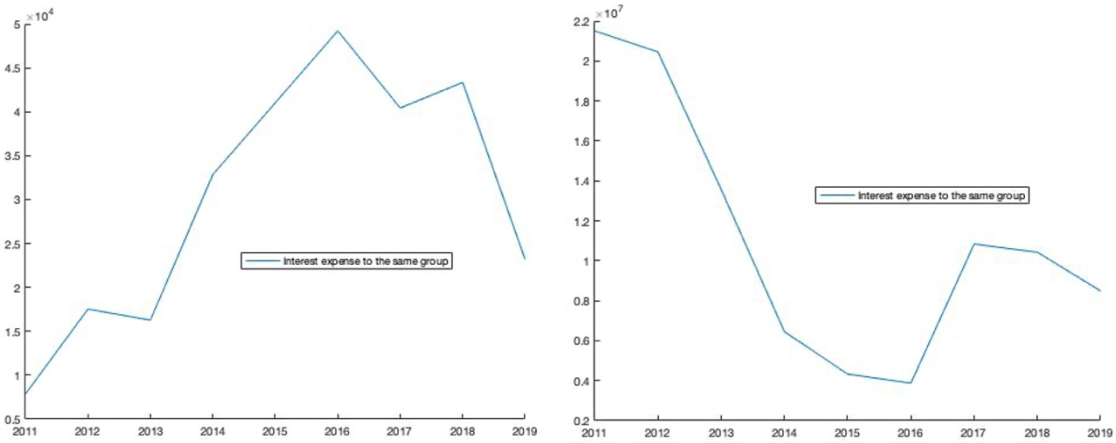
Attachment 6. *Correlation matrix*

	ROE	***ROA***	***TIE***	**RR**	***Size***	***Age***	***Debt***	***Tangi-bility***	***Capital intensity***	***Employees***	***Growth***
ROE	1.000										
ROA	0.290	1.00									
TIE	0.318	0.716	1.00								
RR	0.036	0.085		1.00							
Size	0.235	-0.005	0.029	0.058	1.00						
Age	0.190	-0.046	-0.008	-0.009	0.256	1.00					
Debt	-0.895	-0.309	-0.301	0.027	-0.254	-0.15	1.00				
Tangibility	0.033	-0.174	-0.133	0.046	0.439	0.132	-0.03	1.00			
Capital Intensity	0.316	-0.004	0.024	-0.032	0.824	0.212	-0.298	0.523	1.00		
Employees	-0.008	-0.009	0.017	0.147	0.509	0.101	-0.010	0.065	0.168	1.00	
Growth	-0.270	-0.051	-0.054	0.094	-0.418	-0.119	0.237	-0.422	-0.499	-0.112	1.00

Attachment 7 *Additional regression model for RR*

RR	(1) 2011-2016	(2) 2011-2019
FF*SHOCK	**-0.0206**	**-0.0081**
	(0.0303)	(0.0271)
CEO*SHOCK	**0.0049**	**0.0052**
	(0.0213)	(0.0186)
SHOCK	**0.0028**	**-0.0131**
	(0.0237)	(0.0215)
Size	**0.0460 ****	**0.0433 ****
	(0.0247)	(0.0116)
Age	**-0.0006**	**-0.0027**
	(0.0169)	(0.0188)
Capital Intensity	**0.0109**	**-0.0000**
	(0.0017)	(0.0073)
Growth	**-0.0033****	**-0.0023****
	(0.0017)	(0.0015)
Constant	**-0.646*****	**-0.454*****
	(0.2396)	(0.1723)
Number of observations	4,081	5,829
R squared	0.0075	0.0059

Attachment 8: *Interest expense form family firms and non-family firms (2011-2019)*



*Interest expense is reported as positive numbers

Attachment 9: *Parallel trend test for ROA for different ownership threshold*

ROA	**Ownership Definition 1**		**Ownership and Control Definition 2**	
	20% Threshold			
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**-000045** (0.0118)	**0.00333** (0.0110)	**0.0059** (0.0090)	**0.0079** (0.0084)
	80% Threshold			
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**-0,0216** (0.0,0095)	**-0,0075** (0.0095)	**-0,0062** (0.0085)	**0.00204** (0.0082)

Attachment 10: *Parallel trend test for TIE for different ownership threshold*

TIE	**Ownership Definition 1**		**Ownership and Control Definition 2**	
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
20 % Threshold				
FF*SHOCK	**-0.528** (0.374)	**-0.405** (0.363)	**-0.317** (0.311)	**-0.042** (0.293)
80 % Threshold				
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**-0.527** (0.568)	**0.395** (0.584)	**-0.126** (0.331)	**0.394** (0.310)

Attachment 11: *Parallel trend testing for alternative definition of control variables*

TIE	**Ownership Definition 1**		**Ownership and Control Definition 2**	
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**-0.0209** (0.0182)	**-0.0089** (0.0147)	**-0.0066** (0.0126)	**-0.00152** (0.0110)
Robust SE clustered	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES
Number of observations	2,792	2,792	2,792	2,792

Attachment 12: *Regression results on ROA for alternative control variables*

ROA	**Ownership**					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**0.0268** (0.0214)	**0.0261** (0.0190)	**0.01945** (0.0154)	**0.0158** (0.0145)	**0.0111** (0.0162)	**0.0117** (0.0158)
Ownership and Control						
	(7) 2011-2014	(8) 2011-2015	(9) 2011-2016	(10) 2011-2017	(11) 2011-2018	(12) 2011-2019
FF_CEO* SHOCK	**0.0233** (0.0145)	**0.0350*** ** (0.013)	**0.0326*** ** (0.012)	**-0.0264** ** (0.011)	**0.0235*** (0.012)	**0.0218*** (0.012)
Number of observations	3,785	4,782	5,743	6,614	7,428	8,188

Attachment 13: *Parallel trend testing for alternative definition of control variables*

TIE	**Ownership Definition 1**		**Ownership and Control Definition 2**	
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**-0.143** (0.378)	**0.376** (0.432)	**-0.413** (0.266)	**-0.358** (0.267)
Robust SE clustered	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES
Number of observations	1,956	1,956	1,956	1,956
T-statistic	-0.38	0.87	-1.55	-1.34

Attachment 14 *Regression results on TIE for alternative control variables*

TIE	**Ownership**					
	(1) 2011-2014	(2) 2011-2015	(3) 2011-2016	(4) 2011-2017	(5) 2011-2018	(6) 2011-2019
FF*SHOCK	**-0.211** (0.323)	**-0.047** (0.279)	**0.242** (0.257)	**0.425*** (0.246)	**0.291** (0.240)	**0.193** (0.226)
Ownership and Control						
	(7)	(8)	(9)	(10)	(11)	(12)
FF_CEO* SHOCK	**-0.161**	**-0.180**	**-0.020**	**-0.047**	**-0.122**	**- 0.175**

	(0.243)	(0.191)	(0.181)	(0.174)	(0.168)	(0.162)
Number of observations	2,610	3,254	3,852	4,390	4,885	5,337

Attachment 15: *Parallel trend test for alternative definition of explanatory variable*

ROE = Net income / Total equity

ROE	**Ownership Definition 1**		**Ownership and Control Definition 2**	
	(1) SHOCK = 2012	(2) SHOCK = 2013	(1) SHOCK = 2012	(2) SHOCK = 2013
FF*SHOCK	**0.0111** (0.0168)	**0.0048** (0.0151)	**-0.0038** (0.0111)	**0.0024** (0.0105)
Robust SE clustered	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES
Number of observations	2,792	2,792	2,792	2,792
Number of Firms	1,062	1,062	1,062	1,062
T-statistic	0.66	0.32	-0.34	0.22