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The Effect of Norwegian State Ownership

An empirical case study on the effect of the Norwegian privatization scheme on abnormal return and systematic risk

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Executive Summary

The purpose of this thesis is to analyse the effect of state ownership on abnormal return and systematic risk in Norwegian state-owned firms on the Oslo Stock Exchange in the period 1999-2015. This master thesis provides important insights for both retail and institutional investors by analysing the effect of state ownership from an investor perspective. Inspired by the current political debate and earlier studies on the effect of privatization we seek to answer the following research question: *"How does Norwegian state ownership affect abnormal return and systematic risk in Norwegian publicly listed firms"*

Using an OLS specification we find that state ownership is not significantly correlated with abnormal return. Furthermore, the OLS specification documents that state-owned firms are on average more exposed to systematic risk than private. The results demonstrate that state ownership has a neutral effect on abnormal return, and increases the systematic risk compared to private ownership.

The Event Model reveals that the immediate market reaction after a state divestment is negative. The results are robust and the exogeneity of the divestments are validated using the Synthetic Control Group Method. The results indicate the market perceives the Norwegian Government to contribute with abnormal return in Statoil and Telenor. However, we do not have empirical support to conclude on a general basis that state ownership affects all firm positively.

Further, the Event Model documents an increase in the systematic risk of the firm after a state divestment. The results from the General OLS Model and the Event Model suggest that state ownership leads to higher systematic risk compared to private firms and that privatization in Statoil and Telenor leads to higher systematic risk. One explanation could be that passive ownership increases the riskiness of the firm's investment and at the same time government funds protect the firm against downside risk. As a result, the systematic risk of the firm is lower than the weighted average of its investments.

The results contradict earlier studies which find that state ownership reduces efficiency and profitability. However, our results could be consistent with previous evidence as long as the Norwegian Government contributes with shareholder value which offsets the negative aspects.

Preface

This master thesis is written as part of the master's program in financial economics at the Norwegian School of Economics (NHH). The independent work has lasted one semester and comprises 30 credits.

During our studies at NHH, we have particularly taken interest in the ongoing debate concerning state ownership in Norway. Conflicting results regarding privatization and methodological challenges immediately caught our economic and empirical interest. The detailed scope of our thesis has been solely defined by the authors.

Working with this thesis has been both exciting and challenging. Especially, creating our own dataset and implementing the different models was comprehensive work. We have experienced that the knowledge gained from finance and econometric courses at NHH has been of great importance to the quality of this thesis. The work with this thesis has increased our knowledge about the effect of ownership type on stock performance. We find it exciting to work with a topic of current interest and to contribute to the ongoing political and economic debate of state ownership in Norway.

We want to thank our thesis supervisor, Professor Konrad Raff. Professor Raff has urged us to work independently from day one, although providing us with advice and good guidance along the process.

In addition to our supervisor, the following persons deserve credit for our final result: Tarjei Havnes professor at UiO, Christian Riis professor at BI, Ingrid Vinje and Torkel Halmø. Their input on the econometric and the economic aspect of this master thesis has been valuable to us.

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1 Introduction

Privatization has become an important economic and political mean to increase the efficiency of state-owned firms. The use of financial markets to allocate resources from Governments to private investors first initiated by the Thatcher government in United Kingdom in the early 1980s, now appears to be a legitimate argument for increasing profitability in state-owned firms (Megginson & Netter, 2001). However, the effect of partial privatization is widely argued since privatization programs often begin with the sale of non-controlling equity where control rights remain at the governments' hands. Thus, investigating the impact of partial privatization is of practical importance for investors and governments. Partial privatization is also of theoretical interest due to the insight it offers to the longstanding debate over why state-owned firms[1] perform poorly (Gupta, 2005). With a new coalition government in Norway favouring privatization, the question of privatization is yet again open for debate.

Numerous privatization schemes in the 80's and the 90's have generated a large amount of empirical literature regarding the effects of privatization on company performance. However, the majority of the empirical literature focuses on full privatization transactions in transitional economies where the majority stakes or all assets are transferred to private investors. Earlier studies find evidence that privatization leads to performance and efficiency gains. In contrast to the vast literature on full privatization, the number of studies on partial privatization programs is limited. Boardman and Vining (1989) were among the first researchers to study partial privatization programs. They found evidence that partial and fully state-owned firms perform worse than private companies, indicating that full privatization is necessary for achieving performance improvements. Prior to 2005 there existed little empirical evidence of positive efficiency effects from partial privatization (Gupta, 2005). In contrast to Boardman and Vining (1989), Gupta (2005) finds evidence of higher efficiency and profitability even with partial privatization when studying India's state-owned firms.

The objective of this thesis is to quantify the effects of state ownership from an investor's perspective focusing on abnormal return and systematic risk. In addition, we want to test the direction of the causality between excess stock return and the divestment decision. Previous literature does not test the direction of causality, but addresses the problem using instrument variables or other model specifications. This thesis seeks to fill the gap in the existing literature

[1] State-owned firms are in our analysis referred to as partially state-owned firms.

concerning the effect of partial privatization in a modern market economy from an investor's perspective. This master thesis aims to answer the following research question:

"How does Norwegian state ownership affect abnormal return and systematic risk in Norwegian publicly listed firms"

By answering the research question, we will be able to provide better knowledge to institutional and retail investors and to introduce quantitative arguments to the political debate of why privatization matters. In order to answer the research question empirically we have formulated three null hypotheses.

Following previous researchers, we believe that state ownership has a negative impact on the firm's performance and efficiency through non-profit goals. Hence, the following hypothesis is tested in this thesis:

Hypothesis 1: *The correlation between abnormal return and state ownership is negative*

Moreover, because the Government most likely prevents important national firms to face bankruptcy, we believe that the Norwegian Government reduces the downside risk and hence, the market risk of the firm. Thus, we formulate the hypothesis:

Hypothesis 2: *Private firms are more prone to systematic risk than state-owned firms*

We believe that a reduction in state ownership leads to a positive market reaction because of a reduction in political influence. Moreover, we believe that the market beta will increase due to the reduction in state ownership leading to less protection against downside risk. Hence, the following hypothesis will be tested:

Hypothesis 3: *A reduction in state ownership leads to a positive market reaction and increases the systematic risk of the firm*

Hypothesis 3 tests the market reaction to a divestment. Moreover, testing and analysing the results both empirically and with the use of economic theory enable us to answer the research question listed above.

The thesis is organized as follows. Section 2 briefly describes the main characteristics and history of the Norwegian privatization program in the late 90's until today. Section 3 gives a brief summary of relevant previous literature and theoretical arguments. Section 4 presents theory relevant for the methodology. The dataset is presented in Section 5 and in Section 6 the methodologies and the results of the models are presented in sequential order. The economic

analysis of the main results are presented in Section 7. As an additional analysis, the individual relationship between the state-owned firms and abnormal return is analysed in Section 8. Finally, we conclude on the basis of the economic and empirical analysis in Section 9.

2 History and the Privatization Process

2.1 Historical Review of the Norwegian Privatization Scheme

In the early 1990s new principles of public administration were introduced in Norway to enhance the performance of state-owned enterprises. The private market was used as the benchmark model and the Government assumed that a private market design of the public sector would make it more efficient and qualitatively better. The first step towards a more market-driven economy was the corporatization[2] and privatization of public firms during the 1990s and early 2000s. Although socialization was never an important political goal in Norway, the Norwegian Government had developed a significant public ownership over the years. (Sejersted, 2015)

The Norwegian state ownership model, referred to as the "Hydro Model", is based on passive ownership and the arm length principle, which provides companies commercial freedom and reduced government interference. The Government's principles of good ownership does not allow discriminations between state and private owners. Thus, the Government cannot use political power in decision making. However, in most of the privatization transactions the Norwegian Government retained the control rights in the firm. As a controlling shareholder, the Government can ensure majority consensus in important business decisions such as long term investments and headquarter locations. Historically, this topic has been a critical argument in favour of state ownership.

In the early 2000s many state monopolies were deregulated, especially in the public service sectors. The state-owned firms, which were not privatized went through a corporatization process to enhance their competitiveness in the newly deregulated markets. As a part of the corporatization scheme, the Civil Aviation Administration (Luftfartsverket) and parts of the Norwegian Coastal Administration (Kystverket), National Rail Administration (Jernbaneverket) and the Norwegian Public Roads Administration (Statens Vegvesen) converted into separate joint stock companies. (Sejersted, 2015)

[2] In this thesis, corporatization is defined as the process of implementing and transforming a state-owned firm to look like and behave as a private without selling to private investors. The difference between privatization and corporatization is that shares of the privatized firm are sold by listing the firm on a stock exchange, whereas corporatized firms are still 100% state-owned.

Telecom was the first sector to be privatized. In December 2000, Telenor was listed on Oslo Stock Exchange and a large part of the shares were sold to private investors. Six months later, the privatization wave continued with the PIPO[3] of Statoil in June 2001. Until 2005, further divestments in the listed state-owned firms; DNB, Statoil and Telenor continued. The divestments in Statoil and Telenor were completed through secret block sales to institutional investors, followed by a sale to retail investors approximately a week later. In addition, in October 2005, the giant salmon farming company, Cermaq, went public. This was the end of the privatization scheme, and after the Stoltenberg II coalition government ended in 2005, the privatization wave died out with some exceptions.

In 2013, a new privatization wave started with a new government in Norway. In October 2014 Entra, one of Norway's leading real estate companies, went public on Oslo Stock Exchange. The new Government also planned a PIPO of Mesta, one of Norway's biggest contractors in construction, operation and maintenance of roads. In addition, the Government now wants to divest in multiple state-owned companies such as Telenor, Kongsberg, Flytoget, Statsskog and Hydro. However, due to political disagreement and civic engagement the plans have been put on hold.

2.2 The Financial and Political Process of Divestments

The divestment transactions are often completed through a block sale, and later a small fraction sale to retail investors. However, there exists other relevant processes before the actual divestment takes place. The formal political and financial process associated with the reduction of state ownership consists of three parts. First, the proposal has to be submitted to the Government by the responsible ministry. Which ministry, depends on the firms operational industry. Second, after the Government has considered and agreed on the proposal, a bill will be promoted to the Parliament. Third, once the Parliament has considered the proposal and agreed, the transaction can be carried out. If the responsible ministry already has authorization to carry out the transaction, it is usually sufficient to inform the Parliament after the transaction is completed. The Government normally engages investment banks to carry out the transaction. Legal and financial consultants are also engaged in this process. The financial process secures

[3] PIPO: Privatization Initial Private Offering

that the shares trade at fair value. At the execution date the financial market gets information about the size, buyer and further plans for the sale to retail investors.

3 Why Privatization Matters

3.1 Theoretical Arguments

The analysis focus on theoretical arguments concerning stock return. Previous literature on privatization have often focused on the social welfare aspect of state ownership, considering everything from working condition to market failure. We do not regard these effects from privatization as unimportant, but they are outside the scope of our analysis. An additional difference compared to previous work is that this thesis concentrate on analysing partially state-owned firms. The firms in our sample have characteristics from both fully state-owned and private firms, as a consequence, not all previous arguments[4] regarding full privatization are relevant for the analysis. While there is little theoretical framework on mixed ownership, the analysis utilize previous arguments from Agency Theory and the impact of soft budget constraints, to explain the effect of state ownership.

3.1.1 *The Political View*

In perspective of Agency Theory, a decrease in state ownership can result in shareholder value maximization. The "Political View" postulates that governments promote political and social goals that might be in conflict with shareholder value maximization (Shleifer, 1994). From an Agency Theory perspective managers are agents under the control of the principals. The Government has the power to incorporate conflicting goals in the contract with the managers if they have the majority of the shares. Thus, a reduction in state ownership has the potential to eliminate conflicting goals and ensure a profit maximizing contract between the principals and agents which results in higher stock return. Shareholders might be governments, private institutional block holders or retail investors and will likely have different performance measures and expectations (Li, Xia, Long, & Tan, 2012). Hence, diverging goals make control rights over the firm a critical factor when principal-agent contracts are to be determined.

In addition, political goals can change from one administration to the next. The failure to credibly commit to a set of goals or policies can reduce the efficiency of a firm's operations

[4] Numerous papers have used Property Rights theory to explain why fully state-owned firms might be less efficient than private. The theory is not relevant in this study because we are analysing publicly listed firms with dominant residual claim over its profits.

and governance (Megginson & Netter, 2001). Likewise, managers in traditional state-owned companies are less motivated to strive for efficiency and profit maximization since the company is part of an administrative-bureaucratic system of the government. The systems are more concerned with compliance rather than value creation (Li et al., 2012). This type of problem is most likely significantly reduced for state-owned firms listed on a stock exchange, however, Li et al. (2012) argue that further privatization increases the efficiency of the company. They claim that managers act under guidance from the government and will be influenced by the administrative-bureaucratic system as long as the government retains control rights.

3.1.2 *The Managerial View*

On the other hand, the "Managerial View" explained in Laffont (1993) provides a new perspective on privatization. The "Managerial View" postulates that dilution of ownership in terms of further privatization may have an adverse impact on stock price (Gupta, 2005). Efficient diversification of owners seems to result in a clear separation between ownership and control (Fama, 1980). Managers might seek to maximize firm size, and not profits, and individual shareholders generally have no interest or resources to personally monitor managers (Fama, 1980). As a consequence, a well-diversified, low concentrated ownership can result in agency problems through corporate governance problems and information asymmetry. While small investors might not have the resources or time to influence the managers, a strong owner has incentives and power to induce control and discipline over managers. In contrast to the "Managerial View", Nickell (1996) argues that ownership does not affect performance. He states that competition in general eliminates agency costs through an efficient allocation of resources which reduces managerial slack and stimulates higher effort from managers and employees.

3.1.3 *Soft Budget Constraints*

Soft budget constraints in state-owned firms could lead to less competitive and effective companies. Frydman, Gray, Hessel and Rapaczynski (2000) and Majumdar (1998) are two of several studies arguing that soft budget constraints are a major source of inefficiency. They argue that the threat of takeover disciplines the managers who are not maximizing firm value. State-owned firms are not exposed to the same market discipline as private because governments are less likely to let big and important companies to face bankruptcy or to allow

takeovers. Private firms strives to be as efficient as possible to avoid financial distress and takeovers. On the other hand, state-owned companies could lack the motivation to be as efficient leading to less competitive and profitable companies (Kornai, Maskin, & Roland, 2003).

3.1.4 *Theoretical Conclusion*

To our knowledge, economic theory does not provide any clear guidance on the trade-off between the “Political View” and the “Managerial View”. Most of the earlier arguments presented in this Section are possible explanations of the change in efficiency and profitability due to private ownership, rather than the effect on abnormal return. Beyond profitability and efficiency gains, other advantages and disadvantages of state ownership regarding abnormal return makes a theoretical conclusion based on previous theoretical arguments inconclusive.

3.2 **Previous Empirical Evidence on Privatization**

This Section presents the methodology and the results from some of the main studies on state ownership and privatization. There are two main groups of studies within the privatization literature, "*State versus Private*" and "*Pre versus Post*"-analysis (Frydman, Gray, Hessel, & Rapaczynski, 1999). The same categorization is used in our literature review in order to give a systematic review of previous literature. Moreover, specific attention are given to studies most relevant to the research question. The Section is organized as follows: The first part compares the performance of fully state-owned companies with either private or mixed-owned firms to address the effect of state ownership. The second part concentrates on the change in performance following a privatization, and utilize the change in ownership to do an event study on the effect of state ownership.

3.2.1 *State versus Private Analysis*

The claim that privatization improves firm performance is often the reason behind the privatization programs seen to date. A substantial contribution to this claim stems from the *"State versus Private"* literature (Frydman et al., 1999). The first part start off with a conceptualization of relevant existing papers using this method.

Boardman and Vining (1989) point out numerous theoretical arguments for why private companies should be more efficient than state-owned. Most importantly, they argue that state ownership inhibits managers to bear the consequences of their decisions leading them to pursue personal goals, resulting in reduced profitability. However, empirical literature prior to Boardman and Vining (1989) provides little evidence of privatization effects on company efficiency and profitability. The authors provide several reasons for why earlier empirical results are biased. Among many, they point out that numerous authors only assess companies operating in a limited context e.g. natural monopolies or regulated duopolies. To avoid the methodology weaknesses of previous work, Boardman and Vining (1989) estimate a panel data model using 500 non-US companies operating in competitive markets. Using return on equity, return on assets, return on sales and net income as profitability measures, the author estimates the impact of ownership on performance. To control for the different ownership structures the authors include dummy variables for both state and mixed ownership making private companies the benchmark. In order to account for different accounting principles between countries the authors employ different country dummies. Their empirical results are consistent with their hypothesis, suggesting that mixed and state ownership perform worse than private companies. Hence, full privatization is necessary for achieving performance improvements (A. E. Boardman & Vining, 1989).

Boardman and Vining's paper (1989) is of relevance to this thesis because of their distinction between private and mixed ownership. Their effort to estimate the average impact of privatization makes their methodology comparable to our first hypothesis. Furthermore, they provide useful insight into the theoretical arguments of why private companies should outperform state-owned. In particular they focus on the political influence[5] in the state-owned firms.

In addition to Boardman and Vining (1989), researchers such as Dewenter and Malatesta (2001), and Frydman, Gray, Hessel and Rapaczynski (1999) use the "Political View" and argue that state-owned companies underperform relative to private companies due to the pursuit of other goals[6] than profit maximization. As a consequence, they expect state-owned companies to be less efficient than private. In order to test this hypothesis, Dewenter and Malatesta (2001) employ a similar panel data model as Boardman and Vining (1989). However, they employ a larger cross-sectional sample over longer time periods and control for additional factors that

[5] Referred to as the "Political View" in later studies
[6] E.g. social and political objectives.

might influence company performance. Dwenter and Melatesta (2001) find further empirical evidence that private companies outperform state-owned companies, even when they control for size, location, industry, and business-cycle effects.

As opposed to Boardman and Vining (1989) and Dewenter and Malatesta (2001), Frydman et al. (1999) study full privatization. Their empirical strategy is to investigate privatization effects on revenue growth, employment, labour productivity and cost per output in a fixed effect regression to control for potential pre-privatization fixed differences. Using data from 90 fully state-owned and 128 privatized companies from transition economies in Central Europe, Frydman et al. (1999) investigate the general effect of full privatization. In contrast to previous studies, Frydman et al. (1999) differentiate between insider and outsider-owners[7]. In their analysis, they find that the effect of a change in ownership is significantly different depending on the type of owners to whom control rights are given. The authors find that post-privatization performance of companies controlled by inside owners is not significantly different from state-owned companies. Whereas outsider-owned companies show superior post-privatization performance compared to fully state-owned and privatized companies controlled by insiders. Frydman et al. (1999) results are important because they provide a new insights to the existing literature and give explicit suggestions of how to design privatization programs in order to maximize the benefits. The study challenges the claim that privatization on average leads to higher profitability and emphasizes the need to specify to whom control rights are given (Frydman et al., 1999).

3.2.2 *Pre- versus Post-Privatization Analysis*

The second group of studies examines companies privatized through public share offerings. While these studies employ different empirical techniques, the majority of the studies measures the performance effect of privatization by comparing the 3-year mean or median post-privatization performance to their own 3-year mean or median pre-privatization performance (Boubakri & Cosset, 1998; D'Souza & Megginson, 1999; Megginson, Nash, & Vanrandenborgh, 1994). Megginson, Nash and van Randenborgh (1994) were the first researchers to employ the method, hence it is referred to as the MNR methodology (Megginson & Netter, 2001). The MNR methodology has several economic and econometric drawbacks. Of these, selection bias is of great concern. State-owned companies are most likely be biased towards the largest and most profitable companies. Furthermore, state-owned companies sold

[7] Examples of insider-owners are employees and managers. Outsider-owners are owners external to the firm.

through share offerings might be among the healthiest state-owned companies because governments have a tendency to privatize the best performing companies first (Megginson et al., 1994). As a consequence, the estimated general privatization effect on performance might be biased.

Using the MNR methodology Megginson, Nash and van Randenborgh (1994) argue that the lack of efficiency in state-owned firms is a result of political interference, which Gupta (2005) refers to as the "Political View". The company becomes less efficient since the government pursue objectives other than profit maximization. Hence, only the transfer of management control to private owners is likely to increase efficiency in state-owned firms. Megginson et al. (1994) examine the effects of privatization using a large sample of 61 companies from 18 countries and 32 industries that experience full or partial privatization through public share offerings during the period 1961 to 1990. For the full sample they document an increase in profitability, capital spending and employment (Megginson et al., 1994). Testing the same hypothesis and using the same methodology D'Souza and Megginson (1999) and Boubakri and Cosset (1998) find supporting evidence that privatization works.

Prior to 2005 little research has been done on partial privatization (Gupta, 2005). Gupta (2005) argues that full privatization makes it difficult to distinguish between the "Political View" and the "Managerial View" because ownership and control rights shift to the private sector at the same time. Partial privatization through an IPO enables Gupta (2005) to test the "Managerial View" since the partially privatized company still remains under government control and is subject to political interference (Gupta, 2005). Gupta (2005) uses the "Managerial View" to argue that state-owned companies underperform relative to private owned. Difficulties in monitoring managers or the lack of public share price to provide information about manager actions and skills could result in agency costs. This argument is also shared by La Porta and López-de-Silanes (1999). Gupta (2005) argues that without a public share price, the managerial incentive contracts are restricted leading to reduced performance. Observing the pre- and post -privatization performance of 42 companies partially privatized by the Indian government over the period 1990 to 2000, Gupta (2005) seeks to test whether the performance of state-owned firms in India is affected by the sale of non-controlling equity stakes in the stock market. Following the privatization literature, Gupta (2005) investigates the effect of partial privatization on profitability, labour productivity, investment expenditures and employment.

Rather than employing the MNR methodology, Gupta (2005) uses a panel data model and includes an explanatory variable which measures the accumulated percentage of private equity.

The author finds significant increase in both the level and growth in performance following partial privatization. La Porta and Lopez-De-Silanes (1999) support this conclusion with evidence of large increases in profitability for privatized Mexican companies. They find that the average operating-income-to-sales rises by 24 percentage points in the post privatization period (La Porta & Lopez-De-Silanes, 1999).

3.2.3 *Conclusive Remarks*

All of the privatization studies discussed so far use accounting measures of profitability. However, there are several drawbacks of using accounting information when estimating performance improvements. First, accounting measures are sensitive to different accounting principles (Megginson et al., 1994). Second, accounting data is highly manipulative and are not always reflect the company's true performance (Teoh, Welch, & Wong, 1998).

As mentioned in Frydman et al. (1999) and Megginson et al. (1994), there exists several econometrical challenges when assessing the effects of privatization. Among them are selection bias and the exogenous assumption of the ownership variable. Frydman et al. (1999) and Gupta (2005) provide an interesting and feasible approach to address the potential issues of selection bias. Frydman et al. (1999) and Gupta (2005) are to some degree able to control for pre-privatization fixed differences between the companies using a fixed effect specification on company level. Finally, previous literature discuss and try to avoid[8] the possibility of reverse causality and simultaneously bias, suggesting that causality runs from profitability to privatization or both ways at the same time. However, they do not test the actual direction of the causality between performance and privatization.

In our opinion Gupta (2005) provides the most persuasive paper. First, the study addresses the problems of selection bias and endogeneity. Second, Gupta (2005) is able to test the "Managerial View" when she investigates companies partially privatized through IPOs. However, the part of the "Managerial View" which focuses on the lack of stock price to provide information is not relevant in the analysis because the companies in our sample already trade publicly. The analysis utilize the argument of the "Managerial View" which focuses on the effect of dilution of ownership.

[8] Gupta (2005) provides a solutions to the problem by instrumenting the privatization variable using higher lags of the dependent variable and the privatization variable in a GMM Model developed by Arellano and Bond in 1991. However, Frydman et al. (1999) fail to address the potential endogenous nature of the privatization variable.

On the basis of previous research, this thesis seeks to bring new insight into to the discussion of why privatization matters by analysing the effect of state ownership on abnormal return and systematic risk. In addition, our thesis contributes with new insight using stock return as performance measure, thus eliminating shortcomings due to accounting manipulations and different reporting principles in earlier studies. Finally, this thesis adds a new element to the existing literature by providing an approach to test the direction of the causality between privatization and performance.

4 Theory of the Methodology

This Section gives an introduction to the theory underpinning the empirical models and analysis. First, the Section introduces the Capital Asset Pricing Model, CAPM, and explain its implications. CAPM is one of the most recognized portfolio theories, and is central to the economic reasoning in the analysis. Further, we focus on deviations from the CAPM using the Fama French Four Factor Model in the empirical models. Second, the Efficient Market Hypothesis is introduced to explain the economic rationale behind the event study. Moreover, the Efficient Market Hypothesis provides insight to the market mechanisms after an exogenous event.

4.1 Capital Asset Pricing Model

The Capital Asset Pricing Model, abbreviated CAPM, is based on assumptions from Markowitz's Portfolio Theory (1952) and was developed independently by Sharpe (1964), Lintner (1965) and Mossin (1966).

CAPM is based on numerous assumptions. Among other, CAPM assumes that all investors have the same information and that they want to maximize the relationship between risk and return, referred to as "mean variance optimization" (Sharpe, 1964). Furthermore, CAPM assumes that all investors optimize their portfolio according to Markowitz's portfolio optimization. The assumption implies that if all investors observe the same investable universe and have the same investment opportunities, their efficient frontiers will be identical. Facing the same risk free rate, all investors will draw an identical tangent CAL, Capital Allocation Line, composed of the same risky assets (Sharpe, 1964). As a result, the market portfolio has the same weights as the individual risky portfolios. For this reason, the individual Capital Allocation Line will also be the Capital Market Line.

Likewise, in a world where CAPM assumptions hold, the model implies that the optimal risky portfolio is the market portfolio and that every investors hold this portfolio. The market portfolio is perfectly diversified and is the portfolio which gives the highest return per unit risk.

CAPM is built on the insight that the appropriate risk premium on an asset is determined by its contribution of portfolio risk. The relevant risk is the systematic risk, because idiosyncratic risk can be eliminated through diversification. Mathematically, the model is expressed as:

$$E(r_i) = r_f + \beta_i[E(r_m) - r_f]$$

$E(r_i)$ is the expected return of asset i, r_f is the risk-free rate and $E(r_m)$ is the expected market return. The β represents the relationship between the return of the asset and the market portfolio, and is referred to as the market beta. The market beta represents the normal excess stock return of the firm. The beta of the firm is interpreted as the expected percentage change in excess stock return given one percent point change in the return of the market portfolio. The market beta can be defined as:

$$\beta_i = \frac{Cov(r_i, r_m)}{\sigma_m^2}$$

The relationship between the expected return and the market beta can be interpreted as a reward-risk equation. Risk-averse investors measure the risk of the optimal risky portfolio by its variance. Hence, the risk premium on individual assets is expected to depend on the contribution of the asset to the risk of the portfolio. The market beta measures the stock's contribution to the variance of the market portfolio, therefore, the required risk premium is a function of beta. Moreover, CAPM states that the security risk premium is proportional to both the beta and the risk premium of the market portfolio. That is, the risk premium equals:

$$\beta_i[E(r_m) - r_f].$$

The expected return-beta relationship can be portrayed graphically as the security market line, SML, where the slope is the excess return of the market portfolio.

In CAPM the market portfolio is efficient and consists of all investment opportunities. For instance, the portfolio consists of human capital, which is not observable. As a consequence, a proxy for the hypothetical market portfolio need to be used. For this reason, empirical work has shown that there could be other factors which significantly affect the excess stock return (Bessembinder & Zhang, 2013; Fama & French, 1993, 1996). The relationship between a company's expected return and factors not explained by CAPM is called pricing anomalies. The most recognized pricing anomalies are the value, size and momentum effect, which are incorporated in the Fama French Four Factor Model.

4.2 Fama French Four Factor Model

Empirical research has shown that common risk in stock returns is fairly well explained by the four factors, excess market return, SMB[9], HML[10] and MOM[11] (Carhart, 1997; Fama & French, 1993; Lyon, Barber, & Tsai, 1999)

The Fama French Four Factor Model is one of the most recognized multifactor models. Fama and French discovered that only 70% of the stock return could be explained by the market beta (Fama & French, 1992). They tested different multifactor models, and found that size and value had a significant effect on the stock price which resulted in the Fama French Three Factor Model (Fama & French, 1993). Later the three factor model was augmented by Carhart (1997), including a fourth factor, the momentum. The augmented Fama French Model consists of four factor portfolios, the market excess return, SMB, HML and Momentum.

$$r_{it} - r_{ft} = \alpha_i + B_i(r_{Mt} - r_{ft}) + \gamma_i SMB_t + \theta_i HML_t + \delta_i MOM_t + \varepsilon_{it}$$

Fama and French (2004) claim that the biggest shortage of the Four Factor Model is its economic support. The model is a result of data mining for significant factors. This implies that the empirical relationship is known, but not the economic relationship between the stock return and common risk factors; SMB, HML, Momentum.

4.3 The Efficient Market Hypothesis

The Efficient Market Hypothesis is based on the assumption that stock prices reflect all relevant information about the asset's fundamental value (Fama, 1965; Samuelson, 1965). The hypothesis is based on the assumption that investors have access to the same information as the market and that the stock price is fully reflected by available information. New and relevant information results in a change in the stock price, which eliminates arbitrage opportunities. If these assumptions hold, investors can only expect to achieve annual, risk-adjusted returns. It will be impossible to "beat the market" if the hypothesis of an efficient market is valid (Fama, 1965).

[9] Small Minus Big
[10] High Minus Low
[11] Momentum

There exists three forms of market efficiency: weak, semi-strong and strong. Weak form efficiency implies that the stock price reflects historical data. In a semi-strong form, all investors have access to public information, in addition to historical data. Given the assumption that stock prices adjust quickly to all new available information and investors purchase stocks after this information is released, an investor can only "beat the market" with private information. Hence, to beat a semi-strong efficient market, the investor has to trade on relevant private information. In a strong form efficient market stock prices reflect private, public and historic information, hence investors will not be able to profit above the average investor.

Assuming that stock prices react solely to new and unpredictable information and that price movements are correct and immediate, the stock price follows a random walk implying that the stock return at time *t* is independent of the stock return at time *t-1* (Fama, 1965). For this reason, stock price movements are random and cannot be predicted based on historical data. Today's share price is therefore the best estimate of tomorrow's price.

5 Data

5.1 Creating the Dataset

Our dataset consists of industry, country of origin and daily observations of stock prices[12], market capitalization and trading volumes of 76 international publicly traded companies for the period, 04.01.1999 - 31.08.2015. Daily log stock return is calculated in Excel and is the log of the percentage change in stock prices between trading days. In addition, we have collected the ownership shares of the Norwegian Government and subsequent changes in state ownership. The companies operate in eight different industries and have headquarters in 21 different countries. Furthermore, the sample constitutes of eight companies partially owned by the Norwegian Government and 68 private companies. See Table 10 and 11 in the Appendix for the full list of private and state-owned firms sorted by industry. Firms going public after 04.01.1999, are included in the sample as of their first trading day. Firm level data is collected from the Bloomberg terminal and the daily Fama French four factors[13] are collected from Fama and French's website. The four Fama French factors[14] are the market excess return, SMB, HML and Momentum. The risk free asset is the 1 month American T-bill. Daily risk free return is the arithmetic mean of the 1 month T-bill return.

We use the American market factor defined by French (2015) to control for market risk rather than Oslo Stock Exchange. The state-owned firms have in common that they are large and operate internationally. This implies that they are likely to be exposed to international movements. In addition, Oslo Stock exchange is of limited size, as a result, a value weighted market portfolio of the Norwegian market will mainly reflect the return of a few large companies (Ødegaard, 2009). This will lead to simultaneous bias when estimating the

[12] Closing price

[13] The four Fama French factors are in log returns.

[14] "The Fama/French factors are constructed using the 6 value-weight zero-cost portfolios formed on size and book-to-market. SMB (Small Minus Big) is the average return on the three small portfolios minus the average return on the three big portfolios. HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios. R_m-R_f, the excess return on the market, value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ that have a CRSP share code of 10 or 11 at the beginning of month t, good shares and price data at the beginning of t, and good return data for t minus the one-month Treasury bill rate" (French, 2015)

systematic risk (A. Boardman et al., 1986). As a consequence, the American market is used as a proxy for the market portfolio.

In order to create the panel dataset, we had to match the trading dates for our Fama French variables with the daily observations of each firm and then delete non-trading days. This resulted in deletion of 154 daily observation from each company, 12.012 observations in total. Hence the data consists of 286.460 daily observations. Market capitalization is the daily market capitalization using the closing price. Trading volume is the daily trading volume at the end of each trading day. Our dataset results in a strongly balanced panel dataset (76x4191). A summary of raw daily log stock return, daily market capitalization and daily trading volume organized by ownership type is presented in Table 1.

Raw Return

Ownership	Number of firms	Observations	mean	sd	min	max
State-owned	8	29,209	0.000247	0.0238	-0.425	0.282
Private	68	297,858	0.000227	0.0238	-1.291	0.452
All	76	327,066	0.000229	0.0238	-1.291	0.452

Trading Volume

Ownership	Number of firms	Observations	mean	sd	min	max
State-owned	8	28,267	3,503	5,132	0.194	303,687
Private	68	286,216	8,043	24,076	0.00100	1.074e+06
All	76	314,483	7,635	23,056	0.00100	1.074e+06

Market Capitalization

Ownership	Number of firms	Observations	mean	sd	min	max
State-owned	8	29,209	97,238	124,131	1,678	682,689
Marketcap	68	297,857	56,303	221,945	4.176	3.706e+06
All	76	327,066	59,959	215,344	4.176	3.706e+06

Table 1: Daily raw return, daily trading volume and daily market capitalization sorted by ownership type. All variables are sampled from the period 04.01.1999-31.08.201. Raw return is the average daily log stock return. Trading volume is the average daily trading volume. Market Capitalization is the average daily market cap. The dataset consists of eight state-owned and 68 private firms. The state-owned firms are; Statoil, SAS, Telenor, Cermaq, Hydro, Yara, Kongsberg Gruppen and DNB. The firms are headquartered in 21 different countries, see Table 10 and 11 in the Appendix for further details.

As shown in Table 1, state-owned firms have in average higher daily raw stock return than private firms. Although, comparable firms are included based on size, see next Section for further details, the table reveals that the average state-owned firm has a higher market capitalization than the average private firm. In addition to differences in size, trading volume is on average higher for private firms. However, this is expected because the Government does not actively trade, thus reducing the free-float of the company.

5.2 Selection of Private Companies

The selection of private firms[15] is based on the criteria; size, industry and credit rating. To ensure that the firms are private and not owned by a foreign government, previous ownership details back to 1999 are studied. In order to minimize selection bias, we choose private firms that have the same visible characteristics as the state-owned firms (Frydman et al., 1999). Optimally, the firms should be identical, except for the type of ownership. However, state-owned firms are quite different from each other in terms of industry, capital structure and competitive climate. For this reason, we include the peers[16] to each state-owned company. Bloomberg's peer-group suggestions to each state-owned firm are used to define the respective peer-groups. The peer-group of each state-owned company operates in the same industry and are of similar size[17] and credit rating. Each peer-group consists of three to ten companies depending on the size of the industry and the quality of the financial market where the company is listed. We exclude[18] companies from emerging markets; China, India, Thailand, Egypt and Romania. Our final selection of companies with their corresponding industry is presented in Table 10 and 11 in the Appendix. Moreover, we include only industries in which Norwegian state-owned companies are present, thus reducing the possibility of fundamentals differences between industries with and without state-owned companies. In summary, the dataset consists of 68 private and eight state-owned companies from eight industries and 21 different countries.

5.3 Removing Outliers

The importance of removing outliers in financial data is often disputed in the empirical literature (Hadi & Simonoff, 1993). Irregular outliers[19] may have a significant impact on the regression output and lead to biased results. On the contrary, outliers may also be valid observations, hence adjustments are largely subjective. The daily return series are illustrated in Figure 10 in the Appendix and the graph reveals some particularly extreme observations.

[15] Throughout this thesis, we define private firms as firms with no state ownership after 1999. For Firms privatized before 1999, we assume that the effect of previous state ownership is negliable.
[16] Peers are firms that are comparable in terms of size, industry, credit rating and or are competitors of the firm in question.
[17] Market capitalization is used as a proxy for size.
[18] The companies from emerging markets are excluded in order to reduce the problem of artificially low market betas arising from low liquidity and low degree of integration in the financial market where the companies are listed.
[19] Defined as extreme data points

Extreme returns may have a significant effect on the results. For this reason, a technique called "Winsorization" is applied on the excess return variable. The “Winsorization” procedure involves replacing extreme observations with an upper or lower limit of less extreme excess returns. The most common "Winsorization" level within financial analysis is the 98% level (Leone, Minutti-Meza, & Wasley, 2012). As a result, the 1st and 99th percentile are chosen as the lower and upper limit of the excess return variable. Note that excess returns greater than the 99th percentile and lower than the 1st percentile are not removed, but replaced with their respective boundary. Thus, 2% of the daily excess return observations for the period are modified to either an upper or lower limit. The rationale behind the process is that the observations continue to affect the regression output, but not undermine the analysis. An alternative strategy is to delete extreme observations. However, this would lead to loss of potential valid observations. The daily excess returns after the “Winsorization” are illustrated in Figure 11 in the Appendix.

5.4 Advantages and Disadvantages of the Dataset

Our dataset has different attributes than other privatization studies. First, stock return rather than accounting measures are used as the dependent variable. Market data is less prone to manipulation and is not affected by accounting principles. Moreover, stock return provides us with an unbiased estimator of future profits (A. Boardman et al., 1986). The stock market allows us to benefit from the assumption about an efficient market, as a consequence, the market reaction of an event is the correct adjustment in the price due to changes in the NPV of future profits. Moreover, market data enables us to get frequent observations which is crucial to an event study (Brown & Warner, 1980; Campbell, 1997). Finally, market data allows us to use pricing models and to isolate the potential change in abnormal return and systematic risk.

Second, the firms included in the dataset are listed on highly developed stock exchanges which increases the likelihood of stock prices being an unbiased estimate of future profits. In addition and in contrast to Frydman et al. (1999), who only observe whether firms are privatized, our firms have detailed ownership information which let us analyse the effect of a change in state ownership. Third, the dataset consists of different industries and follows Boardman & Vining’s (1989) suggestion of using a multi-industry approach.

Fourth, we include only industries where state-owned companies are present, thus reducing the possibility of fundamentals differences between industries with and without state ownership. In

addition, the dataset includes private companies similar to the state-owned firms, thus reducing the fundamentals differences between private and state-owned firms mentioned by Frydman et al. (1999).

The main concern about the dataset is the small number of state-owned firms. Too few state-owned firms may result in low cross-sectional variation which might affect the significance level. In addition, a small sample means that we must be careful not to generalize the results. The selection of state-owned firms could have been extended by looking at other countries such as Sweden and Denmark, and analysing the effect of state ownership in Scandinavia. An extension of the dataset is interesting, but we want to focus on state ownership in Norway, thus only Norwegian state-owned firms are included.

6 Methodology and Results

This Section presents the methodology and the results. In order to give a systematic and correct empirical approach to the research question, we employ three different econometrical models; the General OLS Model, the Event Model and the Synthetic Control.

6.1 Empirical Strategy

Our methodology is twofold. First, our methodology seeks to identify the effect of state ownership on abnormal return and systematic risk for Norwegian state-owned firms using a Pooled OLS specification. The model is inspired by the "*State vs. Private*" literature described in Section 3.2.1. The OLS framework allows us to benefit from both cross-sectional and time-variation in the sample. Second, we conduct an event study in order to isolate and quantify the market reaction from a change in state ownership, ceteris paribus. The market reaction gives an indication on how the market perceives the Norwegian Government as an equity owner[20]. In addition, the event study gives an indication of the severity of the potential selection bias problem in the OLS specification. In order to address both abnormal return and systematic risk, the Event Model[21] separates the privatization effect into an immediate market reaction and a structural change in the systematic risk of the firm. The final model, the Synthetic Control[22], is a robustness test of the Event Model. Testing the exogenous event assumption is critical due to the possibilities of reverse causality and omitted variable bias in the Event Model. Finally, as a supplementary analysis we investigate the individual relationship between the state-owned firms and abnormal return in an industry-specific OLS specification.

[20] For instance, if the estimated market reaction is close to zero or insignificant, the market might be indifferent between having the Government as an owner, implying that state ownership is not causing any abnormal return.
[21] The Event Model is inspired by the article of Dube et al. (2011), which analyses the effect of national coups on stock prices.
[22] A method for causal inference in comparative case studies (Abadie et al., 2010; Abadie, Diamond, & Hainmueller, 2015; Abadie & Gardeazabal, 2003)

6.2 The General OLS Model

The General OLS tests the following hypotheses:

Hypothesis 1: *The correlation between abnormal return and state ownership is negative*

Hypothesis 2: *Private firms are more prone to systematic risk than state-owned firms*

6.2.1 *Selection of State-Owned Companies*

This thesis focuses on the effect of state ownership where the Norwegian Government has a strategic and direct ownership, as a consequence, ownership held by the State Pension Fund Global and the State Pension Fund Norway are not relevant. In the General OLS Model every public listed company with direct state ownership is of relevance[23]. The final selection of state-owned firms in the General OLS Model includes; Hydro, Kongsberg Gruppen, Telenor, Statoil, Cermaq, DNB, SAS and Yara. An overview of the Norwegian Government's ownership shares is given the Table 2.

Company	State Ownership
Statoil	67.0%
Telenor	53.97%
Hydro	34.26%
Yara	36.2%
Cermaq	0.0%
SAS	14.3%
DNB	34.0%
Kongsberg Gruppen	50.0%

Table 2: State ownership, as of 09.11.2015, for the selection of state-owned firms in the General OLS Model. Cermaq went public 24.10.2005 and was fully privatized in 2014.

6.2.2 *The General OLS Specification*

Comparing the stock return of state-owned companies to private firms is one method through which the effect of state ownership can be estimated (Megginson & Netter, 2001). The General OLS Model follows the methodology of the "*State vs. Private*" literature described in Section 3.2.1. The objective is to identify the average impact of state ownership on abnormal return and

[23] Aker Solution and Kvaerner are indirectly owned by the Government through a holding company, Aker Holding and for this reason, omitted from the sample. Raufoss is omitted from the sample because the firm faced bankruptcy in 2003.

systematic risk by comparing state-owned to private firms using the following OLS specification[24]:

$$R_{it} = \beta_0 + \alpha_i + \beta_1 SOE_i + \beta_2 StateBeta_i + \beta_3^i R_t^m + \beta_4^i SMB_t + \beta_5^i HML_t + \beta_6^i MOM_t + \beta_7 Year_t + \beta_8 Month_t + \beta_9 Industry_i + \varepsilon_{it}$$

$$StateBeta_i = SOE_i * R_t^m$$

R_{it} is the daily log excess stock return[25] over the risk-free rate on a buy-and-hold portfolio of *i* stocks on day *t*. The explanatory variables of interest are the ownership variable, *SOE*, and the systematic risk variable, *StateBeta*. *SOE* is a dummy variable which is coded 1 for state-owned companies and 0 otherwise. The *SOE*-variable captures fixed effects on the ownership level, state-owned versus private. As a result, *SOE* will be the average abnormal return due to state ownership. Moreover, *SOE* captures the percentage difference in abnormal return between state-owned and private firms. *StateBeta* is an interaction between *SOE* and the market excess return, and represents the difference in the market beta between private and state-owned firms. The scope of this thesis is limited to analyse the systematic risk regarding the correlation with the market return. As a result, the correlation between state ownership and the other pricing factors in the model is not analysed. The variables, *SOE* and *StateBeta*, capture the relationship between state ownership and excess return in terms of abnormal return and systematic risk, respectively.

Furthermore, yearly and monthly dummies are included in the specification in order to capture contemporary correlation (Gupta, 2005). Industry dummies are included to capture fixed effects at the industry level. The unobserved component, α_i, reflects firm specific fixed effects. The random unobserved component, ε_{it}, reflects unobserved shocks affecting the performance of firms.

In order to estimate individual factor loadings, each of the four Fama French factors is interacted with a firm-specific dummy variable, $Firm_i$. The four Fama-French factors: Excess Market Return, High-Minus-Low, Small-Minus-Big and Momentum are denoted as: R_t^m, HML_t, SMB_t and MOM_t. The normal return is given by the Fama French Four Factor Model.

$$AR_{it} = \alpha_i + SOE_i + Industry_i + \varepsilon_{it}$$

[24] We control for the four Fama French factors, excess market return, SMB, HML and Momentum by interacting the factors with a company dummy variable. This creates individual factor loadings.

[25] Stock prices follow an autoregressive process, AR(1) with unit root. In order to create a stationary process, we use the first-difference of the stock price. Log return is used because log return is normally distributed.

$$E(\varepsilon_{it}) = 0$$

$$E(AR_{it}) = \alpha_i + SOE_i + Industry_i$$

By assumption, everything that is not explained by the Fama-French Four-Factor Model is considered abnormal return, AR_{it}. As a result, there exists three sources of abnormal return in the model, when excluding time dummies; α_i , SOE_i, and $Industry_i$. Furthermore and according to pricing theory, AR_{it} is 0, implying that both α_i, SOE_i and $Industry_i$ should be insignificant (Fama & French, 2012; Gupta, 2005). For this reason, if the coefficient of SOE is significantly different than 0, state ownership is correlated with abnormal return, AR_{it}. It is important to emphasize that the General OLS Model only quantifies the correlation between ownership type and abnormal return and between ownership type and systematic risk. An alternative approach would be to create a factor portfolio based on the ownership variable and add it to the existing Fama French factors and test if ownership is a priced factor in the market, this is however, out of scope for this thesis. Furthermore, an alternative specification would be to use a Fixed Effect specification. The FE-model saves degrees of freedom and removes firm fixed effects. The number of degrees of freedom is not considered a problem in the model due to the large number of observations. However, the problem with the fixed effect specification is that the variable of interest, SOE, is constant over time and would be removed if the fixed effects specification was to be used. Hence, we have to use a pooled OLS specification and control for, as far as possible, the firm fixed effects.

6.2.3 *Robustness and Limitations of the General OLS Model*

We cluster standard errors on the cross sectional variable, *Company*, to deal with heteroscedasticity and serial correlation.

Previous literature proves that stock return is driven by time-varying variables[26] (Bessembinder & Zhang, 2013) and not time-constant fundamental differences. However, according to Frydman et al. (1999), the sample of state-owned firms cannot be treated as a random sample from the population of publicly listed firms. Frydman et al. (1999) argue that state-owned firms

[26] The empirical finance literature has shown that systematic risk in stock returns is fairly well explained by the Fama French Four Factor Model (Carhart, 1997; Fama & French, 1993; Lyon et al., 1999). According to Bessembinder and Zhang (2013), additional factors could be relevant control variables for the analysis. Relevant variables to include could be the oil price due to the high exposure to oil price movements on the Norwegian stock exchange, and the world interest rate. However, Ødegaard (2009) finds no support for the oil price being a systematic risk factor in the Norwegian market. To implement and test for all relevant variables will be out of scope for this thesis.

are likely to have different characteristics than private firms, implying a potential selection bias problem in our sample. If the firms are identical, except from different owners, a model with only *SOE* and *StateBeta* captures the effect of state ownership. Even though our dataset constitutes of peer-groups to the state-owned firms, there could be differences across industries and between private and state-owned firms. As a consequence, differences in the sample need to be controlled for. The model addresses the constant differences between industries by including industry dummies. However, the specification does not address the dynamic selection bias[27] that may arise if state ownership is correlated with time-varying or time-constant characteristics, ε_{it} and α_i, respectively, that are unobservable or not included in the model (Gupta, 2005). Moreover, we do not control for firm fixed effects which might cause bias in the estimation.

The possible omitted variables have to be correlated with *SOE* or *StateBeta* to cause bias in the estimators. Hence, our primary concern is to control for relevant variables that could be correlated with state ownership. Megginson and Netter (2001) are especially concerned about the perceived market failure within the particular industry. However, the model partially controls for the constant differences between industries by including industry dummies. Megginson and Netter (2001) argue that some industries are more likely to have state ownership than others. Historically, this has been airlines, telecom and natural resources.

Another potential bias, is reverse causality. Historically, state-owned companies have had natural monopolies in important and profitable industries (Megginson & Netter, 2001). A relationship between a non-competitive, profitable environment and state ownership could imply that the causality runs from performance to state ownership. As a consequence, the *SOE* variable might be endogenous which violates the exogeneity assumption in the OLS framework.

Furthermore, the specification captures only if firms are state-owned or not, and does not take into consideration the different levels of government involvement. That is, the General OLS Model reveals the correlation between state ownership and excess stock return regardless of the size of the state ownership.

[27] E.g. if a company has smarter and more efficient workers, one would expect that such qualities would be reflected in higher profits resulting in higher stock return. This selection bias would have been unobservable for the researcher and could lead to omitted variable bias if not controlled for.

6.2.4 *Results of the General OLS*

For the main analysis we run a general regression model including eight state-owned firms based on the criteria mentioned in Section 5.2 and Section 6.2.1. The variables of primary interest are *SOE*[28] and *StateBeta*[29]. The objective of the General OLS Model is to look at the average correlation between state ownership and abnormal return, and state ownership and systematic risk. The results of the General OLS Model is presented in Table 3.

General Pooled OLS	
VARIABLES	Excess return
SOE	8.96e-05
	(0.000102)
StateBeta	0.314***
	(0.000546)
Observations	327,066
R-squared	0.139
Clustered standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 3: The results presented are from the General OLS regression. State-owned companies not directly owned by the Norwegian Government are dropped from the sample. The sample consists of the eight state-owned companies; Telenor, Kongsberg Gruppen, Statoil, DNB, SAS; Yara, Cermaq and Hydro. The coefficient of "SOE" is on an indicator for state ownership and gives the percentage point change in daily abnormal return relative to private companies. "StateBeta" is an interaction between a dummy variable for all state-owned firms and the market excess return, and represents the difference in the average market beta between state-owned and private firms. Furthermore, we control for the four Fama French factors, excess market return, SMB, HML and Momentum, each interacted with a company dummy variable. Finally, we control for macro factors and seasonal factors using yearly and monthly dummies, respectively. The standard errors are clustered on company level.

The Model implies that state ownership has a positive, but not significant effect on firm's abnormal stock return. The results make us able to reject *Hypothesis 1* of a negative abnormal return for state-owned firms. In addition, the model reveals that state-owned firms have on average a 0.314 higher market beta than private firms, significant at a 1% level. The positive *StateBeta* indicates that state-owned companies are more prone to systematic risk. The results of a higher market beta for state-owned firms are inconsistent with *Hypothesis 2* of higher systematic risk in private firms.

[28] *SOE* is a dummy variable that equals 1 for all state-owned companies and 0 otherwise
[29] *StateBeta* is an interaction of *SOE* and market excess return

6.2.5 *Robustness of the Results*

Furthermore, the General OLS Model reveals no serial correlation using the *xtserial* command in Stata. The normality of the residuals are tested by plotting the residuals and finds that they follow a normal distribution.

It is important to emphasize, that the underlying assumption of the model states that all independent variables are to be exogenous of the model. Omitted variables are most likely causing bias in the *SOE* variable due to fundamental fixed differences between state-owned and private firms. The next model, the Event Model works as a robustness test and give an indication on the endogenous nature of the *SOE* variable.

6.2.6 *Limitations of the Results*

The General OLS Model has an R-squared of 14.9%, which means that it explains 14.9% of the observed variation. Lack of explanatory power may be due to several reasons. First, each company return contains unsystematic risk because the dataset consists of company stock return rather than diversified portfolios, which is by definition not explained by our pricing model. Second, pricing models, such as Fama French, explain the long-run relationship between stock return and systematic risk factors. As a consequence, the low R-squared could be the result of using daily return rather than monthly or yearly observations.

It is important to emphasize that there is a natural limitation to the sample which consists of only eight state-owned firms. The sample is limited although the whole population of Norwegian publicly listed firms with direct state ownership is included. In comparison, Gupta (2005) and Frydman et al. (1999) have 42 and 90 state-owned firms, respectively. A way to increase the number of firms is to include international companies, but this will be beyond the purpose of this thesis. As a consequence, the results are relevant only for Norwegian state-owned firms and caution should be exercised if generalizing the results to international state-owned firms.

In order to conclude that there exists a causal relationship between state ownership and abnormal return, and between state ownership and systematic risk, we estimate the market reaction and the change in the systematic risk after a change in state ownership. The Event Model exploits the gradual change in state ownership.

6.4 The Event Model

In the General OLS Model the objective was to estimate the effect of state ownership on abnormal return and systematic risk. However, the results could be biased due to reverse causality or selection bias. In contrast, the Event Model avoids the selection bias problem by comparing pre- and post-levels of the same firm. The methodology draws parallels to the "*Pre vs. Post*" literature in Section 3.2.2. We test the following hypothesis:

Hypothesis 3: *A reduction in state ownership leads to a positive market reaction and increases the systematic risk of the firm*

6.4.1 *The Objective of the Event Study*

Our event study is twofold. First, the general effect from a change in state ownership is estimated using a panel data model, the Event Model. The objective of the Event Model is to isolate the immediate market reaction from a divestment. The estimated market reaction gives an indication on how the market perceives the Norwegian Government as an equity owner. Second, an in-depth analysis of the divestments is conducted, in which the exogeneity of the divestments are examined using the Synthetic Control. The objective is to confirm the exogeneity of each divestment event.

6.4.2 *Selection of State-Owned Firms*

The selection criteria used in the Event Model are stricter than for the General OLS Model. In addition to direct state ownership, the Event Model requires stock return both before and after the divestment for the selection of state-owned firms. As a consequence, only companies in which the Government has made two or more divestments are relevant to the regression. The firms that fulfil the criteria are: Telenor, Statoil and DNB. However, DNB is omitted from the sample because of the Norwegian Government's bailout during the bank crisis in the 90's and the financial crisis in 2008[30]. As a result, the Government's decision to invest and later divest in DNB is clearly endogenous[31]. Thus, the firm sample consists of Telenor and Statoil.

[30] As a part of the bailout program the Norwegian Government increased their ownership in DNB.
[31] In the case of DNB, the direction of causality goes from performance of the company to the divestment/investment decision.

6.4.3 *Divestment Events*

A decrease in state ownership will potentially lead to a market reaction for two reasons. First, the market might believe that private ownership is better or worse than state ownership. Second, the change in state ownership might cause shifts in the supply or demand of the stock. With a limited demand it is reasonable to assume that the excess supply due to a divestment leads to a negative market reaction. However, the divestments analysed consist of block sales to institutional foreign investors. We assume that the market is capable of absorbing large divestments without severe "supply and demand-reactions" due to the unlimited size of the international capital market.

Sales to retail investors are excluded from the analysis because direct intervention in the market without using the international capital market will result in severe supply and demand reactions. The restriction reduces the probability of getting severe “supply and demand- reactions”, but at a cost of lower variation in the selection of firms and events. In summary, four divestments classify as proper events for our study, two block sales in Telenor and Statoil.

The four divestment events analysed are all block sales to large American investment banks. The first divestment event after the IPO of Telenor in 2001 was a 13.9% block sale to Lehman Brothers on the 30th of June 2003. The announcement took place on the morning that same day. The block sale combined with a small fraction sale to Norwegian investors increased the free float of the company by 67%. The second divestment in Telenor took place on the evening of the 29th of Mars 2004. However, Oslo Stock Exchange was closed at the time of announcement and did not experience the effect of the divestment until the 30th of March. The 9.45% block sale to Goldman Sachs combined with 1.67% to private Norwegian investors increased the free float with almost 30%. The two divestments for Statoil took place on the evening on the 6th of July 2004 and 16th of February 2005. Hence, the effect from the event is expected to materialise the day after the announcement. Both block sales were approximately 4.6%, and were sold to Lehman Brothers and Merill Lynch. The block sale combined with the sale to private Norwegian investors increased the free float by 29.5% and 22.8%. The four different divestment events are illustrated in Table 4.

Approval Date	Announcement Date	Execution Date	Company	Divestment Size	Ownership Before	Ownership After	Critical Change
14.06.00	30.06.03	30.06.03	Telenor	13.9%	77.60%	62.60%	Yes
14.06.00	29.03.04	30.03.04	Telenor	9.45%	62.60%	51.48%	No
26.04.01	06.07.04	07.07.04	Statoil	4.60%	81.70%	76.30%	No
26.04.01	16.02.05	17.02.05	Statoil	4.59%	76.30%	70.90%	No

Table 4: Overview of divestments and respective dates for Statoil and Telenor. Approval date is the date the proposal is approved by the Parliament. Announcement date is the date the transaction is announced by the Government and the execution date is the first trading day where we expect a reaction of the announcement. Change in ownership is characterized as critical if the ownership share decrease below 67%, 50% and 33%.

The rationale for the divestments are driven by political and theoretical arguments, and not firm-specific reasons. According to St.prp.[32] No. 66 and St.meld[33]. No. 38, the justification of the decision to divest was the following: "Ensure similar commercial terms as its competitors, and to clarify the role of the state and the competitive position of the company. Market forces would serve as an important signal and act as a corrective to the company to make decisions that serve value creation" (Energidepartementet, 2004; Samferdselsdepartementet, 2000). The statement indicates that the divestment events are exogenous to the model.

6.4.4 *Estimating the Effect on Shareholder-value*

The potential positive or negative effect of state ownership can be measured by comparing the NPV of future profits under private ownership with the NPV of future profits achieved under state ownership. If the capital market is competitive and efficient, as assumed in the model, stock prices provide an unbiased estimate of a firm's future profits. Consequently, to test how the firm is affected by state ownership, the Event Model estimates the immediate change in abnormal return and the change in company's long-run risk-profile at the time of divestment. Although the empirical approach provides an estimate of the effect expected by the market rather than the actual intrinsic effect of state ownership, the method is well established in the finance literature (A. Boardman, Freedman, & Eckel, 1986). Furthermore, foreign institutional investors are perceived to have a neutral effect on stock prices. We assume that the market reaction is solely based on characteristics of the seller, in this case the Norwegian Government, and not attributes of the buyer.

[32] Parliament bill
[33] Parliamentary report

6.4.5 *Exogenous Event*

The decision to divest in a company is not random and might violate the exogeneity assumption of the Event Model. In the yearly "State Ownership Report" and the Parliament Propositions, the majority of the arguments to divest is based on political principals and not economic reasons. Moreover, we find no evidence which implies that divestment decisions are based upon company-specific events or characteristics that are intuitively correlated with stock return. For this reason, the divestments in Statoil and Telenor are treated as exogenous events. Regardless of our assumptions, the events might not be exogenous and the results have to be interpreted carefully. Finally, we assume that multiple changes in state ownership within each company are independent of each other.

6.4.6 *Constructing the Event Window*

In contrast to more conventional event studies, in which most of the information is revealed during a short event window, information about the Government's divestments reveals more gradually depending on the speed of the political process (Abadie & Gardeazabal, 2003). The decision to divest must pass through several hearings and propositions that may last for several years or possibly never result in a divestment. Many of the proposed and approved divestment decisions from the early 2000s have never been completed. Hence, there exists great uncertainty regarding the execution of the divestment and it is reasonable to assume that the market has not priced in the divestment before the announcement.

As mentioned in Section 2.2, divestment transactions are often completed through block sales, followed by small fraction sales to retail investors. The block sale process is secret[34] until public announcement, thus the event window is determinable. A semi-strong market implies that the announcement and execution date of the block sale are the most relevant events in our event window. Nevertheless, there exists other events[35] during the political process which might be relevant to control for. However, we choose not to investigate these events any further because collecting the exact dates of these events are difficult and time consuming. We focus on a short event window. Campbell (1997) provides evidence that there is a severe drop in explanatory power when the length of the event window is increased. If the timing of an event is known precisely, the probability of statistically identifying the effect will be higher for a short event

[34] After consultation with the Ownership Department in the Industry and Fisheries Ministry in the Norwegian Government, we find it reasonable to assume that the divestments are secret until announcement.
[35] Including hearings, propositions and final approvals from the Parliament.

window. In addition, Brown and Warner (1980) recommend the researcher to spend time collecting accurate event dates, which could improve the analysis substantially. As a consequence, we spend time finding the most important and relevant events such as announcement date, public news around the divestment and final execution date (Eckel, Eckel, & Singal, 1997).

6.4.7 *Model Specification*

The Event Model uses the stock return of Statoil and Telenor. The model seeks to identify the average effect of privatization with the following specification[36] inspired by Boardman, Freedman and Eckel (1986), and Dube et al. (2011):

$$R_{it} = Firm_{it} + \theta_1 Priv_{it}(K) + \theta_2 PostPriv_{it} + B_2^i R_t^m + B_3^i SMB_t + B_4^i HML_t + B_5^i MOM_t + B_6 Year_t + B_7 Month_t + \varepsilon_{it}$$

$$PostPriv_{it} = T_{post} * R_t^m * Firm_i$$

$$Priv_{it}(K) = Change\ in\ ownership_i * Event\ dummy_t(K)$$

$$Length\ of\ the\ event\ window^{37}, K = -1, 1, 2, 3, 5, 7\ and\ 10.$$

We regress a firm's excess stock return, R_{it}, on the change in state ownership. We are interested in the percentage point change in abnormal return, $Priv_{it}(K)$ and the change in market beta, *PostPriv* after a divestment. The model controls for the four Fama French factors[38]. In addition, firm fixed effects are controlled for by implementing firm dummies. This is possible because the variables of interest, $Priv_{it}(K)$ and *PostPriv* varies over time.

$Priv_{it}(K)$[39] is a variable that takes on the percentage size of the change in state ownership interacted with an event dummy for a *K*-day event window. The length of event window varies with *K-days*, from *-1, 1, 2, 3, 5, 7* and *10* days, starting at the execution date. The variable measures the percentage change in abnormal return. The change in daily average abnormal return due to a change in state ownership for each *K*-period, is θ_1. To get the cumulative effect

[36] We control for the four Fama French factors, excess market return, SMB, HML and Momentum by interacting the factors with a company dummy variable. This creates individual factor loadings.
[37] Starting at the execution date.
[38] Each interacted with a firm dummy See the General OLS for further information about the Fama-French Four-factor Model
[39] The $PRIV_{it}(K)$-variable is inspired from the article of Dube et al. (2011).

of a divestment event, the average daily effect, θ_1, has to be multiplied by *K*. The cumulative change in abnormal return, CCAR, is then $K\theta_1$[40].

The second variable of interest is the interaction term, *PostPriv*. In order to control for changes in systematic risk, we implement interaction term between the excess market return, R_t^m, and a firm individual post privatization dummy, $T_{post} * Firm_i$, which equals 0 before and 1 after the divestment depending on the firm. This allows us to test if state ownership affects the systematic risk of the firm. The corresponding coefficient, θ_2, will be the estimated general long-term change in the market beta after a change in ownership. The potential change in the systematic risk and abnormal return will hopefully provide insight on how state ownership affects the firm.

The privatization coefficient, $K\theta_1$, represents the effect of a 100% divestment of a hypothetical state-owned firm. To obtain the effect from a specific divestment event, the size of that particular state divestment has to be multiplied by the coefficient, $K\theta_1$. The total estimated event specific CCAR is:

$$Total\ event\ specific\ CCAR = K\theta_1 * Priv_t.$$

K-day represents the length of the event window and captures potential overreactions. See illustration of the event window in Figure 1. To cope with different levels of market efficiency, we consider *K*-day event windows varying from *-1, 1, 2, 3, 5, 7* and *10* days, starting at the execution date. Testing different lengths of event windows are recommended when the impact of the information at the event date is unclear (Fama, Fisher, Jensen, & Roll, 1969).

We include one-day pre-event, $K = -1$, to capture the possibilities of insider information leaking into the market. Inside information violates the assumptions about a semi-strong market efficiency. In addition, a positive pre-event excess stock return could also indicate that the divestment is not exogenous and that the Government's decision to divest is a response to a positive market movements prior to the event.

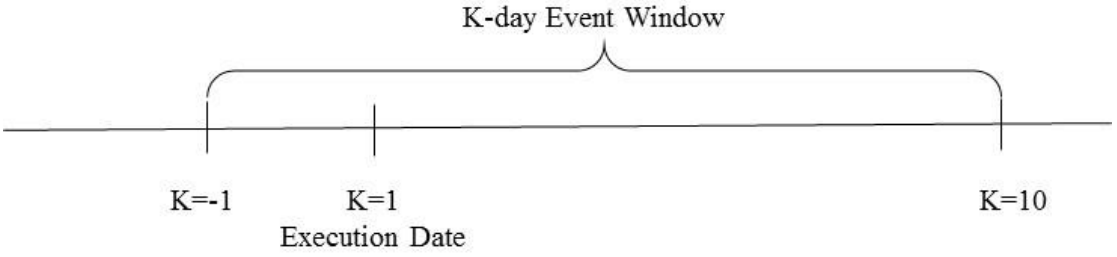

Figure 1: Illustration of the length of the event window represented by the brackets. K are the days after the execution date. We consider K-day event windows varying from -1, 1, 2, 3, 5, 7 and 10 days, starting at the execution date.

[40] This is a standard approximation to $(1 + \theta_1)^k - 1$.

6.4.8 *Robustness and Limitations of the Event Model*

The model might suffer from omitted variables bias. However, relevant omitted variables must be correlated with *Priv* and *PostPriv* to cause bias in the estimators. With this in mind, we find the most relevant omitted variables to be public events and industry specific shocks around the events. Another limitation is the lack of casual interference in the model. The direction of the causality is unknown. To get a better picture of the omitted variable problem and the casual interference between a divestment decision and stock performance, each event is analysed using the Synthetic Control.

In addition to the Synthetic Control, time-shifted placebo tests are conducted to test if the results are an artefact of our dataset. Using the same specification as in the Event Model, we re-estimate the model with different time-shifted placebos ranging from +/- 25 days with a five day interval. The placebo test reveals the likelihood of getting significant results.

One potential limitation to the Event Model specification is that the distribution of abnormal return is often non-normal and the number of events in the study are small (Dube, Kaplan, & Naidu, 2011). That is, the dataset consists of two firms, with a total of four events. As a consequence, conventional standard errors may produce an incorrect test size. To cope with the limitations, Dube et al. (2011) suggest a non-parametric small sample test based on the sign and rank test, but with exact distributions. However, the small sample test is beyond the scope of this research thesis. We use robust standard errors.

In addition to the empirical limitation, the model suffers from an economic limitation similar to the General OLS Model. The Event Model does not capture the different levels of state ownership. Different degrees of state ownership will potentially have varying effect on excess stock return, especially in the case of control rights, vetoes and majority stakes. When the Government retains control rights, it can still use its ownership rights to interfere with business decisions (Li et al., 2012). It is reasonable to believe that a reduction of state ownership, from 51% to 49%, affects the excess stock price significantly more than a change from 61% to 59%. A solution to this limitation, is to separate the divestment events into different sub-groups depending on the level of privatization. However, this reduces the variation of the privatization variable. With only four relevant events, further classification of the events will potentially result in lower significance levels. One solution to this problem is to include international privatization events.

6.4.9 *Results of the Event Model*

The results from the Event Model serve as a robustness test of the results of the General OLS Model, and give further insight into the effect from Norwegian state ownership in Statoil and Telenor.

In row 1 in Table 5, we report the average daily abnormal return, *Priv*, for *K-days* for a hypothetical 100% divestment event. *K* ranges from -1 to 10 and represents the length of the event window. In row 2 in Table 5, we report the results of, *PostPriv.*

	Change in State Ownership						
VARIABLES	(1) K=-1	(2) K=1	(3) K=2	(4) K=3	(5) K=5	(6) K=7	(7) K=10
Priv	0.179***	-0.401***	-0.191***	-0.113**	-0.0596	-0.0419	-0.0349
	(0.0487)	(0.0915)	(0.0726)	(0.0563)	(0.0374)	(0.0276)	(0.0214)
PostPriv	0.123**	0.123**	0.123**	0.123**	0.122**	0.122*	0.122*
	(0.0623)	(0.0623)	(0.0623)	(0.0623)	(0.0623)	(0.0624)	(0.0624)
Observations	7,278	7,278	7,278	7,278	7,278	7,278	7,278
R-squared	0.112	0.114	0.113	0.113	0.112	0.112	0.112

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

Table 5: The results presented are from the Event Model regression. All state-owned companies with fewer than two divestments are dropped from the sample. Furthermore, companies in which sale or purchase of stocks are done through open market auctions rather than block sales to international investors are removed from the sample. The final sample consists of Telenor and Statoil. The coefficient of the "Priv" variable is on an indicator for the length of divestment event, K-day, interacted with the change in ownership. "Priv" gives the average percentage change in daily abnormal return. "PostPriv" is an interaction term between the excess market return, R_t^m, and a firm individual post privatization dummy, $T_{post} * Firm_i$, which equals 0 before and 1 after the divestment depending on the firm. Furthermore, we control for the four Fama French factors, excess market return, SMB, HML and Momentum, each interacted with a company dummy variable. Finally, we control for macro factors and seasonal factors using yearly and monthly dummies, respectively. We use robust standard errors.

Row 1 in Table 5 shows market reactions of the divestments in the Event Model. The coefficient of *Priv*[41] represents the average daily market reaction after a divestment. The results imply that the daily one-day, *K=1*, abnormal return is reduced with 40.1% for a hypothetical 100% divestment. The daily two-day, *K=2*, abnormal return is reduced with 19.1%. Both results are highly significant at a 1% level. The results are significant up to a three-day event window.

In row 2 in Table 5, we report the results for the long-run structural change in the average systematic risk following a divestment. The Event Model reveals that the market beta increases

[41] The coefficient of *Priv* represents the average market reaction for a 100% divestment and is on an indicator for announcement events interacted with the change in ownership (Dube et al., 2011).

with 0.123 after a divestment which is in line with our hypothesis. *PostPriv*, is significant at a 5% level. The coefficient does not represent a hypothetical 100% state-owned firm, but is an average of the change in the systematic risk of Telenor and Statoil after privatization. The interpretation of the coefficient is not dependent on the size of the divestment, but captures the change in the market beta after the divestment. The coefficient reveals that Telenor and Statoil have 0.123 higher market betas after the first divestments. The results imply that the systematic risk increases with privatization, which might seem conflicting with previous results from the General OLS Model. However, *PostPriv* must be interpreted as the increase in market beta relative to previous levels prior to the event, whereas the higher market beta in the General OLS is relative to private firms.

The model finds clear evidence that the market reacts negatively to divestments. The significant change in abnormal return immediately after the execution is inconsistent with our hypothesis that a state divestment causes a positive stock return. While the General OLS Model reveals a neutral effect of state ownership, the Event Model indicates that the Norwegian Government has a positive impact on the abnormal return of Statoil and Telenor. The market reaction is significant at a 1% level on a 1-day and 2-days event window, and 5% for the 3-days event window. However, for event windows longer than three days the stock price reaction is not significant. A reduction in explanatory power is reasonable when increasing the length of the event window (Campbell, 1997). The results of an immediate significant price reaction imply that the market is semi-strong efficient and reacts on public information.

In the first row of Table 5, we report the coefficient of the one-day pre-event variable, *K=-1*. The variable captures the change in the abnormal return on the day before the divestment. The one-day pre-event variable, is meant to incorporate the effect from private information leaking into the market before the public announcement. The increase in the average abnormal return on the day before the execution of a divestment is 17.9%, significant at a 1% level. The results indicate that the market reacts positive prior to a divestment. A significant pre-event variable suggests that the divestment might not be exogenous. An increase in the abnormal return prior to the divestment, implies that there could be a price trend which causes the Government to divest. The timing of the event can no longer be assumed to exogenous as a result of the pre-existing trends in the stock price. The model might suffer from reversed causality. However, the Event Model predicts that the divestment causes a unique market reaction which contradicts

the pre-existing trend, thus reducing the severity[42] of the bias. The uniqueness of this market reaction will be further scrutinized in the Synthetic Control.

The cumulative change in the *K*-day abnormal return is the coefficient multiplied by *K*, resulting in a 38.6% reduction in abnormal return, for *K*=2, within the two days following the announcement of the divestment. Illustrated in Figure 2, the cumulative change in abnormal return, CCAR, is nearly constant when increasing the event window with *K*-days. An almost constant CCAR implies that the immediate market reaction is correct, with no further adjustments. The negative market reaction implies that the market believes that the Government contributes with abnormal return in Statoil and Telenor.

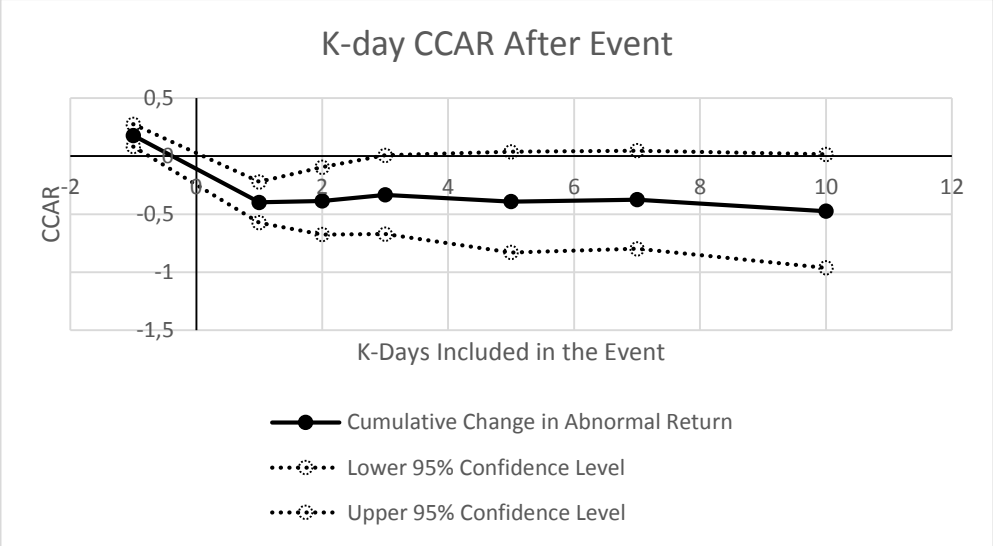

Figure 2: Graphed results of the Event Model, K-day CCAR. To obtain CCAR we use the regression output from Table 5 multiplied by the length of the event window, K-day. The thicker line represents the average daily change in abnormal return from a change in state ownership multiplied by the length of the event window. The horizontal axis denotes the length of the event window. K=3 implies that the event window is three days, the estimated effect is the average of the three day market reaction. The stippled lines represent the 95% confidence intervals using robust standard errors from the regression output. The divestments do not overlap even at the maximum length of the event window at 10 days or later in the in-time placebo tests where the event is moved +/- 25 days.

Figure 2 graphs the results from Table 5 and visualizes the cumulative change in abnormal return, CCAR, and how it changes over the length of the event window. The graph also visualizes by the stippled line, the 95% confidence interval, and illustrates where the coefficient is no longer significant. To obtain CCAR we use the regression output from row 1 in Table 5 multiplied by the length of the event window, *K*-day. The graph shows that the CCAR is approximately constant for all *K*-days, but not significant for event windows greater than three

[42] The bias with have been severe if the pre-existing trend was negative. Then the divestment would be correlated with the pre-trend and the model would overestimate Priv.

days. The results imply that there is no overestimation and that the market reaction is correct and immediate.

As mentioned, the estimates in Table 5 are for a hypothetical company, where the Government reduced an imaginary ownership share from 100% to 0% during one divestment. This is not a very likely scenario, but the results can easily be applied to actual divestment events. To obtain the average effect for the four divestments, the coefficient of *Priv* has to be multiplied by the average change in state ownership. The average divestment is 8.135%. Using the estimates from the Event Model, the predicted average reduction in daily abnormal return is 3.262% for a 1-day event window, *K=1*. For the 2-day event window, *K=2*, the daily average abnormal return is reduced with 1.554%, resulting in a CCAR of -3.101%. The coefficient can also be used on specific divestments. For instance, the Government announced and executed a 13.9% reduction in their ownership in Telenor on the 30th of June 2003. For this divestment the model predicts a reduction in the one-day, *K=1*, abnormal stock return of 5.574%.

6.4.10 *Robustness of the Results*

Our empirical results document a significant negative change in the abnormal stock return in the three days following a divestment announcement. However, the results might be caused by other events in the same period as the divestment. If this is the case, the event variables take credit for such factors, leading to biased results. Relevant factors can be shocks in the industry or other public events happening around the same execution date. As a consequence, the model might suffer from omitted variable bias. However, the Synthetic Control tests if there exists any industry specific shocks and other public events around the time of divestment.

In addition, to test if the estimates are an artefact of our dataset, we have conducted an "In-Time" shifted placebo. We use the same specification as in the Event Model, but re-estimate the model using different time-shifted placebo events ranging from +/- 25 days with a 5-day interval. The 2-day event window, *K=2*, is used in the placebo test.

VARIABLES	(1) t=-25	(2) t=-20	(3) t=-15	(4) t=-10	(5) t=-5	(6) t=0	(7) t=+5	(8) t=+10	(9) t=+15	(10) t=+20	(11) t=+25
F25.Priv2	0.00972										
	(0.0739)										
F20.Priv2		-0.0578*									
		(0.0314)									
F15.Priv2			0.0448								
			(0.0485)								
F10.Priv2				-0.00752							
				(0.0421)							
F5.Priv2					0.0113						
					(0.0333)						
Priv2						-0.191***					
						(0.0726)					
L5.Priv2							-0.0561				
							(0.0686)				
L10.Priv2								0.0164			
								(0.0399)			
L15.Priv2									0.0372		
									(0.0475)		
L20.Priv2										0.00909	
										(0.0439)	
L25.Priv2											-0.0847***
											(0.0181)
Observations	4,069	5,671	5,668	4,078	4,238	7,278	4,238	4,078	5,668	5,671	4,069
R-squared	0.128	0.098	0.119	0.130	0.093	0.113	0.138	0.127	0.098	0.126	0.132

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

Table 6: Results of the "In-Time" Placebo Test. We use the same specification as in the Event Model, and re-estimate the model using different time-shifted placebo events, ranging from +/- 25 days with a 5-day interval. We report the daily change in abnormal return for a 2-day event window, K=2, in the placebo test. The coefficient of F25.priv2 stands for; F25= Forward 25 days and priv2= 2-day event window, and captures the average daily change in AR for 25 and 24 days prior to each divestment event. The coefficient of L25.priv2 stands for; L25= Lagged 25 days and priv2= 2-day event window, and captures the average daily change in AR for 25 and 24 days after to each divestment event. Furthermore, we control for the four Fama French factors, excess market return, SMB, HML and Momentum, each interacted with a company dummy variable. Finally, we control for macro factors using yearly dummies and seasonal factors using monthly dummies.

We report the daily change in abnormal return for a 2-day event window, *K=2*. The results are presented in Table 6. Out of ten time-shifted placebo regressions, the privatization variable is only significant for *t=+25*. The placebo test proves that it is possible to get a significant estimate on a random date with a probability of 1/10 using our dataset[43]. However, none of the time-shifted placebos have a magnitude of similar size to the one observed for the true divestment event, *t=0*. Figure 3 illustrates the magnitude of the placebo estimates compared to the original estimate. By the size of the market reaction at the execution date, *t=0*, it is not very likely that the estimates are an artefact of our dataset. The low magnitude of the placebo estimates, combined with 9/10 placebos being insignificant, reinforce that the original estimate at *t=0*, is not due to local serial correlation in returns (Dube et al., 2011).

[43] The probability is likely to be reduced if our dataset consisted of more than two firms.

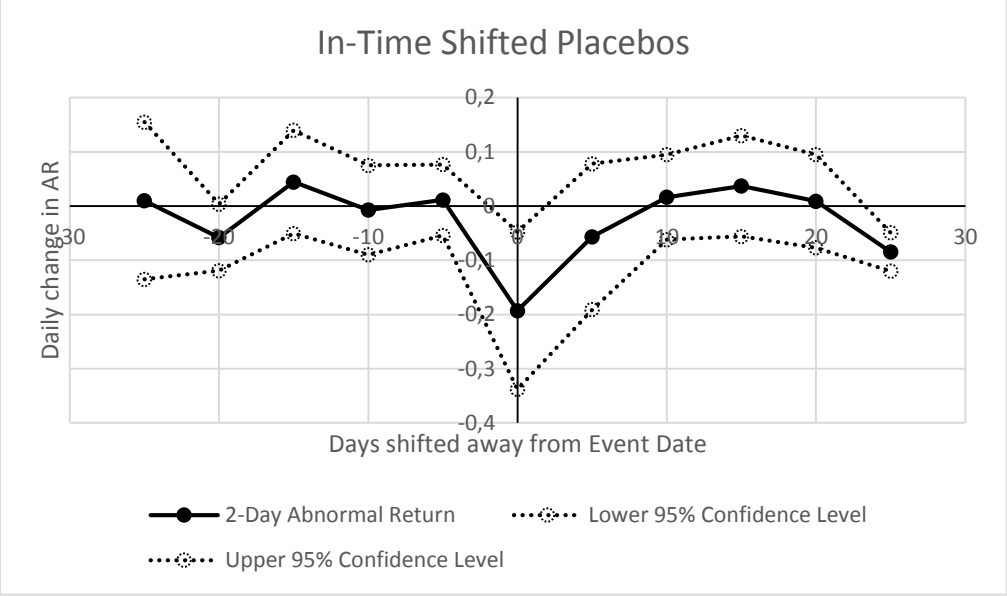

Figure 3: The graph illustrates the average daily change in AR of the "In-Time" Placebo test of the Event Model for K=2. To obtain the change in AR we use the regression output from Table 6. The thicker line represents the average daily change in abnormal return from a change in state ownership with leads and lags ranging from +/- 25 days, with a 5-day interval. The horizontal axis denotes the number of leads and lags of the execution date. t=-25 implies that the 2-day event window is forwarded 25 days, meaning that the effect from the divestment happens 25 and 24 days prior to the execution date. The stippled lines represent the 95% confidence interval using robust standard errors from the regression output.

6.4.11 *Limitations of the Results*

Overall, the Event Model predicts that a reduction in state ownership for Statoil and Telenor leads to an immediate negative abnormal return which is significant up to a 3-day event window. A limitation to the results are the positive change in the abnormal return one-day pre-event which leads to doubts about the exogeneity of the divestments and reduces the probability of a causal relationship between the divestment and the estimated effect. The observed pattern of change in abnormal return prior to the divestment, combined with the possibility of industry-specific shocks in the event window, emphasizes the needs to implement a third model. The Synthetic Control seeks to address the limitation of the Event Model regarding reverse causality and omitted variable bias.

A potential limitation of the results are the small sample of firms included in the event study. Telenor and Statoil might have different characteristics than the rest of the state-owned firms. It is reasonable to believe that the healthiest and most profitable state-owned firms are privatized first, implying that there exists differences between state-owned firms (Frydman et al., 1999; Megginson & Netter, 2001). Thus, using only Telenor and Statoil in the sample increases the likelihood of selection bias in the Event Model. Moreover, the interpretation of the coefficients is for an average divestment, but based on only four divestment. For this reason,

we should be careful to generalize the results to all state-owned firms. The results might be significant and valid for Statoil and Telenor, but for other state-owned firms the results might be biased due to differences between the firms.

6.5 The Synthetic Control

In order to conclude on our second hypothesis, we need to address the possibility of endogenous divestments. The Synthetic Control serves as a robustness test of the exogenous assumption in the Event Model.

6.5.1 *The Objective of the Synthetic Control*

The Event Model might suffer from reverse causality and omitted variable bias. The Synthetic Control allows us to conduct an individual in-depth casual inference analysis for the four divestments and to test the exogenous assumption of the *Priv* variable in the Event Model (Abadie & Gardeazabal, 2003). The objective is to test the exogeneity of the divestments in the Event Model by comparing the pre-trend of the synthetic company with the pre-trend of the treated company. Differences reveal if the Event Model suffers from reverse causality, omitted relevant events or shocks.

6.5.2 *Optimal Model*

The optimal model is a Difference-in-Difference analysis where the treatment effect on state-owned firms is compared to a control group with similar pre-trend. The treatments are the divestments of Statoil and Telenor. To get a valid and significant result from a Difference-in-Difference, we need multiple individuals in the treatment and control group (Kolesar & Imbens, 2012). However, in Norway only two firms qualify for the Event Model. In addition, the change in state ownership occurs at different time for each company, which means that we have one firm in each treatment group. In summary, the lack of firms in the treatment group prevents us from doing a Difference-in-Difference analysis.

6.5.3 *The Synthetic Control*

To cope with the lack of variations in the treatment group, we use the Synthetic Control Group Method. The method is similar to the Difference in Difference Model, see Appendix for further details. Moreover, the Synthetic Control allows us to analyse the effect of a change in state ownership with only one firm treated at a time. However, testing for significance is not possible without variation in the treatment group.

The Synthetic Control is closely related to statistical matching methods for observational studies. In the methods, it is important that the treated firm and the control group have common support (Abadie & Gardeazabal, 2003). The majority of statistical matching methods defines common support using the propensity score of the individuals in the control group, discarding the units with too high propensity score values (King & Zeng, 2006). However, a second approach is used with the Synthetic Control which involves examining the "convex hull" of the covariates by identifying the multi-dimensional space that allows interpolation rather than extrapolation (Abadie & Gardeazabal, 2003; King & Zeng, 2006). The Synthetic Control prevents extrapolation outside the support of the excess stock return predictors by restricting the weights given to each firm to be zero or positive and sum to one (Abadie & Gardeazabal, 2003; King & Zeng, 2006).

The principles behind the Synthetic Control are similar to those of the Propensity Score Matching Method. The quality of the fit between the control and treated company is maximized by matching the best pair. However, the Synthetic Control has only one treated firm, and the credibility of the method depends on the quality of the fit between the pair. To maximize the quality of the fit, the Synthetic Control creates a synthetic company, consisting of a weighted combination of the non-treated companies. The differences between the Synthetic Control and Propensity Score Matching are that the Synthetic Control only match one treated company, and that the treated company is matched with a synthetic company consisting of a weighted combination of relevant non-treated companies.

6.5.4 *Sampling Interval*

Daily data has potentially more explanatory power than monthly data (Brown & Warner, 1980; Campbell, 1997). However, for the Synthetic Control weekly or monthly data could offer advantages over daily data. Longer sampling interval could potentially provide us with smoother data and makes it easier for the Synthetic Control to construct a synthetic company

from the "donor pool". There is a trade-off between maximizing the explanatory power of the event and maximizing the likelihood of getting a good synthetic control group. The Event Model is more vital in the analysis compared the Synthetic Control. In addition, if the market is efficient, the stock prices will reflect all public news immediately after an announcement. Following this argument, the daily market return is necessary in order to capture the immediate market reaction, though at the cost of potentially lower quality of the Synthetic Control.

6.5.5 *Creating the Control Group*

As mentioned, a problem with observational studies is to get a good enough control group for comparison. The Synthetic Control package for Stata allows us to build a synthetic company consisting of firms from the "donor pool". The "donor pool" is a set of non-treated firms which are relevant and comparable to the treated firm. The package selects a weighted combination of the firms from the "donor pool" based on the given criteria variables set by the researchers, and tries to maximize the fit of the pre-treatment outcome, R_{it} of the treated unit (Abadie & Gardeazabal, 2003). The Synthetic Control requires the companies in the "donor pool" to have similar characteristics, such as size, risk and industry. Without similar characteristics between the treated firm and the "donor pool", the Synthetic Control reduces its quality and accuracy. Finally, having a big "donor pool" can result in over-fitting, thus only relevant and comparable firms are included. In order to fulfil the criteria, we define the peer-group of Statoil and Telenor from our primary dataset in the General OLS Model to be the "donor pool".

There is a limited disadvantage in including variables that are uncorrelated with excess stock return since they are of little influence in the optimization procedure. The method simply allocates a low weight to an irrelevant variable. However, excluding a potentially important variable can be very costly in terms of decreased accuracy which creates extreme counterfactuals (Abadie & Gardeazabal, 2003). Stuart (2010) recommends that researchers should be liberal in terms of including variables that may be associated with excess stock return. The variables that we find most important to explain the excess stock return for Statoil and Telenor are; the firm's correlation with the excess market return, R_t^m, *HML*, *SMB* and *MOM*[44]. The "donor pool" consists of only relevant companies in terms of size, operations and competition, as a result, these characteristics are already matched.

[44] We use the rolling 100-day factor loadings for Statoil and Telenor, and the firms in the donor pool to optimize the pre-divestment fit.

The Synthetic Control Package in Stata selects the weights, *W**, such that the resulting synthetic control group minimizes the root mean square prediction error, *RMSPE*, over the pre-treatment period. The *RMPSE* is a quality measure of the fit between the synthetic and treated firm. The package allocates the weights, *W**, that maximize the quality of the fit between the control and treated firm. Technically, it minimizes the *RMSPE* and finds the combination of firms that provides the synthetic company with the highest common support (Abadie et al., 2015), see Appendix for further details regarding the technical properties of the Synthetic Control. The set of weights, *W**, and the post-treatment data are used to estimate the counterfactual. Figure 4 illustrates an example from Abadie et al. (2010), in which they construct a synthetic state for California, using a combination of other states in the US. The quality of the synthetic fit is considered high.

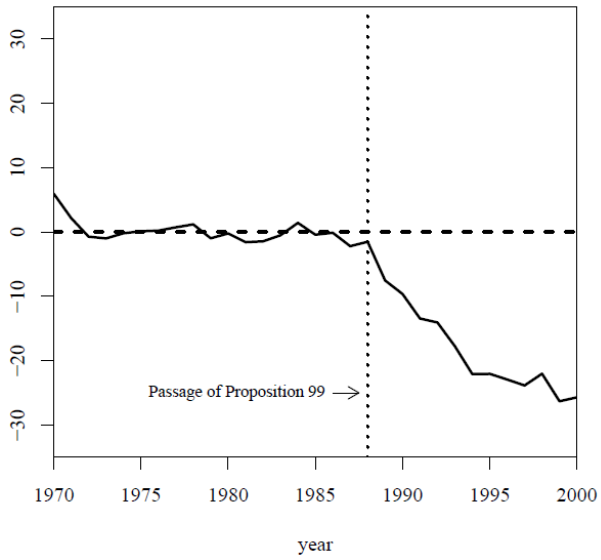

Figure 4: Example of the Synthetic Control (Abadie, Diamond, & Hainmueller, 2010). The Y-axis denotes the differences between the dependent variable for the treated unit and its synthetic control group. The downward sloping line represents the differences. The vertical stippled line highlights the date of the treatment.

6.5.6 *Placebo Test*

Due to the lack of significance levels for the estimated effects, we need to perform inference tests in order to validate the results. In short, the placebo test repeats the optimization procedure for each firm in the donor pool and creates a synthetic company for each firm. With “In-Space” placebo treatments we are able to estimate the probability of observing the same market reaction. The placebo treatment is conducted on the firms in the "donor pool" of both Statoil and Telenor. An illustrative example of the “In-Space” placebo test from Abadie et al. (2010) is presented in Figure 5.

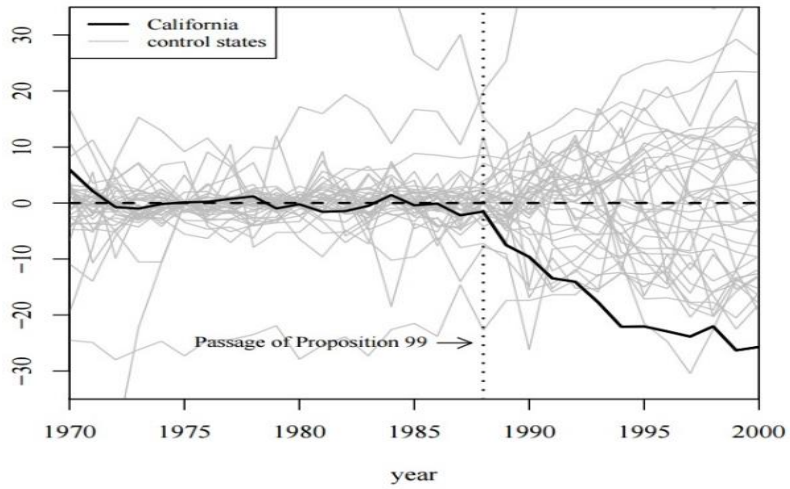

Figure 5: Example of a Placebo test (Abadie et al., 2010). The Y-axis denotes the differences between the synthetic and treated/placebo unit. The bold line represents the differences between the synthetic and the true treated unit. The grey lines represents the differences between the placebo synthetic units and the units in the donor pool. The date of treatment is illustrated by the vertical stippled line. The rarity of the magnitude of the difference on the treatment date indicates if the results are significant.

We implement a similar placebo test on all four divestments. Using the results from the placebo tests, the *Post/Pre RMSPE*-ratio of each placebo-treatment are compared to the true treatment. One important aspect of the ratio-test is that it incorporates the quality of the Synthetic Control. As mentioned, the accuracy of the Synthetic Control depends on the quality of the pre-treatment fit, and a bad fit can result in extreme counterfactuals. A bad fit is indicated with a high *pre-RMSPE*. As a result, to get a high *Post/Pre RMSPE*-ratio, the quality of the fit has to be good (low *Pre-RMSPE*) and the pre-event difference between the treated unit and the counterfactual has to be large (high *Post-RMSPE*). In Figure 5, the treated unit has by far the most extreme ratio in the test. The probability of observing the *Post/Pre RMSPE*-ratio is used as the significance level of the treatment effect.

6.5.7 *Results of the Synthetic Control*

The composition of the synthetic firm for both Statoil and Telenor are tabulated in Table 7. The quality of the pre-treatment fit varies with each event, but the overall quality of the pre-treatment fit is not optimal, thus reducing the accuracy of the method. The Root Mean Square Prediction Error, *RMSPE*, for each event is tabulated in Table 8.

Donor Pool	Synthetic Telenor (First Divestment)	Synthetic Telenor (Second Divestment)	Donor Pool	Synthetic Statoil (First Divestment)	Synthetic Statoil (Second Divestment)
TDC	0.469	0	BP	0.49	0.124
Tele2	0	0.053	Cameron	0	0
Telecom Italia	0.14	0	Chevron	0.196	0
Telefonica	0	0	Conoco Philips	0	0
United Internet	0.391	0.701	Exxon	0	0
Vodafone	0	0.247	Repsol	0.314	0.876
			Shell	0	0
			Total	0	0

Table 7: Tabulation of the different weights, w, given to Statoil and Telenor's donor pool. The tables lists the weights of each firm, i which constitute the synthetic Telenor and synthetic Statoil for each of the two divestments. In the first divestment of Telenor, we have the following weights; TDC 46.9%, Italia Telefonica 14% and United Internet 39.1%.*

Events	RMSPE
First Divestment in Telenor	0.013572
Second Divestment in Telenor	0.017829
First Divestment in Statoil	0.011914
Second Divestment in Statoil	0.011295

Table 8: The Root Mean Square Prediction Error for the four divestment events. See the Appendix for further details regarding RMSPE.

Figure 6 displays the differences between the treated firms and their synthetic counterpart for 30 observations before and 30 observations after each divestment. The graphs shows that the synthetic counterparts replicate the excess stock return for Statoil and Telenor fairly well for some dates, but the difference is often of significant size. However, the magnitude of the differences on the event date is higher than for most of the observed differences in the observation period of 61 days.

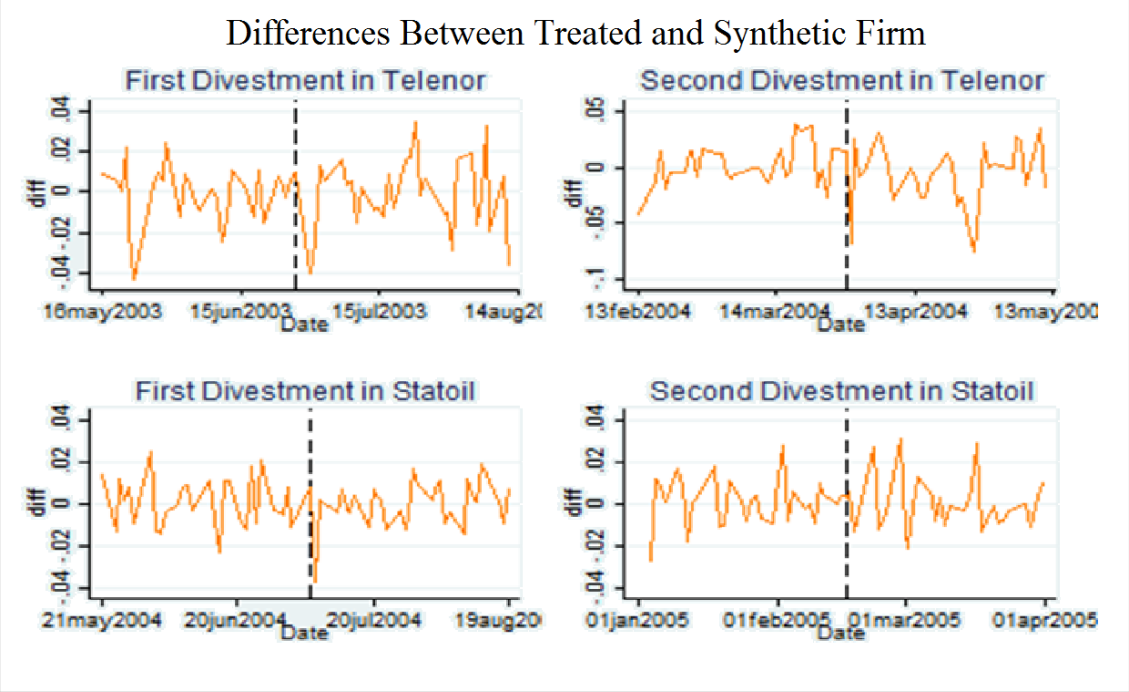

Figure 6: Output from the Synthetic Control Group Method. The y-axis denotes the differences in the excess stock return between Statoil and its synthetic firm, and Telenor and its synthetic firm. The graph illustrates the differences for all four divestment events. The date of divestment is illustrated by a stippled vertical line. Large differences on the date of divestment implies a significant market reaction due to the decrease of government shares.

Regardless of the quality of the pre-treatment fit, the graph shows large differences between the treated and synthetic firm for three out of four events. In both Telenor's divestments and in the first divestment in Statoil, we observe large negative differences, which stand out from the rest of the observations. The market reacts immediately at the date of the divestment and the effect lasts only for a short period. The graphs supports the results in the Event Model, in which the effect from a reduction in state ownership is significant for a 3-day event window.

The graphs in Figure 6 indicate that the estimated market reaction in the Event Model does not contain any omitted variable bias. Industry specific shocks and public events regarding the industry at the time of the event affect both the treated firm and the synthetic firm, hence, the differences between the synthetic and treated firm will be small and have little or no effect on the graph. However, we observe large differences at the execution date. We conclude that the estimated effect from the divestment event has no omitted relevant industry events because the differences between the synthetic and treated firm are abnormally high at the time of the event.

Finally, we conclude that there is no clear pre-treatment trend in the price, suggesting that the Government did not sell in response to movements in the stock price. The negative market reaction takes place on the exact event date and there is no evidence of a persistent trend prior

to the divestment in any of the individual analysis. For this reason, the critical assumption of an exogenous event is more likely to be correct. All things considered, the Synthetic Control provides evidence of an exogenous event and that the causality runs from divestment to excess stock return. Ultimately, the results increase our confidence in the Event Model.

6.5.8 *Robustness of the Results*

To evaluate the credibility of the Synthetic Control, we conduct a final "In-Space" placebo test where the treatment is reassigned to all the comparison firms in the donor pool. Using the Synthetic Control with the same treatment date on all firms, it is possible to test if there is a similar market reaction for the firms in the donor pool. The placebo test enables us, to some degree, to interfere on the results. We will deem the results significant if the estimated effect from a change in state ownership is unusually large for Statoil and Telenor relative to the distribution of the placebo market reactions (Abadie et al., 2015). We expect the market reaction for Statoil and Telenor to be significant larger than the market reactions from the placebo tests. The results of the placebo tests are illustrated in Figure 7.

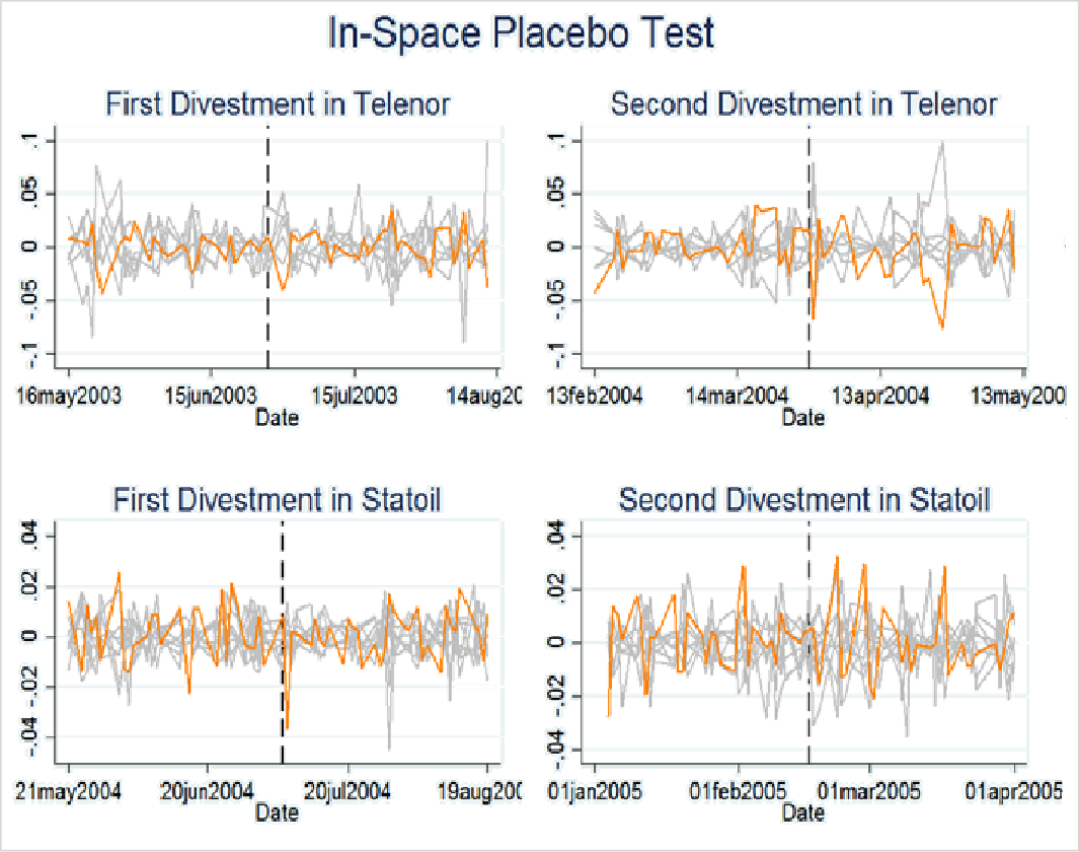

Figure 7: The graphs illustrate the "In-Space" placebo test of the Synthetic Control. The Synthetic Control is used on all firms by reassigning the treatment to all of the comparable firms in the donor pool. The Y-axis denotes the differences between the synthetic and treated/placebo firm. The yellow line represents the differences between the synthetic firm and Statoil or Telenor, respectively. The grey lines represents the differences between the synthetic firms and the firms in the donor pool from the placebo tests. The date of treatment is illustrated by the vertical stippled line. The rarity of the magnitude of the difference on the treatment date indicates if the results are significant.

The yellow line represents the true treatment effect of Statoil or Telenor. The magnitude of the differences in both divestments in Telenor and in the first divestment in Statoil, are unusually high compared to the placebos given by the grey lines in Figure 7, which suggests a significant market reaction from a change in state ownership. In the case of Statoil's second divestment, the magnitude of the differences are more normal relative to the placebos. On that day, many of the placebo treatments have higher differences than the one observe for Statoil, suggesting that the small negative market reaction from the divestment in Statoil in 2005 is not significant. All though eyeballing the graphs might provide some hints on the credibility of the results, it is not a valid approach to decide the statistical significance level.

Finally, Figure 8 reports the ratios between the *Post-RMSPE* and the *Pre-RMSPE* for all events in Statoil and Telenor, combined with the ratio for all placebo treatments. A relative large ratio indicates that the treatment is statistically significant and that the quality of the pre-treatment fit is good, and a small ratio indicates a bad pre-treatment fit or/and insignificant treatment. Using the *Post/Pre-RMSPE* ratios in Figure 8 we are able to calculate the alternative significance level of the results.

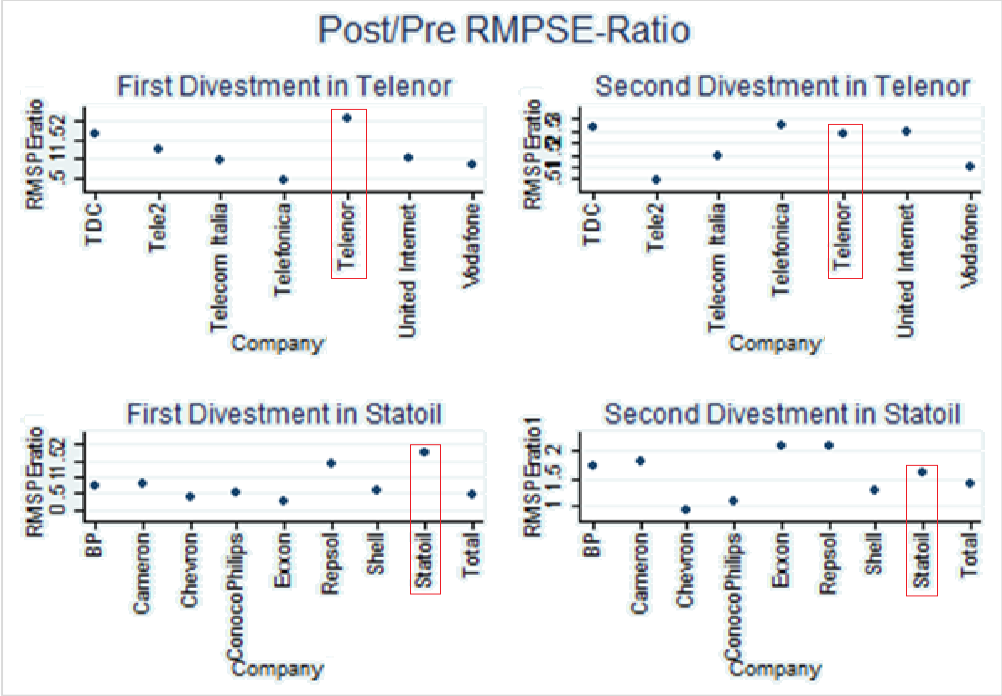

Figure 8: Output of the Post/Pre RMPSE-Ratio for the In-Space Placebo test for the Synthetic Control. The graphs illustrate the ratios between the Post-RMSPE and the Pre-RMSPE for all divestment in Statoil and Telenor, combined with the ratios for all placebo treatments. A relative large ratio compared to the rest of the sample indicates that the market reaction from the divestment is statistically significant and that the quality of the pre-treatment fit is good. A small ratio indicates a bad pre-treatment fit or/and insignificant market reaction. The red square highlights the Post/Pre-RMPSE Ratio for the actual divestments for Statoil and Telenor.

Figure 8 illustrates that two out of four events have the highest *Post/Pre-RMSPE* ratio relative to the placebo test ratios. As a result, if the divestment was randomly assigned to a firm in the "donor pool", the probability of obtaining a ratio as high as Telenor and Statoil's first divestment is $\frac{1}{7} = 14.29\%$ and $\frac{1}{9} = 11.11\%$, respectively. In Telenor's second divestment the probability is $\frac{4}{7} = 57.14\%$, and Statoil's second divestment $\frac{5}{9} = 55.56\%$. Because the "donor pools" only consist of six and eight companies, Telenor and Statoil respectively, the maximum significance level is $\frac{1}{7} = 14.29\%$ for Telenor and $\frac{1}{9} = 11.11\%$ for Statoil. Abadie et al. (2003) use the 5% significance level to deem their results valid. As a consequence, the magnitude of

the market reaction from the Synthetic Control cannot be treated as statistically significant. However, the Synthetic Control, illustrated in Figure 6, is still valid as an indication of the exogenous nature of the divestment event.

6.5.9 *Limitations of the Results*

The relevance of the *Post/Pre-RMSPE* ratio test is highly dependent on the quality of the pre-treatment fit. As mentioned earlier, a poor pre-treatment fit results in lower ratios. Unfortunately, this is the case with the Synthetic Control. The Synthetic Control replicates the excess stock return of Statoil and Telenor fairly well, but the *RMSPE* is too large to be used for any significance level. As a result, the ratios from Figure 8 should not be trusted. For the analysis it means that we do not have any reliable significance levels from the Synthetic Control.

6.6 **Empirical Impact of the Results**

The General OLS Model finds no significant correlation when analysing the general relationship between state ownership and abnormal return. The estimated relationship is positive, but not significant which implies that state ownership in general has a neutral effect on the abnormal return of the firm. In addition, the model reveals that state ownership increases the market beta of the firm. The model reveals a 0.314 higher market beta in state-owned firms compared to private firms, significant at a 1% level. Thus, if the OLS-assumptions hold, the General OLS Model predicts that state ownership has a neutral effect on abnormal return, but leads to higher systematic risk.

The Event Model estimates a 40.1% reduction in daily abnormal return using a 1-day event window, *K=1,* for a hypothetical 100% divestment. The negative market reaction indicates that state ownership leads to higher abnormal return for Telenor and Statoil, if the event is exogenous. Moreover, the Event Model finds that the market beta increases with 0.123 at a 5% significance level after a divestment, implying that state ownership reduces the systematic risk of the firm. The conflicting results regarding systematic risk between the Event Model and the General OLS Model can methodologically be explained by different reference groups, private firms and previous levels of market betas, in the two models.

Earlier studies are concerned with the potential selection bias problem due to fundamental differences between state-owned and private firms. However, the Event Model provides evidence that state ownership in some cases truly has an effect on stock performance. As a result, the correlation in the General OLS Model, represented by *SOE* will to some extent be caused by state ownership. It is worth mentioning that the possibility of fundamental, fixed differences in the dataset could still cause bias in the *SOE* variable, but the Event Model has proven that in the case of Telenor and Statoil abnormal return is partly a result of the benefits of having the Norwegian Government as an owner. However, differences within state-owned firms, and between state-owned firms and private, which are not controlled for in the General OLS Model, make us unable to conclude that the *SOE* is an unbiased estimate of the state ownership effect on stock performance.

Finally, the Synthetic Control indicates that the divestment decision is not endogenous, in terms of reverse causality or omitted variable bias, which makes the Event Model statistically valid. The placebo tests of the Event Study and the results of the Synthetic Control strengthen the statistically significance and validity of the negative market reaction following a divestment. As a consequence of the relative poor quality of the pre-treatment fit, the Synthetic Control is only valid[45] as a robustness test of the exogeneity of the event.

A limitation to the results are the small sample selection of state-owned firms and divestments which limit the impact of the results in the Event Study. There could be differences between state-owned firms, as a consequence, we have to be careful to generalize the results of the Event Model. The empirical results suggest that state ownership has positive impact on the abnormal return of Statoil and Telenor, but have an overall neutral effect for all state-owned firms. In addition, the results suggest that state ownership leads to higher systematic risk compared to private firms and that privatization leads to higher systematic risk. The results from the General OLS Model will be emphasized the most in the analysis, but the model alone is most likely not statistically valid due to unobservable differences between state-owned and private firms. To provide an economic valid answer to our research question the results have to be analysed using economic theory.

[45] If the results of the Synthetic Control were statistically valid, we could also conclude on the size of the individual market reaction due to a reduction in state ownership. This could have been used to analyse different thresholds levels of privatization.

7 Economic Analysis

The abnormal return for Statoil and Telenor in the Event Model are significant and robust. However, the General OLS Model do not find empirical support for a positive correlation between state ownership and abnormal return. To be able to conclude on the impact of state ownership in Norway, we need to further elaborate on the economics behind the results. Hence, economic theory is used to supplement the empirical analysis. Our economic view is through theoretical arguments derived from Agency Theory and Pricing Theory.

7.1 Agency Theory Arguments

Corporate governance contributes to abnormal return. The General OLS Model documents a positive, but not significant, correlation between state ownership and abnormal return. However, the negative market reaction estimated in the Event Model implies that state ownership is believed to have a positive impact on the abnormal return. Privatization in Norwegian state-owned firms diversifies ownership which separates ownership and control, and creates agency costs (Fama, 1980). The "Managerial View" predicts that this should lead to reduced performance and could be one explanation for the negative market reaction estimated in the Event Model. Moreover, diversified ownership might impair the corporate governance practises in the state-owned firms and thus, to a greater extent encourage rent seeking behaviour. As a result, managers in Statoil and Telenor might pursue their own personal goals after privatization which diminish the value of the firm. It is reasonable to assume that it is in the interest of the Government to ensure the highest market value of their assets. Highly developed corporate governance practices increase the likelihood of attracting investors and help build a financially and strategically strong organization for long-term growth in shareholder value. For this reason, state ownership might induce corporate control and ensure shareholder value maximization. Hence, a potential explanation of the perceived positive impact of state ownership in Statoil and Telenor, is through better corporate governance practices.

The corporate governance role of the Government might create free-rider opportunities resulting in abnormal return for investors holding state-owned company stocks. According to the dilution effect of the "Managerial View", state-owned should outperform private firms

because of better monitoring of managers. High ownership stakes in Telenor (53.97%) and Statoil (67%) increases the incentives for corporate governance (Laffont, 1993). The Government is a majority owner who is likely to spend time and resources on enforcing shareholder value maximization thus, creating a free-rider opportunity for passive investors. On the contrary, investors in private firms with diluted ownership will not have the same free-rider opportunity. Moreover, this implies that passive investors in state-owned firms profit on the corporate governance initiatives of the Government and that state-owned should outperform private firms. Thus, high quality of corporate governance practices could be one explanations for the positive abnormal return documented in Statoil and Telenor. Different aspects of state ownership affect the abnormal return of a firm either positively or negatively. Even though the results in the General OLS Model reveal a neutral effect of state ownership, the corporate governance role of the Government might contribute with abnormal return. However, other aspects of state ownership might neutralize the positive contribution with offsetting effects. Another explanation of the neutral effect in the General OLS Model could be that corporate governance practises differ between state-owned firms. The Government might have different roles in Statoil and Telenor, than in the rest of their ownership portfolio. As a consequence, only shareholders in Statoil and Telenor benefit from state ownership.

On the other hand, board members representing the Government might not have the right financial incentives to induce corporate control. The Government relies on their representatives in the board of directors to act on behalf of the Government and to preserve the value of the company. However, lack of incentives might lead to impaired corporate control, and will have a negative effect on the performance of state-owned firms. The representatives are not committed with any personal investments, which might lead to lack of proper incentives to monitor the behaviour of the managers (Xu & Wang, 1999). This implies that state ownership should be negative correlated with abnormal return, which contradicts the neutral effect estimated in the General OLS Model. Moreover, a divestment reduces the number of Government's representatives in the board of directors and should result in a positive market reaction. The argument is inconsistent with the results for Statoil and Telenor, but could be applicable for other firms in the General OLS Model if the financial incentives to induce corporate control vary between state-owned firms.

In addition, state ownership might lead to the pursuit of political goals rather than shareholder value maximization. Having the Government as a majority owner can create "majority-minority problems"(Gitmark, 2015). The Government could be tempted to gain advantages at the

expense of the minority owners and pursuit other goals which could lead to lower returns. However, the principles of passive ownership weakens the "Political View" argument. The Norwegian Government has clear corporate governance principles which state that it shall act as a passive investor. This implies that it cannot interfere in neither strategic decisions nor operational activities.

On the other hand, the election of representatives in the board of directors is a political and subjective process, as a result, the representatives might be political biased. The political bias can result in non-profit maximizing goals, leading to a negative abnormal stock return. This argument could explain parts of the results in the General OLS Model. The "Political View" contributes with a negative aspect to the analysis of why state ownership has a neutral effect on abnormal return. Political and social goals could reduce the profitability of the firm and offset other positive attributes of the Norwegian Government, which results in a neutral effect of state ownership. Following the same argument, the market would expect state-owned firms to be more efficient and react positively to a divestment. A reduction in state ownership could serve as a signal of a reduction or potential elimination of the focus on social and political goals in the firm. The divestments in Telenor and Statoil lead to less government control and make private investors more responsible for ensuring a shareholder value maximization strategy. The argument is supported by Boardman and Vining (1989), Frydman et al. (1999) and Gupta (2005) who find evidence of private and fully privatized firms being more efficient than state-owned. The argument contradicts the results from the Event Model. However, one explanation could be that the control rights continues to be in the hands of the Government after the divestment.

Divestments of limited size reduces the benefits of privatization. The "Political View" argument contradicts the results of a negative market reaction in Statoil and Telenor. However, it is possible that the market does not consider the small divestments in Statoil and Telenor to be sufficient. The market might not believe that a small reduction in state ownership is a big enough commitment for a significant reduction in the political influence over the firm. Earlier studies support our belief that full privatization is vital for achieving performance improvements. Scholars find that control rights have to be passed on to private hands before achieving any privatization benefits. Boardman and Vining's (1989) results indicate that efficiency and profitability gains only are achieved with full privatization. Another study by Eckel, Eckel and Singal (1997) finds concrete evidence that the efficiency of Air Canada did not increase until the control passed to private hands. As a consequence, the level of state

ownership has to surpass a certain threshold level in order to achieve the advantages of privatization. It is possible that the small divestments in Statoil and Telenor are not big enough for the financial market to react positively on. For this reason, the "Political View" argument of a more effective and profitable company after divestment due to a reduction in political goals, might be less relevant when analysing the divestments in Telenor and Statoil.

Many factors affect stock performance, which makes it difficult to conclude on the economic mechanism behind the results. Some characteristics of the Government contributes to abnormal return, while other could have a negative impact. It is reasonable to believe that partial privatization increases efficiency due to fewer political goals, but other benefits from having the Norwegian Government as an owner could explain the negative market reaction estimated in the Event Model. Varying impact of state ownership could be explained by different roles of the Norwegian Government in the state-owned firms. As a result, state ownership in Statoil and Telenor might have a significant positive effect, but on a general basis the effect of state ownership is neutral as documented in the General OLS Model. It is important to emphasize that the increased efficiency earlier studies report is not necessarily inconsistent with a neutral effect of state ownership or a negative market reaction after a divestment. The market might believe that the corporate governance principles or other owner characteristics of the Norwegian Government outweigh or neutralize the increased efficiency from privatization. Especially the perception of protection against downside risk through channelling of government funds to the firms could be an important mechanism which might offset the negative aspects of the state ownership.

7.2 Soft Budget Constraints

The general relationship between state ownership and higher systematic risk, and the negative market reaction documented in Statoil and Telenor, could be the result of soft budget constraints. Increased investments and protection against downside risk, is a mechanism through which soft budget constraints could affect systematic risk and abnormal return. Channelling of government funds and independent management can result in higher risk taking. At the same time, the Government is unlikely to allow the firm to face bankruptcy, thus, reducing downside risk and the firm's market beta without changing the expected return of its investments, potentially increasing the firm's abnormal return. The impact of soft budget constraints will be discussed in the sections below.

The passive ownership of the Government could lead to higher systematic risk in the firm's investments. The argument supports the results in the General OLS Model of a higher systematic risk in state-owned firms compared to private. The passive role of the Government in investment and strategic decisions creates an administrative controlled firm which implies that the decisive authority transferred from the board of directors[46] to the management. Thus, the passive ownership structure may have implications for the firm's investment behaviour. Managers might seek more opportunistic investments which isolated could lead to greater systematic risks and hence, according to CAPM, higher expected return. The argument implies higher systematic risk for state-owned firms, and is consistent with the results in the General OLS Model.

Moreover, financial characteristic of the Government can increase the market beta of the firm. Long investment horizon combined with a well-diversified large portfolio, implies that the Norwegian Government is risk-seeking (Fiskeridepartementet, 2014). A financially strong owner with low risk aversion results in investment opportunities and funding for state-owned firms not available for private. For this reason, state ownership could lead to investments with higher systematic risk compared to private ownership if capital is a scarce resource. This is in line with the results from the General OLS Model where the model estimates a higher market beta for state-owned firms compared to private.

However, other owner characteristics of the Norwegian Government reduces the systematic risk of the firm by partially removing the threat of bankruptcy. The Government is unlikely to allow big and strategically important firms to go bankrupt, thus potentially eliminating or reducing downside risk. The Government acts as a bailout investor. Without the threat of bankruptcy, the firms' downside risk is limited, resulting in a lower market beta of the firm compared to the weighted average of its investments[47]. Following this argument, a reduction in state ownership results in less protection against downside risk which leads to higher market beta of the firm. The argument supports the results in the Event Model, where we find evidence of an average increase in the market beta after a divestment, implying that the systematic risk increases with privatization. The results diverge from the positive relationship in the General OLS Model between state ownership and systematic risk.

[46] In private companies the owners, through the board of directors, have the decisive authority of the firm.
[47] The assumption behind the arguments is that firms constitutes of a portfolio of investment. The firms expected return and risk is calculated as a weighted average of its portfolio.

However, the diverging results from the General OLS Model and the Event model regarding systematic risk could be the result of differences between the systematic risk of the firm and its investments. Whereas state ownership might lead to riskier investments, the Government also provides the firm with protection against any downside risk. As a result, the systematic risk of the firm is lower than the weighted average of its investment. In this way, it is natural to observe a higher systematic risk in state-owned firms compared to private firms, and a higher market beta when the protection against downside risk is reduced after a divestment. This argument supports the findings regarding systematic risk in the general OLS Model and the Event Model. The Section below will explain the impact of protection against downside risk.

A protection against downside risk, without changing the expected return of its investments, is a source of abnormal return. Investors in state-owned firms get the expected return from the firm's investment, but at a lower risk than if they were to replicate the same cash flow. For the same market beta, a state-owned firm has a higher expected return than the comparable private firm, resulting in positive abnormal return. As a result, the bailout role of the Norwegian Government could be a source of abnormal return and contributes positively to the estimated neutral effect of state ownership in the General OLS Model.

An increase in systematic risk after a divestment, without changing the expected return, leads to a negative market reaction. Pricing Theory predicts that the market reacts with an immediate negative price correction on the first trading day after the announcement because of the anticipation of an increase in systematic risk for the same cash flow. According to Gordon's Growth Model and CAPM, an increase in systematic risk increases the cost of equity, and if future dividends are held constant, then stock prices drop immediately. This is in line with the immediate negative market reaction and the increase in the systematic risk of both Telenor and Statoil estimated in the Event Model. The argument supports the findings for Telenor and Statoil in the Event Model. However, soft budget constraints are not in every aspect positive for state-owned firms, especially the lack of market discipline could affect the profitability of the firms.

Lack of market discipline might cause inefficient state-owned firms. The disciplinary effect of the market is a second mechanism through which soft budget constraints could affect the market value of a firm. Fully privatized firms strive to be as efficient and competitive as possible because the threat of financial distress, credit ratings and take-overs is more important to private firms For this reason, private firms should be more efficient than state-owned, which all things equal, contributes negatively to the effect of state ownership and contradicts the results for

Statoil and Telenor. Majumdar (1998) and Kornai, Maskin and Roland (2003) find supporting evidence of soft budget constraints leading to inefficiency in state-owned firms. However, it is important to emphasize that efficiency and stock performance are not necessarily perfect correlated. Soft budget constraints might lead to less efficient firms, but protection against downside risk might have a positive impact on the abnormal return. Moreover, the impact of soft budget constraints may differ between state-owned firms and could be one reason behind the neutral effect of state ownership estimated in the General OLS Model.

7.3 Economic Conclusion

Economic theory does not provide any guidance on the trade-off between state and private ownership. Earlier studies tend to support arguments in favour of privatization, however, without a proper test, it is difficult to conclude on whether the "Managerial View" or the "Political View" of Agency Theory affect returns the most. In addition to the diverging theoretical effect of state ownership, the Government might have varying roles and owner characteristics in the state-owned firms. As a result, the effect of state ownership varies between the firms analysed in the General OLS Model and could explain why we do not have the empirical support to conclude on a general basis that Norwegian state ownership has a positive or negative effect on abnormal return. Neither economic arguments nor the empirical results are able to favour private over state ownership, resulting in a conclusion of a neutral effect of Norwegian state ownership which may vary between firms.

The abnormal return for Statoil and Telenor in the Event Model are significant and robust, but it is difficult to conclude on the economic mechanism behind the results. One explanation is that protection against downside risk for a given level of expected return, results in a positive abnormal return. Further, a divestment might result in less protection against financial distress, leading to higher market beta without increasing the expected return. As a result, the market anticipates the higher future market beta and reacts negatively, which is consistent with the result in the Event Model. To conclude on the economic reasons for the observed relationship between state ownership and abnormal stock return, each economic argument has to be empirically tested. This is left for future research. Further, we recommend future research to analyse state ownership characteristics in Telenor and Statoil with other state-owned firms to see if the Norwegian Government can contribute with abnormal return in all its firms.

8 Firm-Specific Analysis

8.1 Motivation and Background

As a supplementary analysis, we compare the abnormal return of the individual state-owned companies in the sample compared to their peer-average. Our motivation behind this analysis is that the performance of state-owned firms are often[48] compared to an index or industry using accumulated return. Using our own dataset, the state-owned firms are compared to their average peer. The results are presented in Figure 9.

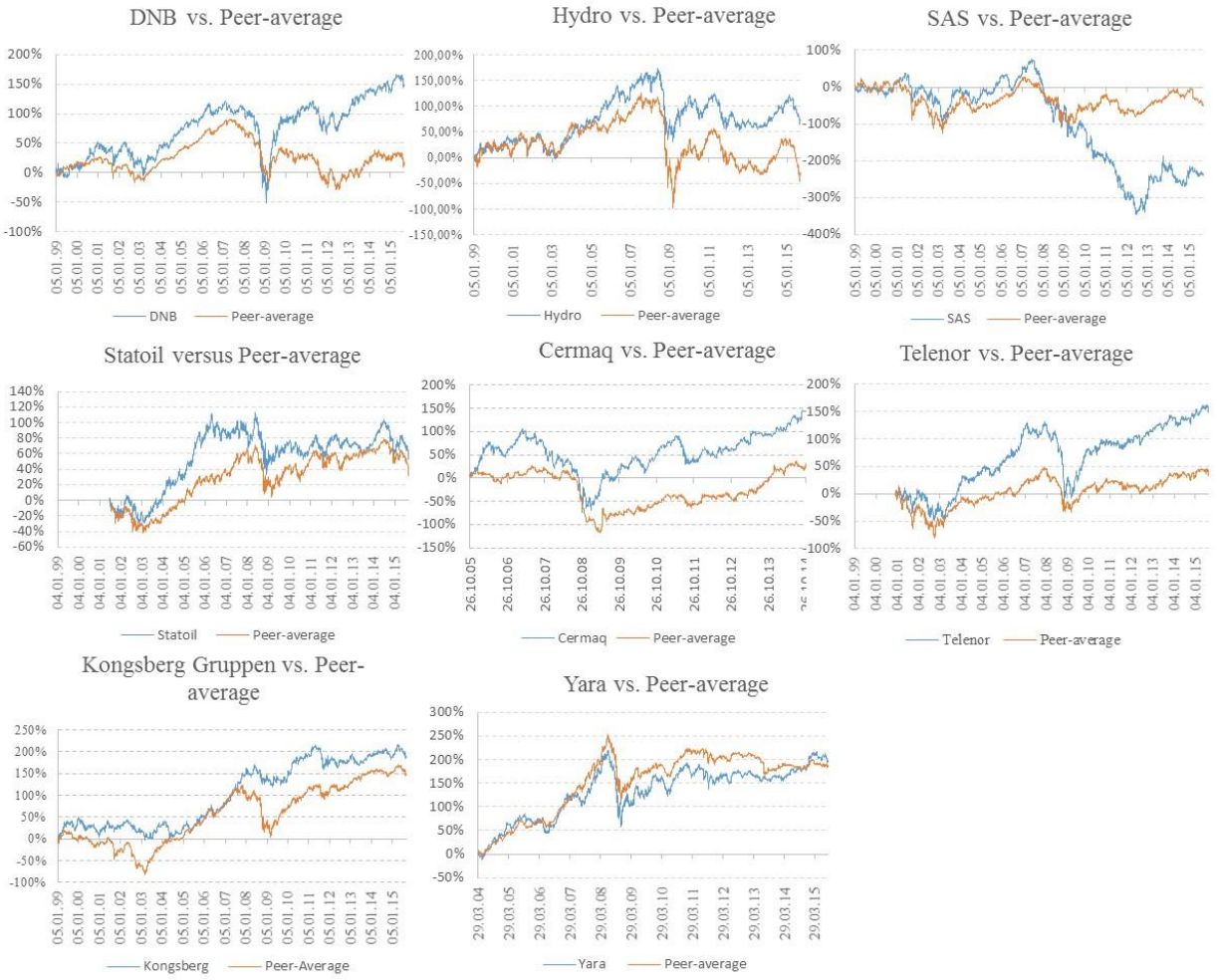

Figure 9: Accumulated excess return of the state-owned companies and the industry average. The industry average is constructed from the average of the state-owned companies' peer-groups.

[48] Among others, an article from Aftenposten uses accumulated graphs to conclude on the effect of state ownership (Bjørnestad, 2014, November 08)

Figure 9 indicates that some of the state-owned firms have higher excess stock return than their respective peer-average. However, graphing accumulated returns mislead the true relationship between state ownership and excess stock return because one period of good return will have an infinite effect on the accumulated return An abnormally high return at time T_0 gives a spike in the accumulated return graph which lasts for the whole period T_t>T_0. Thus, in order to estimate the relationship between individual state-owned firms and abnormal return compared to the average peer-group, we use daily rather than accumulated return and consider normal return.

8.2 Firm-Specific Model

We estimate a firm specific OLS Model[49] for each of the state-owned firms.

$$R_{it} = \alpha_i + B_1 SOE_i + B_2^i R_t^m + B_3^i SMB_t + B_4^i HML_t + B_5^i MOM_t + B_6 Year_t + B_7 Month_t + \varepsilon_{it}, \qquad if\ Industry_j = j$$

The model has the same specifications as the General OLS Model in Section 6.2, except that the regression is run for each industry[50] separately. The firm sample consists of state-owned firms and the average peer. The model tests if the state-owned firm has an abnormal return higher than the average in its industry. It is an empirical test of the graphs in Figure 9.

8.3 Results of the Firm-Specific Model

We perform eight individual regressions, one for each state-owned company. The results are presented in Table 9. The variables listed in column 1 to 8 capture the firm-specific relationship between state ownership and abnormal stock return for each industry. Column 5 shows that SAS has 0.0627% lower abnormal return compared to its peer-average, significant at 1% level. The coefficients displayed in column 1, 2, 3, 6 and 8 show that Statoil, Hydro, Kongsberg, DNB and Telenor have in average significant positive daily abnormal stock returns relative to its peer-average. The coefficients for Hydro, DNB and Kongsberg are significant at a 1% level, Telenor and Statoil are significant at a 5% level. Column 7 shows that Yara is not significant.

[49] We control for the four Fama French factors, excess market return, SMB, HML and Momentum by interacting the factors with a company dummy variable. This creates individual factor loadings.
[50] Airlines, Farming and Fishing, Fertilizer, Financials, Oil and Gas, Industrials, Materials and Telecom

	State Ownership							
VARIABLES	(1) Statoil	(2) Hydro	(3) Kongsberg	(4) Cermaq	(5) SAS	(6) DNB	(7) Yara	(8) Telenor
Statoil	0.000107**							
	(7.54e-06)							
Hydro		0.000222***						
		(2.00e-08)						
Kongsberg			0.000119***					
			(3.91e-17)					
Cermaq				0.000482*				
				(6.42e-05)				
SAS					-0.000627***			
					(2.75e-17)			
DNB						0.000346***		
						(1.51e-07)		
Yara							-1.78e-05	
							(8.05e-06)	
Telenor								0.000327**
								(2.19e-05)
Observations	7,762	8,381	8,382	6,480	8,380	8,381	7,068	7,897
R-squared	0.238	0.267	0.107	0.035	0.109	0.174	0.192	0.166

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

Table 9: Columns 1-10 show the results of the firm-specific regressions in which each state-owned company is regressed on the industry average. The reported coefficient is on a dummy variable for each stated-owned company. The reference group is the average peer-group to the state-owned company in question. Furthermore, we control for the four Fama French factors, excess market return, SMB, HML and Momentum, each interacted with a company dummy variable. Finally, we control for macro factors and seasonal factors using yearly and monthly dummies, respectively.

The results from the Firm-Specific Model show that the relationship between state ownership and abnormal return varies between firms. However, the results demonstrate that majority of the state-owned firms achieves a higher abnormal return compared to the average peer. It is important to emphasize that the results are an empirical test of the graphs in Figure 9, and should not be interpreted as the true effect of state ownership in the individuals firms.

9 Conclusion

The Norwegian state ownership plays a substantial role in the Norwegian economy. The purpose of this thesis, is to analyse the effect of state ownership on abnormal return and systematic risk in Norwegian state-owned firms listed on Oslo Stock Exchange in the period 1999-2015. We compare stock performance between state-owned and private firms and investigate four divestments where Statoil and Telenor are partially privatized through block sales to foreign institutional investors. To our knowledge, this thesis is the first to use the immediate market reactions to analyse the effect of state ownership. Using an OLS specification and an event-study, we are able to estimate the effect of state ownership on abnormal return and systematic risk, and to isolate the effect of state ownership in Statoil and Telenor.

The general relationship between state ownership and abnormal return is analysed in the General OLS Model. The model reveals a positive but not significant correlation which implies that state ownership in general has a neutral effect on the abnormal return of the firm. The results reject *Hypothesis 1* of a negative effect of state ownership and imply that the Norwegian Government contributes with positive abnormal return which offsets the negative effects earlier studies report. In addition, the model reveals that state ownership increases the market beta of the firm. We find evidence of a 0.314 higher market beta in state-owned firms compared to private firms, significant at a 1% level. The results contradict *Hypothesis 2* of less risky state-owned firms and imply that the attributes of the Norwegian Government affect the investment behaviour of the firm. Thus, if the OLS-assumptions hold, the General OLS Model predicts that state ownership has a neutral effect on abnormal normal, but leads to higher systematic risk.

Further, this thesis has analysed the market reactions from four exogenous divestment events in Statoil and Telenor in an Event Model inspired by Dube et al. (2011). The results indicate that state ownership is perceived by the market to have a positive effect on the abnormal return of Statoil and Telenor. The results reveal a negative market reaction of a change in abnormal return of 40.1% for a 1-day event window, $K=1$, and a cumulative change in abnormal return of 38.2% for a 2-day event window, $K=2$, both significant at a 1% level. The market reaction happens immediately after the divestment announcement and is significant up to three days after the event. The results reject *Hypothesis 3* of a positive market reaction and further suggest that the Norwegian Government contributes with positive aspects affecting abnormal return. The exogeneity of the event is validated using the Synthetic Control Group Method. The results

from the Event Model are significant and robust for both "In-Space" and "In-Time" placebo tests.

Finally, the results reveal that privatization increases the systematic risk of Telenor and Statoil. The market beta increases with 0.123 at a 5% significance level after a divestment. The results contradict the positive relationship between state ownership and systematic risk in the General OLS Model. However, the diverging results could be explained by differences between the systematic risk of the firm and the weighted average of its investments. State ownership might lead to riskier investments, and at the same time provide protection against downside risk. As a result, the systematic risk of the firm is lower than the weighted average of its investment. Following this argument, the systematic risk in state-owned firms would be higher compared to private, and a higher market beta would be observed when protection against downside risk is reduced after a divestment.

The mechanisms behind the results are difficult to identify because many aspects of state ownership could affect stock performance. However, the Event Model is able to quantify one mechanism through which state ownership could affect abnormal return. The results of the Event Model imply that state ownership reduces the systematic risk of Statoil and Telenor. This could be a source of abnormal return if the Government reduces the downside risk of the firm without affecting the expected return. A reduction in state ownership results in less protection against downside risk, leading to higher market beta without increasing the expected return. As a result, the market reaction from a state divestment will be negative as we observe in the Event Model. However, the results from the Event Model cannot be generalized to all state-owned firms because state ownership is not homogenous between firms. The effect of Norwegian state ownership may vary between different firms.

Neither the results from the empirical analysis nor economic theory provides any clear guidance on the trade-offs between private and state ownership. The “Political View”, “Managerial View” and different aspect of soft budget constraints provide diverging arguments. In addition, the Norwegian Government’s owner characteristics and roles may vary between the different firms. As a consequence, the theoretical conclusion on how state ownership affects the abnormal return is inconclusive and might be neutral as we estimate in the General OLS model.

Earlier studies support the claim that state ownership leads to inefficiency and low productivity through political goals and lack of market discipline. Boardman and Vining (1989), Dewenter and Malatesta (2001), Gupta (2005) and Frydman et al. (1999) find clear

evidence that privatization leads to profitability and efficiency gains. Majumdar (1998) also supports this claim while investigating the implications of soft budget constraints and the lack of market discipline in state-owned firms. Our results of a neutral effect of state ownership are somewhat diverging from the results in earlier studies. An explanation could be that this thesis stands out from previous work in two ways. First, the dataset consists of market data rather than accounting data. Second, we analyse the effect of state ownership on abnormal return and systematic risk rather than on efficiency or profitability. A neutral effect of state ownership could be consistent with previous evidence as long as the Government contributes with shareholder value which offsets the lower efficiency.

Given the evidence from earlier studies, we conclude that the Norwegian Government contributes with abnormal return which neutralizes, and in Statoil and Telenor offsets other negative aspects of state ownership. Further, we conclude that state ownership affects the systematic risk of the firm positively compared to private ownership, but in the case of Statoil and Telenor contributes with a reduction in systematic risk in comparison to higher levels of private ownership.

The event analysis is relatively robust. The Synthetic Control Group Method combined with "In-Time" and "In-Space" placebos stress the robustness of the results. Still, the models and the dataset are not perfect. One key limitation to the results in the General OLS Model is the potential selection bias problem. The estimated neutral effect of state ownership could be biased due to fundamental differences between private and state-owned firms. We recommend future research to include a broader variety of state-owned firms and divestment events to address the general effect of state ownership in an event study to avoid selection bias. Moreover, with further divestment events the researcher could analyse at which threshold level of privatization the potential increase in efficiency outweighs the benefits of state ownership. Another interesting topic for further research is to analyse the characteristics of the Norwegian Government’s corporate governance practices in Statoil and Telenor to optimize the Government’s contribution to abnormal return in other state-owned firms.

10 Appendix

Company	Country	Industry	SOE	Daily Mean (Raw Return)	SD (Raw Return)	Market Cap.	Volume
Deutsche Lufthansa	Germany	Airlines	No	-0.000136	0.0223	6348.71	3533.34
Intl. Consolidated	Spain	Airlines	No	0.000073	0.0281	3927.59	11906.83
SAS	Sweden	Airlines	Yes	-0.000563	0.0326	8736.27	451.64
Transaero Airlines	Russia	Airlines	No	-0.000675	0.0192	24645.01	12.29
Carr's Group	UK	Farming and Fishing	No	0.000741	0.0168	52.27	94.59
Cermaq	Norway	Farming and Fishing	Yes	0.000628	0.0257	6894.90	296.90
Havfisk	Norway	Farming and Fishing	No	0.000010	0.0328	1073.68	58.32
Agrium	Canada	Fertilizer	No	0.000545	0.0235	7441.66	642.88
CF Industries	USA	Fertilizer	No	0.001136	0.0309	7757.32	8198.67
Israel Chemicals	Israel	Fertilizer	No	0.000398	0.0202	32146.68	2955.16
K+S	Germany	Fertilizer	No	0.000591	0.0235	4153.22	1169.75
Mosaic	USA	Fertilizer	No	0.000151	0.0304	12715.90	3061.45
Potash	Canada	Fertilizer	No	0.000436	0.0231	22099.62	2545.21
Soc Quimica	Chile	Fertilizer	No	0.000458	0.0208	1331741.20	301.91
Uralkali	Russia	Fertilizer	No	0.000270	0.0388	471828.98	3955.42
Yara	Norway	Fertilizer	Yes	0.000688	0.0256	63414.26	2176.02
Alpha Bank	Greece	Financials	No	-0.001065	0.0398	5024.38	5755.97
Bankinter	Spain	Financials	No	-0.000059	0.0175	103274.14	52921.13
Danske Bank	Denmark	Financials	No	0.000221	0.0204	104554.95	1983.66
Dell'Emilia Roma	Italy	Financials	No	-0.000031	0.0205	2624.03	851.94
Di Sondrio	Italy	Financials	No	0.000096	0.0159	1895.18	304.65
DNB	Norway	Financials	Yes	0.000356	0.0230	88395.15	3829.99
Oberbank	Austria	Financials	No	0.000238	0.0048	875.34	1.27
Unicredit	Italy	Financials	No	-0.000388	0.0264	33644.37	35565.86
Alfa Laval	Sweden	Industrials	No	0.000527	0.0228	38191.50	2349.75
Andritz	Austria	Industrials	No	0.000789	0.0224	2303.12	256.42
Beijer Alma	Sweden	Industrials	No	0.000127	0.0224	3281.83	3359.26
Bucher	Swizterland	Industrials	No	0.000384	0.0207	1277.08	16.44
Concentric	Sweden	Industrials	No	0.000965	0.0236	3151.00	89.28
Fischer Georg	Swizterland	Industrials	No	0.000408	0.0223	3926.84	1209.57
Gea	Germany	Industrials	No	0.000218	0.0251	3410.17	643.51
Graco	USA	Industrials	No	0.000488	0.0193	2252.28	318.15
Kongsberg	Norway	Industrials	Yes	0.000450	0.0196	8172.75	84.71
Krones	Germany	Industrials	No	0.000546	0.0227	1139.73	46.39
Rolls-Royce	UK	Industrials	No	0.000343	0.0223	8709.17	10641.09
Senior PLC	UK	Industrials	No	0.000229	0.0277	441.94	887.34
Akka	France	Industrials	No	0.000601	0.0191	224.36	17.00
Atkins	UK	Industrials	No	0.000258	0.0282	770.08	356.51
Costain Group	UK	Industrials	No	0.000249	0.0247	143.74	86.89

Table 10: Descriptive statistics by peer-group. Daily mean raw return is the average daily log stock return, market cap is the average market cap and volume is the average daily trading volume from the period 05.01.1999 -31.08.2015. Firms listed after 05.01.1999 are included from their first trading day.

Company	Country	Industry	SOE	Daily Mean (Raw Return)	SD (Raw Return)	Market Cap.	Volume
Goodwin	UK	Industrials	No	0.000865	0.0208	71.42	3.18
Monberg&Thorsen	Denmark	Industrials	No	0.000170	0.0199	1013.55	3.75
Ricardo	UK	Industrials	No	0.000329	0.0182	189.01	92.83
Sweco	Sweden	Industrials	No	0.000838	0.0238	3575.72	43.17
Alcoa	USA	Materials	No	-0.000159	0.0269	20680.13	14461.24
Aluar	Argentina	Materials	No	0.000342	0.0240	5859.76	404.42
Alumina	Australia	Materials	No	-0.000114	0.0257	5987.79	10086.45
Century	USA	Materials	No	-0.000131	0.0480	889.83	1171.99
Hydro	Norway	Materials	Yes	0.000174	0.0220	98616.03	7309.77
Kaiser	USA	Materials	No	0.000376	0.0258	1078.98	190.40
Noranda	USA	Materials	No	-0.002061	0.0457	439.86	71.60
United Company	russia	Materials	No	-0.000750	0.0238	89274.13	3518.08
BP	UK	Oil&Gas	No	0.000429	0.0225	2069.93	17.94
Chevron	USA	Oil&Gas	No	0.000295	0.0165	141521.45	7682.65
ConocoPhilips	USA	Oil&Gas	No	0.000365	0.0184	67720.90	7414.69
Exxon	USA	Oil&Gas	No	0.000268	0.0159	343099.93	17405.42
Galp	Portugal	Oil&Gas	No	0.000199	0.0226	8878.71	1587.67
Repsol	Spain	Oil&Gas	No	-0.000057	0.0189	23160.67	10902.57
Shell	Netherland	Oil&Gas	No	0.000068	0.0172	49932.06	8129.92
Statoil	Norway	Oil&Gas	Yes	0.000164	0.0192	360490.58	7831.92
Total S.A	France	Oil&Gas	No	0.000151	0.0174	103474.35	8574.99
Cameron Int.	USA	Oil&Gas	No	0.000557	0.0283	7116.47	3568.01
Dril-Quip	USA	Oil&Gas	No	0.000487	0.0293	1643.87	339.09
FMC	USA	Oil&Gas	No	0.000067	0.0235	1662.10	14.97
Helix Energy	USA	Oil&Gas	No	0.000091	0.0347	1668.66	1205.76
Oceaneeri	USA	Oil&Gas	No	0.000610	0.0283	2815.57	1096.10
Subsea 7	UK	Oil&Gas	No	0.000080	0.0351	18849.07	1352.12
Technip	France	Oil&Gas	No	0.000210	0.0252	4921.61	611.29
Megafon	Russia	Telecom	No	0.000370	0.0222	599844.90	27.82
Mobile Telesystems	Russia	Telecom	No	0.000159	0.0243	466401.68	1285.67
TDC	Denmark	Telecom	No	0.000052	0.0191	52616.69	2961.42
Tele2	Sweden	Telecom	No	0.000084	0.0226	40650.01	2371.19
Telecom Italia	Italy	Telecom	No	-0.000404	0.0235	16953.20	87947.18
Telefonic	Spain	Telecom	No	0.000035	0.0184	66455.48	42643.50
Telenor	Norway	Telecom	Yes	0.000408	0.0205	134813.98	4862.86
United Internet	Germany	Telecom	No	0.000725	0.0344	2490.52	558.33
Vodafone	UK	Telecom	No	0.000012	0.0213	86525.04	107849.87

Table 11: Descriptive statistics by peer-group Continued. Daily mean raw return is the average daily log stock return, market cap is the average market cap and volume is the average daily trading volume from the period 05.01.1999 -31.08.2015. Firms listed after 05.01.1999 are included from their first trading day.

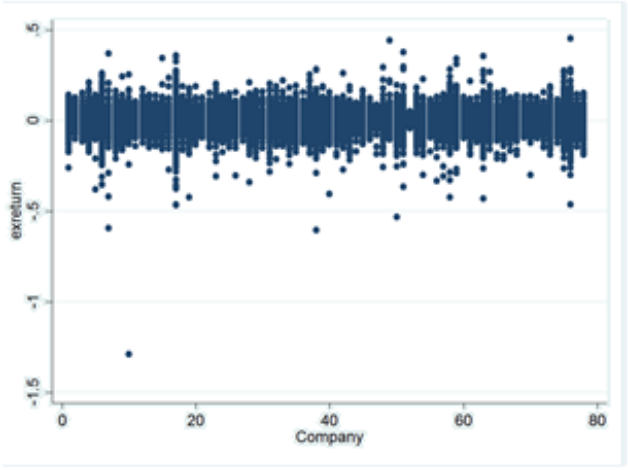

Figure 110: Plot of individual stock return before "Winsorization"

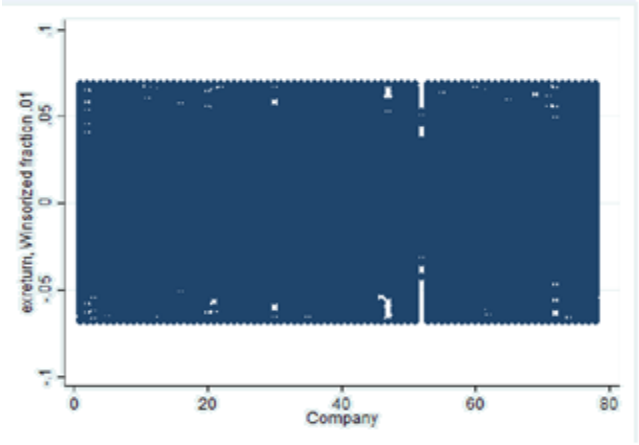

Figure 101: Plot of individual stock return after "Winsorization"

Technical Properties Synthetic Control Method

The technical properties of the Synthetic Control Method are quite complicated. However, the choice of weights W* is quite intuitive. W* is a vector chosen to minimize

$(X_1 - X_0W)'V(X_1 - X_0)$ subject to $w_j \geq 0$ $(j = 1, 2, \dots, J)$ and $w_1 + \cdots + w_j = 1$.

Where X_0 is the firm from the donor pool, and X_1 is the treated firm. The vector, W* optimize the combination of publicly listed firms which best resembles the treated firms excess stock return determinants; RMRF, HML, SMB and MOM, before the change in state ownership. The V vector represents the importance of each excess stock return determinant. The choice of V could be subjective, reflecting knowledge about the relative importance of each particular stock return predictor, or Stata can determine V such that the excess stock return path for the treated firm in the pre-event period is best reproduced by the synthetic control group. In this analysis, V is chosen with the latter method. W* then optimizes both the pre-treatment fit of the excess stock return and the given determinants of the excess stock return. Mathematically the method minimizes the Root Mean Square Prediction Error. The RMSPE is defined below.

$$RMSPE = \left(\frac{1}{T_0} \sum_{T_1}^{T_0} \left(Y_{it} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \right)^2 \right)^{1/2}$$

Our goal is to approximate the excess stock return path that the treated firm would have experienced in the absence of the change in ownership. This is referred to as the counterfactual. The counterfactual is mathematically expressed as $Y_1^* = Y_0 W^*$ and Y_1 is the path of the treated firm. We are interested in the differences, graphed in Figure 4, after the event between Y_1^* and Y_1, denoted as ΔY_{post} (Abadie & Gardeazabal, 2003).

Diff-in-Diff and the Synthetic Control Group Method

The relationship between the *DID*-estimator and the Synthetic Control estimator is easy to show mathematically. The intuition behind the *DID* estimator can be illustrated with an intuitively table:

	Pre - treatment	Post - treatment	Post - Pre
Control Group	β_0	$\beta_0 + \delta_0$	δ_0
Treatment Group	$\beta_0 + \beta_1$	$\beta_0 + \delta_0 + \beta_1 + \delta_1$	$\delta_0 + \delta_1$
Treatment - Control	β_1	$\beta_1 + \delta_1$	δ_1
DID Estimator	Δy_{pre}	Δy_{post}	$\Delta y_{post} - \Delta y_{pre}$
Synth Estimator	≈ 0	Δy_{post}	$\Delta y_{post} - 0$

Table 12: Illustration of the DID-estimator

The *DID*-estimators, δ_1 is presented in Table 12. The *DID* estimator can also be written as: $\delta_1 = Y_{pre} - Y_{pre}$. In comparison, the synthetic control group estimator is, ΔY_{post}. The Synthetic Control minimizes the pre-treatment differences between the control group and the treatment group, ΔY_{pre}. ΔY_{pre} is close to zero if the synthetic control group is of high quality and tracks the treated firm's stock return well. This implies that if the synthetic control group is good, the *DID* estimator and the Synthetic Control estimator should yield the same result.

Strengths and Weaknesses of the Synthetic Control

An important feature of the Synthetic Control, is that the method forces us to test the similarity between the treated firm and the firms from the "donor pool". As a result, we get an indication of the quality of the control group and prevents us from estimating extreme counterfactuals. Extreme counterfactuals are those counterfactuals that are far outside the convex hull of the data (King & Zeng, 2006).

Interpolation biases can be severe if the relationship between excess stock return and the four factor loadings are highly nonlinear and the support of the variables are high (Abadie et al., 2010). To avoid this bias we have restricted the donor pool to only include firms with similar characteristics to the treated firm. Another reason to consider firms similar to the treated unit, is to avoid over-fitting. Over-fitting problems arise when the characteristics of the treated firm are artificially matched by exploiting idiosyncratic variations in a large sample of completely different firms. This could result in a control group which do not follow the same trends and

characteristics as the treated firm, hence resulting in extreme counterfactuals (Abadie et al., 2015).

The credibility of the Synthetic Control depends upon how well it tracks the treated firm's characteristics and R_{it} over a longer time-period prior to the change in state ownership. Abadie et al. (2015) do not recommend this approach when the number of pre-treatment periods is small or the fit is poor. They also state that a longer period of post-treatment data may be required in cases where the treatment effect emerges gradually or changes after the event. Our dataset consists of a multiple periods both before and after a change in state ownership and we believe that the standards of Abadie et al. (2015) are met.

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Stata Do-File

The do-file is organized in sequential order of the methodology with explanatory comments for each step in the methodology. Descriptive statistics and the General OLS Model come first. Further, the do-file of the Event Model is presented and last the four Synthetic Control are presented.

```
1
2   *** Descriptive Statitisics ***
3
4       import excel "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Paneldata.xlsx", sheet("Sheet1")
    cellrange(C1:P368897) firstrow clear
5       cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata\Model 1"
6
7       import excel "C:\Users\Stig
    Bratfos\Dropbox\Masteroppgave\Sluttfase\Datasett\Paneldata.xlsx", sheet("Sheet1")
    cellrange(C1:P368897) firstrow clear
8       cd "C:\Users\Stig Bratfos\Dropbox\Masteroppgave\Sluttfase\output stata\Model 1"
9
10  *** Preparing the dataset ***
11      encode(SOE), gen(SOE1)
12      encode(Company), gen(Company1)
13      encode(Country), gen(Country1)
14      encode(Sector), gen(Sector1)
15      replace Rmrf = ln(1+Rmrf)
16      replace SMB = ln(1+SMB)
17      replace HML = ln(1+HML)
18      replace Momentum = ln(1+Momentum)
19
20  *** Multiplying the closingprice by 100 for the firms where Bloomberg report only 1/100
    of the stock price ***
21      replace Closingprice=Closingprice*100 if Company==("Shell")
22      replace Closingprice=Closingprice*100 if Company==("BP")
23      replace Closingprice=Closingprice*100 if Company==("Rolls-Royce")
24      replace Closingprice=Closingprice*100 if Company==("Senior")
25      replace Closingprice=Closingprice*100 if Company==("Vodafone")
26      replace Closingprice=Closingprice*100 if Company==("Carr's Group")
27      replace Closingprice=Closingprice*100 if Company==("Ricardo")
28      replace Closingprice=Closingprice*100 if Company==("Goodwin")
29      replace Closingprice=Closingprice*100 if Company==("Costain Group")
30      replace Closingprice=Closingprice*100 if Company==("Atkins")
31      replace Closingprice=Closingprice*100 if Company==("Intl Consolidated")
32      replace Closingprice=Closingprice*100 if Company==("Israel Chemicals")
33      rename (Closingprice) (Price)
34      rename (Mcap) (Marketcap)
35
36  *** Generating Excess Stock Return ***
37      gen exreturn =return-rf
38      drop if exreturn==.
39
40  *** Deleting the first observation for all companies ***
41      sort Date
42      gen index=_n
43      drop if index<=88
44      xtset Company1 Date
45
46  *** Generate the SOE and StateBeta variable for all State-owned Firms ***
47      gen SOE2 = 1
48      replace SOE2 = 0 if SOE == "No" | SOE == ""
49      gen StateBeta = SOE2*Rmrf
50
51  ******Descriptive before cleaning********
52      scatter exreturn Company1, msize(vsmall) graphregion(color(white))
53      graph export "scatterexreturnbeforewashing.png", replace
54  *** Testing the normality of the returns before cleaning***
55      qui histogram return
56      graph export "histoexreturnbeforewashing.png", replace
57
58  **** Summary Statistics Return, Mcap and Volume - before cleaning*****
59      sum return Marketcap Volume
60      outreg2 using returnMcapVolume, tex replace sum(log) keep(return Marketcap Volume)
61
62  *** Summary Statistics for state-owned vs private, and for all firms ***
63
64  ***Decriptive Return***
65      sum return if SOE2==1
66      outreg2 using returndescriptive if SOE2==1, tex replace sum(log) keep(return) eqkeep(N
     mean) cttop(State Owned)
67      sum return if SOE2!=1
68      outreg2 using returndescriptive if SOE2!=1, tex append sum(log) keep(return)  eqkeep(N
     mean) cttop(Private Firms)
69      sum return
70      outreg2 using returndescriptive, tex append sum(log) keep(return) cttop(State Owned)
```

```
    cttop(All Firms)
 71
 72 ***Decriptive Marketcap***
 73     sum Marketcap if SOE2==1
 74     outreg2 using marketcapdescriptive if SOE2==1, tex replace sum(log) keep(Marketcap)
    eqkeep(N mean) cttop(State Owned)
 75     sum Marketcap if SOE2!=1
 76     outreg2 using marketcapdescriptive if SOE2!=1, tex append sum(log) keep(Marketcap)
    eqkeep(N mean) cttop(Private Firms)
 77     sum Marketcap
 78     outreg2 using marketcapdescriptive, tex append sum(log) keep(Marketcap) cttop(Private
    Firms) cttop(All Firms)
 79
 80 ***Decriptive Volume***
 81     sum Volume if SOE2==1
 82     outreg2 using volumedescriptive if SOE2==1, tex replace sum(log) keep(Volume)  eqkeep(
    N mean) cttop(State Owned)
 83     sum Volume if SOE2!=1
 84     outreg2 using volumedescriptive if SOE2!=1, tex append sum(log) keep(Volume)  eqkeep(N
     mean) cttop(Private Firms)
 85     sum Volume
 86     outreg2 using volumedescriptive, tex append sum(log) keep(Volume) cttop(All Firms)
 87
 88 **** Summary statistics for all companies, (Appendix)***
 89     tab Company1, sum(return)
 90     tab Company, sum(Marketcap)
 91     tab Company, sum(Volume)
 92     outreg2 using companies, tex append sum(detail) keep(return) eqkeep(N mean)
 93
 94 *** Winsorizing the dataset to handle outliers, at the 98% level***
 95     winsor exreturn, gen(Exreturn) p(0.01)
 96
 97 ***Plottting return after cleaining ***
 98     scatter Exreturn Company1, msize(vsmall) graphregion(color(white))
 99     graph export "scatterrexreturnafterwashing.png",replace
100
101 *** Testing the normality of the returns after cleaning***
102     histogram Exreturn
103     graph export "historeturnafterwashing.png", replace
104     * The returns are normally distributed
105
106 ***Graphing state-owned firms to the average peer-group***
107 ***Statoil***
108     by Company1: gen sumstat1= sum(exreturn) if Date>(`=td(19jun2001)')
109     twoway (line sumstat1 Date if Company=="Statoil" & Date>(`=td(19jun2001)'), lcolor(red
    ) graphregion(color(white)) lwidth(vthin)) /*
110     */(line sumstat1 Date if Company=="SecSta" & Date>(`=td(19jun2001)'), lcolor(blue)
    graphregion(color(white)) lwidth(vthin)), /*
111     */legend(label(1 "Statoil") label(2 "Oil Sector"))
112     graph export "Statoil.png", replace
113     graph save "Statoil.gph", replace
114
115
116 ***Hydro***
117 ***Sector average***
118     twoway (line sumstat Date if Company=="Hydro", lcolor(red) graphregion(color(white))
    lwidth(vthin))/*
119     */(line sumstat Date if Company=="Sechyd", lcolor(blue) graphregion(color(white))
    lwidth(vthin)), /*
120     */legend(label(1 "Hydro") label(2 "Materials Sector"))
121     graph export "Hydro.png", replace
122     graph save "Hydro.gph", replace
123
124 ***DnB***
125 ***Sector average***
126     twoway (line sumstat Date if Company=="DnB", lcolor(red) graphregion(color(white))
    lwidth(vthin))/*
127     */(line sumstat Date if Company=="SecDnb", lcolor(blue) graphregion(color(white))
    lwidth(vthin)), /*
128     */legend(label(1 "DnB") label(2 "Financial Sector"))
129     graph export "DNB.png", replace
130     graph save "DNB.gph", replace
131
132 ***Kongsberggruppen***
133 ***Sector average***
134     twoway (line sumstat Date if Company=="Kongsberg", lcolor(red) graphregion(color(white
    )) lwidth(vthin))/*
```

```
135       */(line sumstat Date if Company=="SecKon", lcolor(blue) graphregion(color(white))
      lwidth(vthin)), /*
136       */legend(label(1 "Kongsberggruppen") label(2 "Industry Sector"))
137       graph export "Kongsberggruppen.png", replace
138       graph save "KongsbergGruppen.gph", replace
139
140   ***Telenor***
141   ***Sector average***
142       by Company1: gen sumstat2= sum(exreturn) if Date>(`=td(04dec2000)')
143       twoway (line sumstat2 Date if Company=="Telenor" & Date>(`=td(04dec2000)'), lcolor(red
      ) graphregion(color(white)) lwidth(vthin))/*
144       */(line sumstat2 Date if Company=="SecTel" & Date>(`=td(04dec2000)'), lcolor(blue)
      graphregion(color(white)) lwidth(vthin)), /*
145       */legend(label(1 "Telenor") label(2 "Telecom Sector"))
146       graph export "Telenor.png", replace
147       graph save "Telenor.gph", replace
148
149
150   ***Cermaq***
151   ***Sector average***
152       by Company1: gen sumstat3= sum(exreturn) if Date>(`=td(25oct2005)')
153       twoway (line sumstat3 Date if Company=="Cermaq" & Date>(`=td(25oct2005)'), lcolor(red)
       graphregion(color(white)) lwidth(vthin))/*
154       */(line sumstat3 Date if Company=="SecCer" & Date>(`=td(25oct2005)'), lcolor(blue)
      graphregion(color(white)) lwidth(vthin)), /*
155       */legend(label(1 "Cermaq") label(2 "Farming and Fishing Sector"))
156       graph export "Cermaq.png", replace
157       graph save "Cermaq.gph", replace
158
159
160   ***SAS***
161   ***Sector average***
162       twoway (line sumstat Date if Company=="SAS", lcolor(red) lcolor(red) graphregion(color
      (white)) lwidth(vthin))/*
163       */(line sumstat Date if Company=="SecSas", lcolor(blue) graphregion(color(white))
      lwidth(vthin)),/*
164       */ legend(label(1 "SAS") label(2 "Airlines Sector"))
165       graph export "SAS.png", replace
166       graph save "SAS.gph", replace
167
168
169
170   ***YARA***
171   ***Sector average***
172       by Company1: gen sumstat6= sum(exreturn) if Date>(`=td(26mar2004)')
173       twoway (line sumstat6 Date if Company=="Yara" & Date>(`=td(26mar2004)'), lcolor(red)
      xlabel(`=td(01jan2004)'(1000)`=td(01jan2015)') graphregion(color(white)) lwidth(vthin))/*
174       */(line sumstat6 Date if Company=="SecYar" & Date>(`=td(26mar2004)'), lcolor(blue)
      xlabel(`=td(01jan2004)'(1000)`=td(01jan2015)') graphregion(color(white)) lwidth(vthin)), /*
175       */legend(label(1 "Yara") label(2 "Fertilizer Sector"))
176       graph export "Yara.png", replace
177       graph save "Yara.gph", replace
178
179       graph combine "Statoil.gph" "Hydro.gph" "DNB.gph" "KongsbergGruppen.gph" "Telenor.gph"
      , graphregion(color(white)) cols(2)
180       graph export "Combined1.png", replace
181       graph combine "Cermaq.gph" "Kvaerner.gph" "Aker Solutions.gph" "SAS.gph" "Yara.gph",
      graphregion(color(white)) cols(2)
182       graph export "Combined2.png", replace
183       graph combine
184
185
186
```

```
1
2   ****** OLS Model ******
3
4       import excel "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Paneldata.xlsx", sheet("Sheet1")
    cellrange(C1:P368897) firstrow clear
5       cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata\Model 1"
6
7       import excel "C:\Users\Stig
    Bratfos\Dropbox\Masteroppgave\Sluttfase\Datasett\Paneldata.xlsx", sheet("Sheet1")
    cellrange(C1:P368897) firstrow clear
8       cd "C:\Users\Stig Bratfos\Dropbox\Masteroppgave\Sluttfase\output stata\Model 1"
9
10  *** Preparing the dataset ***
11      encode(SOE), gen(SOE1)
12      encode(Company), gen(Company1)
13      encode(Country), gen(Country1)
14      encode(Sector), gen(Sector1)
15      replace Rmrf = ln(1+Rmrf)
16      replace SMB = ln(1+SMB)
17      replace HML = ln(1+HML)
18      replace Momentum = ln(1+Momentum)
19
20  *** Multiplying the closingprice by 100 for the firms where Bloomberg report only 1/100
    of the stock price ***
21      replace Closingprice=Closingprice*100 if Company==("Shell")
22      replace Closingprice=Closingprice*100 if Company==("BP")
23      replace Closingprice=Closingprice*100 if Company==("Rolls-Royce")
24      replace Closingprice=Closingprice*100 if Company==("Senior")
25      replace Closingprice=Closingprice*100 if Company==("Vodafone")
26      replace Closingprice=Closingprice*100 if Company==("Carr's Group")
27      replace Closingprice=Closingprice*100 if Company==("Ricardo")
28      replace Closingprice=Closingprice*100 if Company==("Goodwin")
29      replace Closingprice=Closingprice*100 if Company==("Costain Group")
30      replace Closingprice=Closingprice*100 if Company==("Atkins")
31      replace Closingprice=Closingprice*100 if Company==("Intl Consolidated")
32      replace Closingprice=Closingprice*100 if Company==("Israel Chemicals")
33      rename (Closingprice) (Price)
34      rename (Mcap) (Marketcap)
35
36  *** Generating Excess Stock Return ***
37      gen exreturn =return-rf
38      drop if exreturn==.
39
40  *** Deleting the first observation for all companies ***
41      sort Date
42      gen index=_n
43      drop if index<=88
44      xtset Company1 Date
45
46  *** Generate the SOE and StateBeta variable for all State-owned Firms ***
47      gen SOE2 = 1
48      replace SOE2 = 0 if SOE == "No" | SOE == ""
49      gen StateBeta = SOE2*Rmrf
50
51  *** Winsorizing the dataset to handle outliers, at the 98% level***
52      winsor exreturn, gen(Exreturn) p(0.01)
53
54  ***** THE OLS MODEL *****
55
56  *** generating yearly dummies ***
57      gen year=year(Date)
58      tab year, gen(y)
59      rename (y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12 y13 y14 y15 y16 y17)(y99 y00 y01 y02
    y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15)
60
61  *** generating monthly dummies ***
62      gen month= month(Date)
63      tabulate month, gen(Jan)
64      rename (Jan2 Jan3 Jan4 Jan5 Jan6 Jan7 Jan8 Jan9 Jan10 Jan11 Jan12) (Feb Mar Apr May
    Jun Jul Aug Sep Oct Nov Dec)
65
66  *** generating peer group dummies  for the firm-specific OLS Model***
67      gen OilGas = 1 if Sector == "Oil&Gas" // Statoil and its peer group
68      replace OilGas =0 if Sector != "Oil&Gas"
69
70      gen Industrials = 1 if Sector == "Industrials" // Kongsberg and its peer group
```

```
71      replace Industrials =0 if Sector != "Industrials"
72
73      gen Airlines = 1 if Sector == "Airlines" // SAS and its peer group
74      replace Airlines =0 if Sector != "Airlines"
75
76      gen Fishing = 1 if Sector == "Farming and Fishing" // Cermaq and its peer group
77      replace Fishing =0 if Sector != "Farming and Fishing"
78
79      gen Fertilizer = 1 if Sector == "Fertilizer" // Yara and its peer group
80      replace Fertilizer =0 if Sector != "Fertilizer"
81
82      gen Financials = 1 if Sector == "Financials" // DnB and its peer group
83      replace Financials =0 if Sector != "Financials"
84
85      gen Materials = 1 if Sector == "Materials" // Hydro and its peer group
86      replace Materials =0 if Sector != "Materials"
87
88      gen Telecom = 1 if Sector == "Telecom" // Telenor and its peer group
89      replace Telecom =0 if Sector != "Telecom"
90
91  *** generating company specific dummies ***
92      tabulate Company1, gen(x)
93      rename (x1 x2 x3 x4 x5 x6 x7 x8 x9 x10 x11)(Agrium AkerSolutions Akka Alcoa AlfaLaval
    AlphaBank Aluar Alumina Andritz Atkins BP)
94      rename (x12 x13 x14 x15 x16 x17 x18 x19 x20 x21 x22 x23 x24 x25 x26)(Bankinter Beijer
    Bucher Cameron Carr Century Cermaq CF /*
95      */Chevron Concentric ConoccoP Costain Danske EmiliaRoma Deutsche)
96      rename (x27 x28 x29 x30 x31 x32 x33 x34 x35 x36 x37 x38 x39 x40 x41)(DiSondrio DNB
    DrilQ Exxon FMC Fischer Galp Gea /*
97      */Goodwin Graco Havfisk HelixEnergy Hydro Intl Israel)
98      rename (x42 x43 x44 x45 x46 x47 x48 x49 x50 x51 x52 x53 x54 x55 x56)(KS Kaiser
    Kongsberg Krones Kvaerner Megafon/*
99      */ MobileTeles MonbergThorsen Mosaic Noranda Oberbank Oceaneering Potash REPSOL
    Ricardo)
100     rename (x57 x58 x59 x60 x61 x62 x63 x64 x65 x66 x67 x68 x69 x70 x71 x72 x73 x74 x75
    x76 x77 x78 x79 x80 x81 x82 x83 x84 x85 x86 x87 x88)/*
101     */(RollsRoyce SAS SecAker SecCer SecDnb SecKon SecKva SecSas SecSta SecTel Secyar
    Sechyd Senior Shell SOC Statoil Subsea7 Sweco TDC Technip Tele2 TelecomItalia Telefonica /*
102     */ Telenor Total Transaero Unicredit UnitedCompany UnitedInternet Uralkali Vodafone
    Yara)
103
104 *************
105 *Model 1 reg*
106 *************
107 *** Creating individual loadings for the Fama French Four Factors ***
108     gen agrRmrf=Agrium*Rmrf
109     gen akkRmrf=Akka*Rmrf
110     gen alcRmrf=Alcoa*Rmrf
111     gen alfRmrf=AlfaLaval*Rmrf
112     gen alpRmrf= AlphaBank*Rmrf
113     gen aluaRmrf= Aluar*Rmrf
114     gen alumRmrf= Alumina*Rmrf
115     gen andRmrf=Andritz*Rmrf
116     gen atkRmrf=Atkins*Rmrf
117     gen bpRmrf=BP*Rmrf
118     gen banRmrf=Bankinter*Rmrf
119     gen beiRmrf=Beijer*Rmrf
120     gen bucRmrf= Bucher*Rmrf
121     gen camRmrf=Cameron*Rmrf
122     gen carrRmrf=Carr*Rmrf
123     gen cenRmrf=Century*Rmrf
124     gen cerRmrf=Cermaq*Rmrf
125     gen cfRmrf=CF*Rmrf
126     gen cheRmrf=Chevron*Rmrf
127     gen conRmrf=Concentric*Rmrf
128     gen conoRmrf=ConoccoP*Rmrf
129     gen cosRmrf=Costain*Rmrf
130     gen danRmrf=Danske*Rmrf
131     gen emiRmrf=EmiliaRoma*Rmrf
132     gen deuRmrf=Deutsche*Rmrf
133     gen disRmrf=DiSondrio*Rmrf
134     gen dnbRmrf= DNB*Rmrf
135     gen driRmrf=DrilQ*Rmrf
136     gen exxRmrf=Exxon*Rmrf
137     gen fmcRmrf=FMC*Rmrf
138     gen fisRmrf=Fischer*Rmrf
139     gen galRmrf=Galp*Rmrf
```

```
gen geaRmrf=Gea*Rmrf
gen gooRmrf=Goodwin*Rmrf
gen graRmrf=Graco*Rmrf
gen havRmrf=Havfisk*Rmrf
gen helRmrf=HelixEnergy*Rmrf
gen hydRmrf=Hydro*Rmrf
gen intRmrf=Intl*Rmrf
gen isrRmrf=Israel*Rmrf
gen ksRmrf=KS*Rmrf
gen kaiRmrf= Kaiser*Rmrf
gen konRmrf=Kongsberg*Rmrf
gen kroRmrf= Krones*Rmrf
gen megRmrf=Megafon*Rmrf
gen mobRmrf= MobileTeles*Rmrf
gen monRmrf=MonbergThorsen*Rmrf
gen mosRmrf=Mosaic*Rmrf
gen norRmrf=Noranda*Rmrf
gen obeRmrf=Oberbank*Rmrf
gen oceRmrf=Oceaneering*Rmrf
gen potRmrf=Potash*Rmrf
gen repRmrf=REPSOL*Rmrf
gen ricRmrf=Ricardo*Rmrf
gen rolRmrf=RollsRoyce*Rmrf
gen sasRmrf=SAS*Rmrf
gen senRmrf=Senior*Rmrf
gen sheRmrf= Shell*Rmrf
gen socRmrf=SOC*Rmrf
gen staRmrf=Statoil*Rmrf
gen subRmrf= Subsea7*Rmrf
gen sweRmrf=Sweco*Rmrf
gen tdcRmrf=TDC*Rmrf
gen tecRmrf=Technip*Rmrf
gen teleRmrf=Tele2*Rmrf
gen telecRmrf=TelecomItalia*Rmrf
gen telefRmrf=Telefonica*Rmrf
gen telenRmrf=Telenor*Rmrf
gen totRmrf=Total*Rmrf
gen traRmrf=Transaero*Rmrf
gen unicRmrf=Unicredit*Rmrf
gen unitRmrf=UnitedCompany*Rmrf
gen unitiRmrf=UnitedInternet*Rmrf
gen uraRmrf=Uralkali*Rmrf
gen vodaRmrf=Vodafone*Rmrf
gen yarRmrf=Yara*Rmrf


gen agrSMB=Agrium*SMB
gen akkSMB=Akka*SMB
gen alcSMB=Alcoa*SMB
gen alfSMB=AlfaLaval*SMB
gen alpSMB= AlphaBank*SMB
gen aluaSMB= Aluar*SMB
gen alumSMB= Alumina*SMB
gen andSMB=Andritz*SMB
gen atkSMB=Atkins*SMB
gen bpSMB=BP*SMB
gen banSMB=Bankinter*SMB
gen beiSMB=Beijer*SMB
gen bucSMB= Bucher*SMB
gen camSMB=Cameron*SMB
gen carrSMB=Carr*SMB
gen cenSMB=Century*SMB
gen cerSMB=Cermaq*SMB
gen cfSMB=CF*SMB
gen cheSMB=Chevron*SMB
gen conSMB=Concentric*SMB
gen conoSMB=ConoccoP*SMB
gen cosSMB=Costain*SMB
gen danSMB=Danske*SMB
gen emiSMB=EmiliaRoma*SMB
gen deuSMB=Deutsche*SMB
gen disSMB=DiSondrio*SMB
gen dnbSMB= DNB*SMB
gen driSMB=DrilQ*SMB
gen exxSMB=Exxon*SMB
gen fmcSMB=FMC*SMB
gen fisSMB=Fischer*SMB
```

```
217         gen galSMB=Galp*SMB
218         gen geaSMB=Gea*SMB
219         gen gooSMB=Goodwin*SMB
220         gen graSMB=Graco*SMB
221         gen havSMB=Havfisk*SMB
222         gen helSMB=HelixEnergy*SMB
223         gen hydSMB=Hydro*SMB
224         gen intSMB=Intl*SMB
225         gen isrSMB=Israel*SMB
226         gen ksSMB=KS*SMB
227         gen kaiSMB= Kaiser*SMB
228         gen konSMB=Kongsberg*SMB
229         gen kroSMB= Krones*SMB
230         gen megSMB=Megafon*SMB
231         gen mobSMB= MobileTeles*SMB
232         gen monSMB=MonbergThorsen*SMB
233         gen mosSMB=Mosaic*SMB
234         gen norSMB=Noranda*SMB
235         gen obeSMB=Oberbank*SMB
236         gen oceSMB=Oceaneering*SMB
237         gen potSMB=Potash*SMB
238         gen repSMB=REPSOL*SMB
239         gen ricSMB=Ricardo*SMB
240         gen rolSMB=RollsRoyce*SMB
241         gen sasSMB=SAS*SMB
242         gen senSMB=Senior*SMB
243         gen sheSMB= Shell*SMB
244         gen socSMB=SOC*SMB
245         gen staSMB=Statoil*SMB
246         gen subSMB= Subsea7*SMB
247         gen sweSMB=Sweco*SMB
248         gen tdcSMB=TDC*SMB
249         gen tecSMB=Technip*SMB
250         gen teleSMB=Tele2*SMB
251         gen telecSMB=TelecomItalia*SMB
252         gen telefSMB=Telefonica*SMB
253         gen telenSMB=Telenor*SMB
254         gen totSMB=Total*SMB
255         gen traSMB=Transaero*SMB
256         gen unicSMB=Unicredit*SMB
257         gen unitSMB=UnitedCompany*SMB
258         gen unitiSMB=UnitedInternet*SMB
259         gen uraSMB=Uralkali*SMB
260         gen vodaSMB=Vodafone*SMB
261         gen yarSMB=Yara*SMB
262
263         gen agrHML =  Agrium*HML
264         gen akkHML = Akka*HML
265         gen alcHML = Alcoa*HML
266         gen alfaHML = AlfaLaval*HML
267         gen alpHML = AlphaBank*HML
268         gen aluaHML = Aluar*HML
269         gen alumHML = Alumina*HML
270         gen andHML = Andritz*HML
271         gen atkHML = Atkins*HML
272         gen bpHML = BP*HML
273         gen bankHML = Bankinter*HML
274         gen beiHML = Beijer*HML
275         gen bucHML = Bucher*HML
276         gen camHML = Cameron*HML
277         gen carrHML = Carr*HML
278         gen centHML = Century*HML
279         gen cermHML = Cermaq*HML
280         gen cfHML = CF*HML
281         gen cheHML = Chevron*HML
282         gen conHML = Concentric*HML
283         gen conpHML = ConoccoP*HML
284         gen costHML = Costain*HML
285         gen danHML = Danske*HML
286         gen emrHML = EmiliaRoma*HML
287         gen deuHML = Deutsche*HML
288         gen disHML = DiSondrio*HML
289         gen dnbHML = DNB*HML
290         gen drilHML = DrilQ*HML
291         gen exxHML =  Exxon*HML
292         gen fmcHML = FMC*HML
293         gen fisHML = Fischer*HML
```

```
294         gen galHML = Galp*HML
295         gen geaHML =Gea*HML
296         gen godHML = Goodwin*HML
297         gen graHML = Graco*HML
298         gen havHML = Havfisk*HML
299         gen heliHML = HelixEnergy*HML
300         gen hydHML = Hydro*HML
301         gen intHML = Intl*HML
302         gen isrHML = Israel*HML
303         gen ksHML = KS*HML
304         gen kaiHML = Kaiser*HML
305         gen konHML = Kongsberg*HML
306         gen kroHML = Krones*HML
307         gen megHML = Megafon*HML
308         gen mobHML = MobileTeles*HML
309         gen monHML = MonbergThorsen*HML
310         gen mosHML = Mosaic*HML
311         gen norHML = Noranda*HML
312         gen obeHML = Oberbank*HML
313         gen oceHML = Oceaneering*HML
314         gen potHML = Potash*HML
315         gen repHML = REPSOL*HML
316         gen ricHML = Ricardo*HML
317         gen rolHML = RollsRoyce*HML
318         gen sasHML = SAS*HML
319         gen senHML = Senior*HML
320         gen sheHML = Shell*HML
321         gen socHML = SOC*HML
322         gen staHML = Statoil*HML
323         gen subHML = Subsea7*HML
324         gen sweHML = Sweco*HML
325         gen tdcHML = TDC*HML
326         gen tecHML = Technip*HML
327         gen teleHML = Tele2*HML
328         gen telcHML = TelecomItalia*HML
329         gen telefHML = Telefonica*HML
330         gen telenHML = Telenor*HML
331         gen totHML = Total*HML
332         gen tranHML = Transaero*HML
333         gen unicHML = Unicredit*HML
334         gen unitHML = UnitedCompany*HML
335         gen unitiHML = UnitedInternet*HML
336         gen uraHML = Uralkali*HML
337         gen vodHML = Vodafone*HML
338         gen yarHML = Yara*HML
339
340
341         gen agrMOM=Agrium*Momentum
342         gen akkMOM=Akka*Momentum
343         gen alcMOM=Alcoa*Momentum
344         gen alfMOM=AlfaLaval*Momentum
345         gen alpMOM= AlphaBank*Momentum
346         gen aluaMOM= Aluar*Momentum
347         gen alumMOM= Alumina*Momentum
348         gen andMOM=Andritz*Momentum
349         gen atkMOM=Atkins*Momentum
350         gen bpMOM=BP*Momentum
351         gen banMOM=Bankinter*Momentum
352         gen beiMOM=Beijer*Momentum
353         gen bucMOM= Bucher*Momentum
354         gen camMOM=Cameron*Momentum
355         gen carrMOM=Carr*Momentum
356         gen cenMOM=Century*Momentum
357         gen cerMOM=Cermaq*Momentum
358         gen cfMOM=CF*Momentum
359         gen cheMOM=Chevron*Momentum
360         gen conMOM=Concentric*Momentum
361         gen conoMOM=ConoccoP*Momentum
362         gen cosMOM=Costain*Momentum
363         gen danMOM=Danske*Momentum
364         gen emiMOM=EmiliaRoma*Momentum
365         gen deuMOM=Deutsche*Momentum
366         gen disMOM=DiSondrio*Momentum
367         gen dnbMOM= DNB*Momentum
368         gen driMOM=DrilQ*Momentum
369         gen exxMOM=Exxon*Momentum
370         gen fmcMOM=FMC*Momentum
```

```
    gen fisMOM=Fischer*Momentum
    gen galMOM=Galp*Momentum
    gen geaMOM=Gea*Momentum
    gen gooMOM=Goodwin*Momentum
    gen graMOM=Graco*Momentum
    gen havMOM=Havfisk*Momentum
    gen helMOM=HelixEnergy*Momentum
    gen hydMOM=Hydro*Momentum
    gen intMOM=Intl*Momentum
    gen isrMOM=Israel*Momentum
    gen ksMOM=KS*Momentum
    gen kaiMOM= Kaiser*Momentum
    gen konMOM=Kongsberg*Momentum
    gen kroMOM= Krones*Momentum
    gen megMOM=Megafon*Momentum
    gen mobMOM= MobileTeles*Momentum
    gen monMOM=MonbergThorsen*Momentum
    gen mosMOM=Mosaic*Momentum
    gen norMOM=Noranda*Momentum
    gen obeMOM=Oberbank*Momentum
    gen oceMOM=Oceaneering*Momentum
    gen potMOM=Potash*Momentum
    gen repMOM=REPSOL*Momentum
    gen ricMOM=Ricardo*Momentum
    gen rolMOM=RollsRoyce*Momentum
    gen sasMOM=SAS*Momentum
    gen senMOM=Senior*Momentum
    gen sheMOM= Shell*Momentum
    gen socMOM=SOC*Momentum
    gen staMOM=Statoil*Momentum
    gen subMOM= Subsea7*Momentum
    gen sweMOM=Sweco*Momentum
    gen tdcMOM=TDC*Momentum
    gen tecMOM=Technip*Momentum
    gen teleMOM=Tele2*Momentum
    gen telecMOM=TelecomItalia*Momentum
    gen telefMOM=Telefonica*Momentum
    gen telenMOM=Telenor*Momentum
    gen totMOM=Total*Momentum
    gen traMOM=Transaero*Momentum
    gen unicMOM=Unicredit*Momentum
    gen unitMOM=UnitedCompany*Momentum
    gen unitiMOM=UnitedInternet*Momentum
    gen uraMOM=Uralkali*Momentum
    gen vodaMOM=Vodafone*Momentum
    gen yarMOM=Yara*Momentum


**********
*Model 1 - general*
**********

*** Excluding Aker Solution and Kvaerner ***
    drop  if Company =="Aker Solutions"
    drop if Company == "Kvaerner"


*** Final General OLS Model ***
    reg Exreturn SOE2 StateBeta agrRmrf akkRmrf alcRmrf alfRmrf alpRmrf aluaRmrf alumRmrf
andRmrf atkRmrf bpRmrf banRmrf beiRmrf bucRmrf camRmrf carrRmrf cenRmrf cerRmrf cfRmrf /*
    */cheRmrf conRmrf conoRmrf cosRmrf danRmrf emiRmrf deuRmrf disRmrf dnbRmrf driRmrf
exxRmrf fmcRmrf fisRmrf galRmrf geaRmrf gooRmrf graRmrf havRmrf helRmrf /*
    */hydRmrf intRmrf isrRmrf ksRmrf kaiRmrf konRmrf kroRmrf megRmrf mobRmrf monRmrf
mosRmrf norRmrf obeRmrf oceRmrf potRmrf repRmrf ricRmrf rolRmrf /*
    */sasRmrf senRmrf sheRmrf socRmrf staRmrf subRmrf sweRmrf tdcRmrf tecRmrf teleRmrf
telecRmrf telefRmrf telenRmrf totRmrf traRmrf unicRmrf unitRmrf unitiRmrf /*
    */uraRmrf vodaRmrf yarRmrf agrSMB akkSMB alcSMB alfSMB alpSMB aluaSMB alumSMB andSMB
atkSMB bpSMB banSMB beiSMB bucSMB camSMB carrSMB cenSMB cerSMB cfSMB /*
    */cheSMB conSMB conoSMB cosSMB danSMB emiSMB deuSMB disSMB dnbSMB driSMB exxSMB fmcSMB
 fisSMB galSMB geaSMB gooSMB graSMB havSMB helSMB hydSMB intSMB isrSMB /*
    */ksSMB kaiSMB konSMB kroSMB megSMB mobSMB monSMB mosSMB norSMB obeSMB oceSMB potSMB
repSMB ricSMB rolSMB sasSMB senSMB sheSMB socSMB staSMB subSMB sweSMB /*
    */tdcSMB tecSMB teleSMB telecSMB telefSMB telenSMB totSMB traSMB unicSMB unitSMB
unitiSMB uraSMB vodaSMB yarSMB agrHML akkHML alcHML alfaHML alpHML aluaHML /*
    */alumHML andHML atkHML bpHML bankHML beiHML bucHML camHML carrHML centHML cermHML
cfHML cheHML conHML conpHML costHML danHML emrHML deuHML disHML dnbHML drilHML /*
    */exxHML fmcHML fisHML galHML geaHML godHML graHML havHML heliHML hydHML intHML isrHML
```

```
 ksHML kaiHML konHML kroHML megHML mobHML monHML mosHML norHML obeHML /*
439      */oceHML potHML repHML ricHML rolHML sasHML senHML sheHML socHML staHML subHML sweHML
    tdcHML tecHML teleHML telcHML telefHML telenHML totHML tranHML unicHML unitHML /*
440      */unitiHML uraHML vodHML yarHML agrMOM akkMOM alcMOM alfMOM alpMOM aluaMOM alumMOM
    andMOM atkMOM bpMOM banMOM beiMOM bucMOM camMOM carrMOM cenMOM cerMOM cfMOM /*
441      */cheMOM conMOM conoMOM cosMOM danMOM emiMOM deuMOM disMOM dnbMOM driMOM exxMOM fmcMOM
     fisMOM galMOM geaMOM gooMOM graMOM havMOM helMOM hydMOM intMOM isrMOM ksMOM kaiMOM /*
442      */konMOM kroMOM megMOM mobMOM monMOM mosMOM norMOM obeMOM oceMOM potMOM repMOM ricMOM
    rolMOM sasMOM senMOM sheMOM socMOM staMOM subMOM sweMOM tdcMOM tecMOM teleMOM /*
443      */telecMOM telefMOM telenMOM totMOM traMOM unicMOM unitMOM unitiMOM uraMOM vodaMOM
    yarMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec y99 y00 y01 y02 /*
444      */y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 OilGas Industrials Airlines
    Fishing Fertilizer Financials Materials Telecom, cluster(Company1)
445      */  //Cermaq is the reference firm
446      estimates store General
447      outreg2 using Model1, tex replace title(General Pooled OLS) keep(SOE2 StateBeta)
    nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes, Fama-French 4
    Factor, Yes)
448
449  ***** Test for serial correlation****
450      xtserial Exreturn SOE2 StateBeta agrRmrf akkRmrf alcRmrf alfRmrf alpRmrf aluaRmrf
    alumRmrf andRmrf atkRmrf bpRmrf banRmrf beiRmrf bucRmrf camRmrf carrRmrf cenRmrf cerRmrf
    cfRmrf /*
451      */cheRmrf conRmrf conoRmrf cosRmrf danRmrf emiRmrf deuRmrf disRmrf dnbRmrf driRmrf
    exxRmrf fmcRmrf fisRmrf galRmrf geaRmrf gooRmrf graRmrf havRmrf helRmrf /*
452      */hydRmrf intRmrf isrRmrf ksRmrf kaiRmrf konRmrf kroRmrf megRmrf mobRmrf monRmrf
    mosRmrf norRmrf obeRmrf oceRmrf potRmrf repRmrf ricRmrf rolRmrf /*
453      */sasRmrf senRmrf sheRmrf socRmrf staRmrf subRmrf sweRmrf tdcRmrf tecRmrf teleRmrf
    telecRmrf telefRmrf telenRmrf totRmrf traRmrf unicRmrf unitRmrf unitiRmrf /*
454      */uraRmrf vodaRmrf yarRmrf agrSMB akkSMB alcSMB alfSMB alpSMB aluaSMB alumSMB andSMB
    atkSMB bpSMB banSMB beiSMB bucSMB camSMB carrSMB cenSMB cerSMB cfSMB /*
455      */cheSMB conSMB conoSMB cosSMB danSMB emiSMB deuSMB disSMB dnbSMB driSMB exxSMB fmcSMB
     fisSMB galSMB geaSMB gooSMB graSMB havSMB helSMB hydSMB intSMB isrSMB /*
456      */ksSMB kaiSMB konSMB kroSMB megSMB mobSMB monSMB mosSMB norSMB obeSMB oceSMB potSMB
    repSMB ricSMB rolSMB sasSMB senSMB sheSMB socSMB staSMB subSMB sweSMB /*
457      */tdcSMB tecSMB teleSMB telecSMB telefSMB telenSMB totSMB traSMB unicSMB unitSMB
    unitiSMB uraSMB vodaSMB yarSMB agrHML akkHML alcHML alfaHML alpHML aluaHML /*
458      */alumHML andHML atkHML bpHML bankHML beiHML bucHML camHML carrHML centHML cermHML
    cfHML cheHML conHML conpHML costHML danHML emrHML deuHML disHML dnbHML drilHML /*
459      */exxHML fmcHML fisHML galHML geaHML godHML graHML havHML heliHML hydHML intHML isrHML
     ksHML kaiHML konHML kroHML megHML mobHML monHML mosHML norHML obeHML /*
460      */oceHML potHML repHML ricHML rolHML sasHML senHML sheHML socHML staHML subHML sweHML
    tdcHML tecHML teleHML telcHML telefHML telenHML totHML tranHML unicHML unitHML /*
461      */unitiHML uraHML vodHML yarHML agrMOM akkMOM alcMOM alfMOM alpMOM aluaMOM alumMOM
    andMOM atkMOM bpMOM banMOM beiMOM bucMOM camMOM carrMOM cenMOM cerMOM cfMOM /*
462      */cheMOM conMOM conoMOM cosMOM danMOM emiMOM deuMOM disMOM dnbMOM driMOM exxMOM fmcMOM
     fisMOM galMOM geaMOM gooMOM graMOM havMOM helMOM hydMOM intMOM isrMOM ksMOM kaiMOM /*
463      */konMOM kroMOM megMOM mobMOM monMOM mosMOM norMOM obeMOM oceMOM potMOM repMOM ricMOM
    rolMOM sasMOM senMOM sheMOM socMOM staMOM subMOM sweMOM tdcMOM tecMOM teleMOM /*
464      */telecMOM telefMOM telenMOM totMOM traMOM unicMOM unitMOM unitiMOM uraMOM vodaMOM
    yarMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec y99 y00 y01 y02 /*
465      */y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 OilGas Industrials Airlines
    Fishing Fertilizer Financials Materials Telecom
466
467
468  ***** Firm-Specific OLS MODEL *****
469
470      gen secstaRmrf=SecSta*Rmrf
471      gen secstaSMB=SecSta*SMB
472      gen secstaHML=SecSta*HML
473      gen secstaMOM=SecSta*Momentum
474
475      gen seccerRmrf=SecCer*Rmrf
476      gen seccerSMB=SecCer*SMB
477      gen seccerHML=SecCer*HML
478      gen seccerMOM=SecCer*Momentum
479
480      gen secdnbRmrf=SecDnb*Rmrf
481      gen secdnbSMB=SecDnb*SMB
482      gen secdnbHML=SecDnb*HML
483      gen secdnbMOM=SecDnb*Momentum
484
485      gen seckonRmrf=SecKon*Rmrf
486      gen secakonSMB=SecKon*SMB
487      gen seckonHML=SecKon*HML
488      gen seckonMOM=SecKon*Momentum
489
```

```
490       gen secsasmrf=SecSas*Rmrf
491       gen secsasSMB=SecSas*SMB
492       gen secsasHML=SecSas*HML
493       gen secsasMOM=SecSas*Momentum
494
495       gen sectelRmrf=SecTel*Rmrf
496       gen sectelSMB=SecTel*SMB
497       gen sectelHML=SecTel*HML
498       gen sectelMOM=SecTel*Momentum
499
500       gen secyarRmrf=Secyar*Rmrf
501       gen secyarSMB=Secyar*SMB
502       gen secyarHML=Secyar*HML
503       gen secyarMOM=Secyar*Momentum
504
505       gen sechydRmrf=Sechyd*Rmrf
506       gen sechydSMB=Sechyd*SMB
507       gen sechydHML=Sechyd*HML
508       gen sechydMOM=Sechyd*Momentum
509
510   *** Generating industry dummies which includes only the average of the peers and the
      state-owned company for the firm-specific OLS regression ***
511
512       gen dummysta = (Company==("Statoil") | Company==("SecSta"))
513       gen dummycer = (Company==("Cermaq") | Company==("SecCer"))
514       gen dummykon = (Company==("Kongsberg") | Company==("SecKon"))
515       gen dummydnb = (Company==("DnB") | Company==("SecDnb"))
516       gen dummysas = (Company==("SAS") | Company==("SecSas"))
517       gen dummytel = (Company==("Telenor") | Company==("SecTel"))
518       gen dummyyar = (Company==("Yara") | Company==("SecYar"))
519       gen dummyhyd = (Company==("Hydro") | Company==("Sechyd"))
520
521
522   ***Model 1 - Statoil***
523       reg Exreturn staRmrf secstaRmrf secstaSMB secstaHML secstaMOM staSMB/*
524           */ staHML staMOM Statoil Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec y99 y00
      y01 y02 /*
525           */y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummysta ==1,ro cluster(
      Company1)
526       estimates store Statoil
527       outreg2 using Single, tex replace title(State Ownership) ctitle(Statoil)keep(Statoil)
      nocons
528
529   ****Model 1 - Hydro****
530       reg Exreturn hydRmrf hydSMB hydHML hydMOM sechydRmrf sechydSMB sechydHML sechydMOM
      Hydro Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec y99 y00 y01 y02 /*
531       */y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummyhyd ==1,ro cluster(
      Company1)
532       estimates store Hydro
533       outreg2 using Single, tex append title(State Ownership) ctitle(Hydro)keep(Hydro) nocons
534
535   ****Model 1 - Kongsberg****
536       reg Exreturn konRmrf konSMB konHML konMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov
       Dec /*
537       */ Kongsberg seckonRmrf secakonSMB seckonHML seckonMOM y99 y00 y01 y02 /*
538       */ y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummykon ==1, ro cluster(
      Company1)
539       estimates store Kongsberg
540       outreg2 using Single, tex append title(State Ownership) ctitle(Kongsberg)keep(
      Kongsberg) nocons
541
542   **** Model 1- Cermaq****
543       reg Exreturn cerRmrf cerSMB cermHML cerMOM Cermaq seccerRmrf seccerSMB seccerHML
      seccerMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec /*
544       */ y99 y00 y01 y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummycer ==1
      ,ro cluster(Company1)
545       estimates store Cermaq
546       outreg2 using Single, tex append title(State Ownership) ctitle(Cermaq)keep(Cermaq)
      nocons
547
548   **** Model 1 - SAS***
549       reg Exreturn sasRmrf sasSMB sasHML sasMOM SAS secsasmrf secsasSMB secsasHML secsasMOM
      Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec /*
550       */ y99 y00 y01 y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummysas ==1
      ,ro cluster(Company1)
551       estimates store SAS
552       outreg2 using Single, tex append title(State Ownership) ctitle(SAS)keep(SAS) nocons
```

```
553
554   **** Model 1- DNB*****
555       reg Exreturn dnbRmrf dnbSMB dnbHML dnbMOM DNB secdnbRmrf secdnbSMB secdnbHML secdnbMOM
       Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec /*
556       */ y99 y00 y01 y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummydnb ==1
      , ro cluster(Company1)
557       estimates store DNB
558       outreg2 using Single, tex append title(State Ownership) ctitle(DNB)keep(DNB) nocons
559
560   **** Model 1 - Yara***
561       reg Exreturn yarRmrf yarSMB yarHML yarMOM Yara secyarRmrf secyarSMB secyarHML
      secyarMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec /*
562       */ y99 y00 y01 y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 if dummyyar ==1
      , ro cluster(Company1)
563       estimates store Yara
564       outreg2 using Single, tex append title(State Ownership) ctitle(Yara)keep(Yara) nocons
565
566   **** Model 1 - Telenor***
567       reg Exreturn  telenRmrf telenSMB telenHML telenMOM Telenor sectelRmrf sectelSMB
      sectelHML sectelMOM Jan1 Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec y99 y00 y01 y02 y03
      y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 /*
568       */ if dummytel ==1, ro cluster(Company1)
569       estimates store Telenor
570       outreg2 using Single, tex append title(State Ownership) ctitle(Telenor)keep(Telenor)
      nocons
571
572
573
```

```
1
2   *** The Event Model ***
3       clear all
4
5       import excel using "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model2.xlsx", sheet ("Model 2")
    cellrange (B3:p12579) firstrow  clear
6       cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata\Model2"
7
8       import excel using "C:\Users\Stig
    Bratfos\Dropbox\Masteroppgave\Sluttfase\Datasett\Model2.xlsx", sheet ("Model 2") cellrange
     (B3:p12579) firstrow  clear
9       cd "C:\Users\Stig Bratfos\Dropbox\Masteroppgave\Sluttfase\output stata\Model2"
10
11  *** Preparing the dataset ***
12      encode (Sector), gen(Sector1)
13      encode (Company), gen (Company1)
14      rename (Closingprice) (Price)
15
16
17      replace Rmrf = ln(1+Rmrf)
18      replace SMB = ln(1+SMB)
19      replace HML = ln(1+HML)
20      replace Momentum = ln(1+Momentum)
21
22  *** Generating excess stock return ***
23      gen exreturn =return-rf
24      drop if exreturn==.
25
26  *** Deleting the first observation due to no return ***
27      sort Date
28      gen index = _n
29      drop if index<4
30      drop index
31      xtset Company1 Date
32      drop if Company=="Cermaq"
33
34  *** Winsorizing the dataset to handle outliers, at the 98% level***
35      winsor exreturn, gen(Exreturn) p(0.01)
36
37  *** Generating year dummies ***
38      gen year=year(Date)
39      tab year, gen(y)
40      rename (y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12 y13 y14 y15 y16)(y00 y01 y02 y03 y04
    y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15)
41
42  *** Generating monthly dummies ***
43      gen month= month(Date)
44      tabulate month, gen(Jan)
45      rename (Jan2 Jan3 Jan4 Jan5 Jan6 Jan7 Jan8 Jan9 Jan10 Jan11 Jan12) (Feb Mar Apr May
    Jun Jul Aug Sep Oct Nov Dec)
46
47  *** Generating a dummy for Telenor after the first divestment ***
48      gen PostPrivTelenor = (Date>td(30jun2003)& Company=="Telenor")
49
50  *** Generating a dummy for Telenor after the second divestment ***
51      gen PostPrivStatoil = (Date>td(07jul2004)& Company=="Statoil")
52
53  *** Creating the PostPriv variable ***
54      gen PostPrivStatoilRmrf= PostPrivStatoil*Rmrf
55      gen PostPrivTelenorRmrf= PostPrivTelenor*Rmrf
56      gen PostPriv= PostPrivStatoilRmrf + PostPrivTelenorRmrf
57
58  *** Creating individual loadings for the Fama French Four Factors ***
59      tabulate Company1, gen(x)
60      rename(x1 x2)(Statoil Telenor)
61
62      gen staRmrf=Statoil*Rmrf
63      gen staHML=Statoil*HML
64      gen staSMB=Statoil*SMB
65      gen staMOM=Statoil*Momentum
66
67      gen telRmrf=Telenor*Rmrf
68      gen telHML=Telenor*HML
69      gen telSMB=Telenor*SMB
70      gen telMOM=Telenor*Momentum
71
```

```
*************
*Reg model 2*
*************

**** K-days = -1 ****
*** Generating the change in ownership variable ***
        *First divestment Telenor
        gen Dummy1min1= (Date==`=td(29jun2003)' & Company=="Telenor")
        gen Change1=0.139

        *Second divestment Telenor
        gen Dummy2min1= (Date==`=td(29mar2004)' & Company=="Telenor")
        gen Change2=0.0945

        *First divestment Statoil
        gen Dummy3min1= (Date==`=td(06jul2004)' & Company=="Statoil")
        gen Change3=0.046

        *Second divestment Statoil
        gen Dummy4min1= (Date==`=td(16feb2005)' & Company=="Statoil")
        gen Change4=0.0459

*** Generating the average Priv variable ***
    gen priv=Dummy1min1*Change1 + Dummy2min1*Change2 + Dummy3min1*Change3 + Dummy4min1*
Change4

*** Reg K=-1 ***
    reg Exreturn priv staRmrf staHML staSMB telRmrf /*
    */telHML telSMB telMOM staMOM PostPriv y00 y01 Statoil Telenor/*
    */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
    */ May Jun Jul Aug Sep Oct Nov Dec, ro
    estimates store Kmin1
    outreg2 using Model2, tex replace title(Change in State Ownership) ctitle(K=-1)keep(
priv PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
 Fama-French 4 Factor, Yes)

**** K-days = 1 ****
*** Generating the change in ownership variable ***
        *First divestment Telenor
        gen Dummy11= (Date==`=td(30jun2003)' & Company=="Telenor")

        *Second divestment Telenor
        gen Dummy21= (Date==`=td(30mar2004)' & Company=="Telenor")

        *First divestment Statoil
        gen Dummy31= (Date==`=td(07jul2004)' & Company=="Statoil")

        *Second divestment Statoil
        gen Dummy41= (Date==`=td(17feb2005)' & Company=="Statoil")

*** Generating the average Priv variable ***
    drop priv
    gen priv=Dummy11*Change1 + Dummy21*Change2 + Dummy31*Change3 + Dummy41*Change4

*** Reg K=1 ***
    reg Exreturn priv staRmrf staHML staSMB telRmrf /*
    */telHML telSMB telMOM staMOM PostPriv /*
    */ y00 y01 Statoil Telenor/*
    */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
    */ May Jun Jul Aug Sep Oct Nov Dec, ro
    estimates store K1
    outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=1)keep(priv
 PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
Fama-French 4 Factor, Yes)

**** K-days = 2 ****
*** Generating the change in ownership variable ***
        *First divestment Telenor
        gen Dummy1= (Date==`=td(30jun2003)' | Date==`=td(01jul2003)' & Company=="Telenor")

        *Second divestment Telenor
        gen Dummy2= (Date==`=td(30mar2004)' | Date==`=td(31mar2004)' & Company=="Telenor")

        *First divestment Statoil
        gen Dummy3= (Date==`=td(07jul2004)' | Date==`=td(08jul2004)' & Company=="Statoil")

        *Second divestment Statoil
```

```
144         gen Dummy4= (Date==`=td(17feb2005)' | Date==`=td(18feb2005)' & Company=="Statoil")
145
146     *** Generating the average Priv variable ***
147         drop priv
148         gen priv=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4
149
150     *** Generating the average Priv variable for the Placebo test ***
151         gen priv2=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4
152
153     *** Reg k=2 ***
154         reg Exreturn priv staRmrf staHML staSMB telRmrf /*
155         */telHML telSMB PostPriv telMOM staMOM /*
156         */ y00 y01 Statoil Telenor /*
157         */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
158         */ May Jun Jul Aug Sep Oct Nov Dec, ro
159         estimates store K2
160         outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=2)keep(priv
     PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
    Fama-French 4 Factor, Yes)
161
162     **** K-days = 3 ****
163     *** Generating the change in ownership variable ***
164             *First divestment Telenor
165             drop Dummy1
166             gen Dummy1= (Date==`=td(30jun2003)' | Date==`=td(01jul2003)' | Date==
    `=td(02jul2003)' & Company=="Telenor")
167
168             *Second divestment Telenor
169             drop Dummy2
170             gen Dummy2= (Date==`=td(30mar2004)' | Date==`=td(31mar2004)' | Date==
    `=td(01apr2004)' & Company=="Telenor")
171
172             *First divestment Statoil
173             drop Dummy3
174             gen Dummy3= (Date==`=td(07jul2004)' | Date==`=td(08jul2004)' | Date==
    `=td(09jul2004)' & Company=="Statoil")
175
176             *Second divestment Statoil
177             drop Dummy4
178             gen Dummy4= (Date==`=td(17feb2005)' | Date==`=td(18feb2005)' | Date==
    `=td(22feb2005)' & Company=="Statoil")
179
180     *** Generating the average Priv variable ***
181         drop priv
182         gen priv=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4
183
184     *** Reg k=3 ***
185         reg Exreturn priv staRmrf staHML staSMB telRmrf /*
186         */telHML telSMB PostPriv telMOM staMOM /*
187         */ y00 y01 Statoil Telenor/*
188         */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
189         */ May Jun Jul Aug Sep Oct Nov Dec, ro
190         estimates store K3
191         outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=3)keep(priv
     PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
    Fama-French 4 Factor, Yes)
192
193     **** K-days = 5 ****
194     *** Generating the change in ownership variable ***
195             *First divestment Telenor
196             drop Dummy1
197             gen Dummy1= (Date==`=td(30jun2003)' | Date==`=td(01jul2003)' | Date==
    `=td(02jul2003)' | Date==`=td(03jul2003)' | Date==`=td(07jul2003)' & Company=="Telenor")
198
199             *Second divestment Telenor
200             drop Dummy2
201             gen Dummy2= (Date==`=td(30mar2004)' | Date==`=td(31mar2004)' | Date==
    `=td(01apr2004)' | Date==`=td(02apr2004)' | Date==`=td(05apr2004)' & Company=="Telenor")
202
203             *First divestment Statoil
204             drop Dummy3
205             gen Dummy3= (Date==`=td(07jul2004)' | Date==`=td(08jul2004)' | Date==
    `=td(09jul2004)' | Date==`=td(12jul2004)' | Date==`=td(13jul2004)' & Company=="Statoil")
206
207             *Second divestment Statoil
208             drop Dummy4
209             gen Dummy4= (Date==`=td(17feb2005)' | Date==`=td(18feb2005)' | Date==
```

```
`=td(22feb2005)' | Date==`=td(23feb2005)' | Date==`=td(24feb2005)' & Company=="Statoil")

*** Generating the average Priv variable ***
    drop priv
    gen priv=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4

*** Reg k=5 ***
    reg Exreturn priv staRmrf staHML staSMB telRmrf /*
    */telHML telSMB PostPriv telMOM staMOM /*
    */ y00 y01 Statoil Telenor/*
    */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
    */ May Jun Jul Aug Sep Oct Nov Dec, ro
    estimates store K5
    outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=5)keep(priv
 PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
Fama-French 4 Factor, Yes)

**** K-days = 7 ****
*** Generating the change in ownership variable ***
        *First divestment Telenor
        drop Dummy1
        gen Dummy1= (Date==`=td(30jun2003)' | Date==`=td(01jul2003)' | Date==
`=td(02jul2003)' | Date==`=td(03jul2003)' | Date==`=td(07jul2003)' /*
        */| Date==`=td(08jul2003)' | Date==`=td(09jul2003)' & Company=="Telenor")

        *Second divestment Telenor
        drop Dummy2
        gen Dummy2= (Date==`=td(30mar2004)' | Date==`=td(31mar2004)' | Date==
`=td(01apr2004)' | Date==`=td(02apr2004)' | Date==`=td(05apr2004)' /*
        */| Date==`=td(06apr2004)' | Date==`=td(07apr2004)' & Company=="Telenor")

        *First divestment Statoil
        drop Dummy3
        gen Dummy3= (Date==`=td(07jul2004)' | Date==`=td(08jul2004)' | Date==
`=td(09jul2004)' | Date==`=td(12jul2004)' | Date==`=td(13jul2004)' /*
        */| Date==`=td(14jul2004)' | Date==`=td(15jul2004)' & Company=="Statoil")

        *Second divestment Statoil
        drop Dummy4
        gen Dummy4= (Date==`=td(17feb2005)' | Date==`=td(18feb2005)' | Date==
`=td(22feb2005)' | Date==`=td(23feb2005)' | Date==`=td(24feb2005)' /*
        */| Date==`=td(25feb2005)' | Date==`=td(28feb2005)' & Company=="Statoil")

*** Generating the average Priv variable ***
    drop priv
    gen priv=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4

*** Reg k=7 ***
    reg Exreturn priv staRmrf staHML staSMB telRmrf /*
    */telHML telSMB PostPriv telMOM staMOM /*
    */ y00 y01 Statoil Telenor/*
    */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
    */ May Jun Jul Aug Sep Oct Nov Dec, ro
    estimates store K5
    outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=7)keep(priv
 PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
Fama-French 4 Factor, Yes)

**** K-days = 10 ****
*** Generating the change in ownership variable ***
        *First divestment Telenor
        drop Dummy1
        gen Dummy1= (Date==`=td(30jun2003)' | Date==`=td(01jul2003)' | Date==
`=td(02jul2003)' | Date==`=td(03jul2003)' | Date==`=td(07jul2003)' /*
        */| Date==`=td(08jul2003)' | Date==`=td(09jul2003)' | Date==`=td(10jul2003)' |
Date==`=td(11jul2003)' | Date==`=td(14jul2003)' & Company=="Telenor")

        *Second divestment Telenor
        drop Dummy2
        gen Dummy2= (Date==`=td(30mar2004)' | Date==`=td(31mar2004)' | Date==
`=td(01apr2004)' | Date==`=td(02apr2004)' | Date==`=td(05apr2004)' /*
        */| Date==`=td(06apr2004)' | Date==`=td(07apr2004)' | Date==`=td(08apr2004)' |
Date==`=td(12apr2004)' | Date==`=td(13apr2004)' & Company=="Telenor")

        *First divestment Statoil
        drop Dummy3
        gen Dummy3= (Date==`=td(07jul2004)' | Date==`=td(08jul2004)' | Date==
```

```
`=td(09jul2004)' | Date==`=td(12jul2004)' | Date==`=td(13jul2004)' /*
274         */| Date==`=td(14jul2004)' | Date==`=td(15jul2004)' | Date==`=td(16jul2004)' |
    Date==`=td(19jul2004)' | Date==`=td(20jul2004)'& Company=="Statoil")
275
276         *Second divestment Statoil
277         drop Dummy4
278         gen Dummy4= (Date==`=td(17feb2005)' | Date==`=td(18feb2005)' | Date==
    `=td(22feb2005)' | Date==`=td(23feb2005)' | Date==`=td(24feb2005)' /*
279         */| Date==`=td(25feb2005)' | Date==`=td(28feb2005)' | Date==`=td(01mar2005)' |
    Date==`=td(02feb2005)' | Date==`=td(03feb2005)' & Company=="Statoil")
280
281 *** Generating the average Priv variable ***
282     drop priv
283     gen priv=Dummy1*Change1 + Dummy2*Change2 + Dummy3*Change3 + Dummy4*Change4
284
285 *** Reg k=10 ***
286     reg Exreturn priv staRmrf staHML staSMB telRmrf /*
287     */telHML telSMB PostPriv telMOM staMOM /*
288     */ y00 y01 Statoil Telenor/*
289     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
290     */ May Jun Jul Aug Sep Oct Nov Dec, ro
291     estimates store K5
292     outreg2 using Model2, tex append title(Change in State Ownership) ctitle(K=10)keep(
    priv PostPriv) nocons addtext( Year Dummy, Yes, Monthly Dummy, Yes, Individual Dummy, Yes,
     Fama-French 4 Factor, Yes)
293
294 ********* In-time Placebo test *****
295 *t=-25
296     reg Exreturn f25.priv2 staRmrf staHML staSMB telRmrf /*
297     */telHML telSMB PostPriv telMOM staMOM /*
298     */ y00 y01 Statoil Telenor/*
299     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
300     */ May Jun Jul Aug Sep Oct Nov Dec, ro
301     estimates store tmin25
302     outreg2 using placebo, tex replace title(In-Time shifted Placebos) ctitle(t=-25)keep(
    f25.priv2) nocons
303 *t=-20
304     reg Exreturn f20.priv2 staRmrf staHML staSMB telRmrf /*
305     */telHML telSMB PostPriv telMOM staMOM /*
306     */ y00 y01 Statoil Telenor/*
307     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
308     */ May Jun Jul Aug Sep Oct Nov Dec, ro
309     estimates store tmin20
310     outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=-20)keep(
    f20.priv2) nocons
311 *t=-15
312     reg Exreturn f15.priv2 staRmrf staHML staSMB telRmrf /*
313     */telHML telSMB PostPriv telMOM staMOM /*
314     */ y00 y01 Statoil Telenor/*
315     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
316     */ May Jun Jul Aug Sep Oct Nov Dec, ro
317     estimates store tmin15
318     outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=-15)keep(
    f15.priv2) nocons
319 *t=-10
320     reg Exreturn f10.priv2 staRmrf staHML staSMB telRmrf /*
321     */telHML telSMB PostPriv telMOM staMOM /*
322     */ y00 y01 Statoil Telenor/*
323     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
324     */ May Jun Jul Aug Sep Oct Nov Dec, ro
325     estimates store tmin10
326     outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=-10)keep(
    f10.priv2) nocons
327 *t=-5
328     reg Exreturn f5.priv2 staRmrf staHML staSMB telRmrf /*
329     */telHML telSMB PostPriv telMOM staMOM /*
330     */ y00 y01 Statoil Telenor/*
331     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
332     */ May Jun Jul Aug Sep Oct Nov Dec, ro
333     estimates store tmin5
334     outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=-5)keep(f5.
    priv2) nocons
335 *t=0
336     reg Exreturn priv2 staRmrf staHML staSMB telRmrf /*
337     */telHML telSMB PostPriv telMOM staMOM /*
338     */ y00 y01 Statoil Telenor/*
339     */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
```

```
340       */ May Jun Jul Aug Sep Oct Nov Dec, ro
341       estimates store tmin0
342       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=0)keep(
      priv2) nocons
343   *t=+5
344       reg Exreturn l5.priv2 staRmrf staHML staSMB telRmrf /*
345       */telHML telSMB PostPriv telMOM staMOM /*
346       */ y00 y01 Statoil Telenor/*
347       */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
348       */ May Jun Jul Aug Sep Oct Nov Dec, ro
349       estimates store tplu5
350       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=+5)keep(l5.
      priv2) nocons
351   *t=+10
352       reg Exreturn l10.priv2 staRmrf staHML staSMB telRmrf /*
353       */telHML telSMB PostPriv telMOM staMOM /*
354       */ y00 y01 Statoil Telenor/*
355       */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
356       */ May Jun Jul Aug Sep Oct Nov Dec, ro
357       estimates store tplu10
358       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=+10)keep(
      l10.priv2) nocons
359   *t=+15
360       reg Exreturn l15.priv2 staRmrf staHML staSMB telRmrf /*
361       */telHML telSMB PostPriv telMOM staMOM /*
362       */ y00 y01 Statoil Telenor/*
363       */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
364       */ May Jun Jul Aug Sep Oct Nov Dec, ro
365       estimates store tplu15
366       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=+15)keep(
      l15.priv2) nocons
367   *t=+20
368       reg Exreturn l20.priv2 staRmrf staHML staSMB telRmrf /*
369       */telHML telSMB PostPriv telMOM staMOM /*
370       */ y00 y01 Statoil Telenor/*
371       */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
372       */ May Jun Jul Aug Sep Oct Nov Dec, ro
373       estimates store tplu20
374       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=+20)keep(
      l20.priv2) nocons
375   *t=+25
376       reg Exreturn l25.priv2 staRmrf staHML staSMB telRmrf /*
377       */telHML telSMB PostPriv telMOM staMOM /*
378       */ y00 y01 Statoil Telenor/*
379       */ y02 y03 y04 y05 y06 y07 y08 y09 y10 y11 y12 y13 y14 y15 Jan1 Feb Mar Apr /*
380       */ May Jun Jul Aug Sep Oct Nov Dec, ro
381       estimates store tplu25
382       outreg2 using placebo, tex append title(In-Time shifted Placebos) ctitle(t=+25)keep(
      l25.priv2) nocons
383
```

```
1
2   ******** Synthetic Control Group Method *******
3
4   ******* Telenor: Divestment 1 *******
5   import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
6   cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
7
8       encode (Company), gen(Company1)
9
10  *** Deleting all observation, without 30 observations prior/after the event****
11      tabulate (Company1)
12      drop if Date<`=td(16may2003)' | Date>`=td(12aug2003)'
13      tsset Company1 Date
14      label drop Company1
15
16  *** Running the Synth package***
17      synth Return Rmrf SMB HML Mom, trunit(5) trperiod(`=td(30jun2003)') fig keep(tele1,
    replace)
18
19  ** Graphing the differences between synth and treatment firm**
20      use tele1, clear
21      gen diff = _Y_treated - _Y_synthetic
22
23      rename _time Date
24      format Date %td
25      drop if missing(Date)
26      local lp `lp' line diff Date, lcolor(gs12) ||
27
28  **** Graph the difference ****
29      twoway `lp' || line diff Date, ///
30      lcolor(orange) legend(off) xline(`=td(27jun2003)', lpattern(dash) lcolor(grey)) xlabel
    (`=td(16may2003)'(30)`=td(12aug2003)') title("First Divestment in Telenor")
31      *Note: We use the day before the execution date to draw the vertical line
    representing the event, because the graph draws the line at the end of date.
32      graph save "Telenor1diff", replace
33      graph export "Telenor1diff.png", replace
34
35  *** Post/pre ratio ***
36      gen diff2=diff^2
37      sum diff2 if Date<(`=td(30jun2003)'), meanonly
38      mat t1=(r(mean))^0.5
39      sum diff2 if Date>(`=td(30jun2003)'), meanonly
40      mat t2=(r(mean))^0.5
41      loc names "diff"
42      mat t3=t2[1,1] / t1[1,1]
43      matlist t3
44
45  ********* Placebo Analysis**********************
46  import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
47  cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
48
49      encode (Company), gen(Company1)
50
51  *** Preparing the dataset ***
52      tabulate (Company1)
53      drop if Date<`=td(16may2003)' | Date>`=td(12aug2003)'
54      tsset Company1 Date
55      label drop Company1
56
57  *** Iterative Program for Placebo test ***
58      forval i=1/7 {
59              qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(30jun2003)') fig
    keep(placebo_`i', replace)
60              }
61
62      forval i=1/7{
63              use placebo_`i', clear
64              rename _time Date
65              gen diff`i' = _Y_treated - _Y_synthetic
66              keep Date diff`i'
67              drop if missing(Date)
68              save placebo_`i', replace
69              }
70
71  *** Merging all placebo effects into one graph ***
```

```
    use placebo_1, clear
    forval i=2/7{
            qui merge 1:1 Date using placebo_`i', nogenerate
            }
    local lp
    forval i=1/7 {
            local lp `lp' line diff`i' Date, lcolor(gs12) ||
            }

*** Creating the merged graph ***
    format Date %td
    twoway `lp' || line diff5 Date, ///
    lcolor(orange) legend(off) xline(`=td(27jun2003)', lpattern(dash) lcolor(grey)) xlabel
(`=td(16may2003)'(30)`=td(12aug2003)') title("First Divestment in Telenor")
    graph save "Telenor1placebo", replace
    graph export "Telenor1placebo.png", replace

********'' Post/Pre ratio************
import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"

    encode (Company), gen(Company1)

*** Preparing the dataset ***
    tabulate (Company1)
    drop if Date<`=td(16may2003)' | Date>`=td(02jul2003)'
    tsset Company1 Date
    label drop Company1

*** Iterative Program for Post/Pre ratio test ***
    forval i=1/7 {
            qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(30jun2003)') fig
keep(placebo_`i', replace)
            }

tempname resmat
        forval i=1/7{
                use placebo_`i', clear
                rename _time Date
                gen diff`i' = _Y_treated - _Y_synthetic
                gen diff2`i'=diff`i'^2
                sum diff2`i' if Date<(`=td(30jun2003)'), meanonly
                mat t1=(r(mean))^0.5

                sum diff2`i' if Date>=(`=td(30jun2003)'), meanonly
                mat t2=(r(mean))^0.5
                mat t3=t2[1,1]/t1[1,1]
                matrix `resmat' = nullmat(`resmat') \ t3
                local names `"`names' `"`i'"'"'
                }
            mat colnames `resmat' = "ratio"
            mat rownames `resmat' = `names'
            matlist `resmat' , row("Unit")
            svmat `resmat', names(RMSPEratio)

    generate str var9 = "TDC" in 1
    replace var9 = "Tele2" in 2
    replace var9 = "Telecom Italia" in 3
    replace var9 = "Telefonica" in 4
    replace var9 = "Telenor" in 5
    replace var9 = "United Internet" in 6
    replace var9 = "Vodafone" in 7
    rename var9 Company
    encode (Company), gen(Company1)
    scatter RMSPEratio1 Company1, xlabel(1 2 3 4 5 6 7, valuelabel angle(90)) title(
"First Divestment in Telenor")
    graph save "Telenor1ratio", replace
    graph export "Telenor1ratio.png", replace
```

```
1
2   ******** Synthetic Control Group Method *******
3
4   ******* Telenor: Divestment 2 *******
5   import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
6   cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
7
8       encode (Company), gen(Company1)
9
10  *** Deleting all observation, without 30 observations prior/after the event****
11      tsset Company1 Date
12      tabulate (Company1)
13      drop if Date<`=td(13feb2004)' | Date>`=td(11may2004)'
14      tsset Company1 Date
15      label drop Company1
16
17  *** Running the Synth package***
18      synth Return Rmrf SMB HML Mom, trunit(5) trperiod(`=td(30mar2004)') fig keep(tele2,
    replace)
19
20  ** Graphing the differences between synth and treatment firm**
21      use tele2, clear
22      gen diff = _Y_treated - _Y_synthetic
23      rename _time Date
24      format Date %td
25      drop if missing(Date)
26      local lp `lp' line diff Date, lcolor(gs12) ||
27
28  **** Graph the difference ****
29      twoway `lp' || line diff Date, ///
30      lcolor(orange) legend(off) xline(`=td(29mar2004)', lpattern(dash) lcolor(grey)) xlabel
    (`=td(13feb2004)'(30)`=td(11may2004)') title("Second Divestment in Telenor")
31      *Note: We use the day before the execution date to draw the vertical line
    representing the event, because the graph draws the line at the end of date.
32      graph save "Telenor2diff", replace
33      graph export "Telenor2diff.png", replace
34
35  *** Post/pre ratio ***
36      gen diff2=diff^2
37      sum diff2 if Date<(`=td(30mar2004)'), meanonly
38      mat t1=(r(mean))^0.5
39      sum diff2 if Date>(`=td(30mar2004)'), meanonly
40      mat t2=(r(mean))^0.5
41      loc names "diff"
42      mat t3=t2[1,1] / t1[1,1]
43      matlist t3
44
45  ********* Placebo Analysis**********************
46  import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
47  cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
48
49      encode (Company), gen(Company1)
50
51  *** Preparing the dataset ***
52      tabulate (Company1)
53      drop if Date<`=td(13feb2004)' | Date>`=td(11may2004)'
54      tsset Company1 Date
55      label drop Company1
56
57  *** Iterative Program for Placebo test ***
58      forval i=1/7 {
59              qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(30mar2004)') fig
    keep(placebo_`i', replace)
60              }
61
62      forval i=1/7{
63              use placebo_`i', clear
64              rename _time Date
65              gen diff`i' = _Y_treated - _Y_synthetic
66              keep Date diff`i'
67              drop if missing(Date)
68              save placebo_`i', replace
69              }
70
71  *** Merging all placebo effects into one graph ***
```

```
72      use placebo_1, clear
73      forval i=2/7{
74              qui merge 1:1 Date using placebo_`i', nogenerate
75              }
76      local lp
77      forval i=1/7 {
78              local lp `lp' line diff`i' Date, lcolor(gs12) ||
79              }
80
81  *** Creating the merged graph ***
82      format Date %td
83      twoway `lp' || line diff5 Date, ///
84      lcolor(orange) legend(off) xline(`=td(29mar2004)', lpattern(dash) lcolor(grey)) xlabel
    (`=td(13feb2004)'(30)`=td(11may2004)') title("Second Divestment in Telenor")
85      graph save "Telenor2placebo", replace
86      graph export "Telenor2placebo.png", replace
87
88  ******** Post/Pre ratio ************
89  import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    telenor.xlsx", sheet("Telenor") cellrange(D3:j28647) firstrow  clear
90  cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
91
92      encode (Company), gen(Company1)
93
94  *** Preparing the dataset ***
95      tabulate (Company1)
96      drop if Date<`=td(13feb2004)' | Date>`=td(01apr2004)'
97      tsset Company1 Date
98      label drop Company1
99
100 *** Iterative Program for Post/Pre ratio test ***
101     forval i=1/7 {
102             qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(30mar2004)') fig
    keep(placebo_`i', replace)
103             }
104
105 tempname resmat
106         forval i=1/7{
107                 use placebo_`i', clear
108                 rename _time Date
109                 gen diff`i' = _Y_treated - _Y_synthetic
110                 gen diff2`i'=diff`i'^2
111                 sum diff2`i' if Date<(`=td(30mar2004)'), meanonly
112                 mat t1=(r(mean))^0.5
113
114                 sum diff2`i' if Date>=(`=td(30mar2004)'), meanonly
115                 mat t2=(r(mean))^0.5
116                 mat t3=t2[1,1]/t1[1,1]
117                 matrix `resmat' = nullmat(`resmat') \ t3
118                 local names `"`names' `"`i'"'"'
119                 }
120             mat colnames `resmat' = "ratio"
121             mat rownames `resmat' = `names'
122             matlist `resmat' , row("Unit")
123             svmat `resmat', names(RMSPEratio)
124
125     generate str var9 = "TDC" in 1
126     replace var9 = "Tele2" in 2
127     replace var9 = "Telecom Italia" in 3
128     replace var9 = "Telefonica" in 4
129     replace var9 = "Telenor" in 5
130     replace var9 = "United Internet" in 6
131     replace var9 = "Vodafone" in 7
132     rename var9 Company
133     encode (Company), gen(Company1)
134     scatter RMSPEratio1 Company1, xlabel(1 2 3 4 5 6 7, valuelabel angle(90)) title(
    "Second Divestment in Telenor")
135     graph save "Telenor2ratio", replace
136     graph export "Telenor2ratio.png", replace
137
138
```

```
1
2   ******** Synthetic Control Group Method *******
3
4   ******* Statoil: Divestment 1 *******
5   import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    statoil.xlsx", sheet("Sheet1") cellrange(D2:j36830) firstrow  clear
6   cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
7
8       encode (Company), gen(Company1)
9
10  *** Deleting all observation, without 30 observations prior/after the event****
11      tsset Company1 Date
12      tabulate (Company1)
13      drop if Date<`=td(21may2004)' | Date>`=td(19aug2004)'
14      tsset Company1 Date
15      label drop Company1
16
17  *** Running the Synth package***
18      synth Return Rmrf SMB HML Mom, trunit(8) trperiod(`=td(07jul2004)') fig keep(stat1,
    replace)
19
20  ** Graphing the differences between synth and treatment firm**
21       use stat1, clear
22       gen diff = _Y_treated - _Y_synthetic
23
24       rename _time Date
25       format Date %td
26       drop if missing(Date)
27       local lp `lp' line diff Date, lcolor(gs12) ||
28
29  **** Graph the difference ****
30      twoway `lp' || line diff Date, ///
31      lcolor(orange) legend(off) xline(`=td(06jul2004)', lpattern(dash) lcolor(grey)) xlabel
    (`=td(21may2004)'(30)`=td(19aug2004)') title("First Divestment in Statoil")
32      *Note: We use the day before the execution date to draw the vertical line
    representing the event, because the graph draws the line at the end of date.
33      graph save "Statoil1diff", replace
34      graph export "Statoil1diff.png", replace
35
36  *** Post/pre ratio ***
37      gen diff2=diff^2
38      sum diff2 if Date<(`=td(07jul2004)'), meanonly
39      mat t1=(r(mean))^0.5
40      sum diff2 if Date>(`=td(07jul2004)'), meanonly
41      mat t2=(r(mean))^0.5
42      loc names "diff"
43      mat t3=t2[1,1] / t1[1,1]
44      matlist t3
45
46  ********* Placebo Analysis**********************
47      import excel "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3 statoil.xlsx", sheet("Sheet1")
    cellrange(D2:j36830) firstrow  clear
48      cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
49
50      encode (Company), gen(Company1)
51
52  *** Preparing the dataset ***
53      tsset Company1 Date
54      tabulate (Company1)
55      drop if Date<`=td(21may2004)' | Date>`=td(19aug2004)'
56      tsset Company1 Date
57      label drop Company1
58
59  *** Iterative Program for Placebo test ***
60      forval i=1/9 {
61              qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(07jul2004)') fig
    keep(placebo_`i', replace)
62              }
63
64      forval i=1/9{
65              use placebo_`i', clear
66              rename _time Date
67              gen diff`i' = _Y_treated - _Y_synthetic
68              keep Date diff`i'
69              drop if missing(Date)
70              save placebo_`i', replace
```

```
            }

*** Merging all placebo effects into one graph ***
    use placebo_1, clear
    forval i=2/9{
            qui merge 1:1 Date using placebo_`i', nogenerate
            }
    local lp
    forval i=1/9 {
            local lp `lp' line diff`i' Date, lcolor(gs12) ||
            }

*** Creating the merged graph ***
    format Date %td
    twoway `lp' || line diff8 Date, ///
    lcolor(orange) legend(off) xline(`=td(06jul2004)', lpattern(dash) lcolor(grey)) xlabel
(`=td(21may2004)'(30)`=td(19aug2004)') title("First Divestment in Statoil")
    graph save "Statoil1placebo", replace
    graph export "Statoil1placebo.png", replace


********'' Post/Pre ratio************
    import excel "C:\Users\Thomas
Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3 statoil.xlsx", sheet("Sheet1")
cellrange(D2:j36830) firstrow  clear
    cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"

    encode (Company), gen(Company1)

*** Preparing the dataset ***
    tsset Company1 Date
    tabulate (Company1)
    drop if Date<`=td(21may2004)' | Date>`=td(09jul2004)'
    tsset Company1 Date
    label drop Company1

*** Iterative Program for Post/Pre ratio test ***
    forval i=1/9 {
            qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(07jul2004)') fig
keep(placebo_`i', replace)
            }

tempname resmat
        forval i=1/9{
                use placebo_`i', clear
                rename _time Date
                gen diff`i' = _Y_treated - _Y_synthetic
                gen diff2`i'=diff`i'^2
                sum diff2`i' if Date<(`=td(07jul2004)'), meanonly
                mat t1=(r(mean))^0.5

                sum diff2`i' if Date>=(`=td(07jul2004)'), meanonly
                mat t2=(r(mean))^0.5
                mat t3=t2[1,1]/t1[1,1]
                matrix `resmat' = nullmat(`resmat') \ t3
                local names `"`names' `"`i'"'"'
                }
            mat colnames `resmat' = "ratio"
            mat rownames `resmat' = `names'
            matlist `resmat' , row("Unit")
            svmat `resmat', names(RMSPEratio)

    generate str var9 = "BP" in 1
    replace var9 = "Cameron" in 2
    replace var9 = "Chevron" in 3
    replace var9 = "ConocoPhilips" in 4
    replace var9 = "Exxon" in 5
    replace var9 = "Repsol" in 6
    replace var9 = "Shell" in 7
    replace var9 = "Statoil" in 8
    replace var9 = "Total" in 9
    rename var9 Company
    encode (Company), gen(Company1)
    scatter RMSPEratio1 Company1, xlabel(1 2 3 4 5 6 7 8 9, valuelabel angle(90)) title(
"First Divestment in Statoil")
    graph save "Statoil1ratio", replace
    graph export "Statoil1ratio.png", replace
```

```
1
2   ******* Synthetic Control Group Method *******
3
4   ******* Statoil: Divestment 2 *******
5   import excel "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3
    statoil.xlsx", sheet("Sheet1") cellrange(D2:j36830) firstrow  clear
6   cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
7
8       encode (Company), gen(Company1)
9
10  *** Deleting all observation, without 30 observations prior/after the event****
11      tabulate (Company1)
12      drop if Date<`=td(04jan2005)' | Date>`=td(01apr2005)'
13      tsset Company1 Date
14      label drop Company1
15
16  *** Running the Synth package***
17      synth Return Rmrf SMB HML Mom, trunit(8) trperiod(`=td(17feb2005)') fig keep(stat2,
    replace)
18
19  ** Graphing the differences between synth and treatment firm**
20      use stat2, clear
21      gen diff = _Y_treated - _Y_synthetic
22
23      rename _time Date
24      format Date %td
25      drop if missing(Date)
26      local lp `lp' line diff Date, lcolor(gs12) ||
27
28      **** Graph the difference ****
29      twoway `lp' || line diff Date, ///
30      lcolor(orange) legend(off) xline(`=td(16feb2005)', lpattern(dash) lcolor(grey)) title(
    "Second Divestment in Statoil")
31      *Note: We use the day before the execution date to draw the vertical line
    representing the event, because the graph draws the line at the end of date.
32      graph save "Statoil2diff", replace
33      graph export "Statoil2diff.png", replace
34
35  *** Post/pre ratio ***
36      gen diff2=diff^2
37      sum diff2 if Date<(`=td(16feb2005)'), meanonly
38      mat t1=(r(mean))^0.5
39      sum diff2 if Date>(`=td(16feb2005)'), meanonly
40      mat t2=(r(mean))^0.5
41      loc names "diff"
42      mat t3=t2[1,1] / t1[1,1]
43      matlist t3
44
45  ********* Placebo Analysis**********************
46      import excel "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3 statoil.xlsx", sheet("Sheet1")
    cellrange(D2:j36830) firstrow  clear
47      cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
48
49  *** Preparing the dataset ***
50      encode (Company), gen(Company1)
51      tsset Company1 Date
52      tabulate (Company1)
53      drop if Date<`=td(04jan2005)' | Date>`=td(01apr2005)'
54      label drop Company1
55
56  *** Iterative Program for Placebo test ***
57      forval i=1/9 {
58              qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(16feb2005)') fig
    keep(placebo_`i', replace)
59              }
60
61      forval i=1/9{
62              use placebo_`i', clear
63              rename _time Date
64              gen diff`i' = _Y_treated - _Y_synthetic
65              keep Date diff`i'
66              drop if missing(Date)
67              save placebo_`i', replace
68              }
69
70  *** Merging all placebo effects into one graph ***
```

```
71
72      use placebo_1, clear
73      forval i=2/9{
74              qui merge 1:1 Date using placebo_`i', nogenerate
75              }
76      local lp
77      forval i=1/9 {
78              local lp `lp' line diff`i' Date, lcolor(gs12) ||
79              }
80
81  *** Creating the merged graph ***
82      format Date %td
83      twoway `lp' || line diff8 Date, ///
84      lcolor(orange) legend(off) xline(`=td(16feb2005)', lpattern(dash) lcolor(grey)) title(
    "Second Divestment in Statoil")
85      graph save "Statoil2placebo", replace
86      graph export "Statoil2placebo.png", replace
87
88  ********'' Post/Pre ratio************
89      import excel "C:\Users\Thomas
    Kringlebu\Dropbox\Masteroppgave\Sluttfase\Datasett\Model3 statoil.xlsx", sheet("Sheet1")
    cellrange(D2:j36830) firstrow  clear
90      cd "C:\Users\Thomas Kringlebu\Dropbox\Masteroppgave\Sluttfase\output stata"
91
92  *** Preparing the dataset ***
93      encode (Company), gen(Company1)
94      tsset Company1 Date
95      tabulate (Company1)
96      drop if Date<`=td(04jan2005)' | Date>`=td(22feb2005)'
97      label drop Company1
98
99  *** Iterative Program for Post/Pre ratio test ***
100     forval i=1/9 {
101             qui synth Return Rmrf SMB HML Mom, trunit(`i') trperiod(`=td(17feb2005)') fig
    keep(placebo_`i', replace)
102             }
103
104 tempname resmat
105     forval i=1/9{
106             use placebo_`i', clear
107             rename _time Date
108             gen diff`i' = _Y_treated - _Y_synthetic
109             gen diff2`i'=diff`i'^2
110             sum diff2`i' if Date<(`=td(17feb2005)'), meanonly
111             mat t1=(r(mean))^0.5
112
113             sum diff2`i' if Date>=(`=td(17feb2005)'), meanonly
114             mat t2=(r(mean))^0.5
115             mat t3=t2[1,1]/t1[1,1]
116             matrix `resmat' = nullmat(`resmat') \ t3
117             local names `"`names' `"`i'"'"'
118             }
119             mat colnames `resmat' = "ratio"
120             mat rownames `resmat' = `names'
121             matlist `resmat' , row("Unit")
122             svmat `resmat', names(RMSPEratio)
123
124     generate str var9 = "BP" in 1
125     replace var9 = "Cameron" in 2
126     replace var9 = "Chevron" in 3
127     replace var9 = "ConocoPhilips" in 4
128     replace var9 = "Exxon" in 5
129     replace var9 = "Repsol" in 6
130     replace var9 = "Shell" in 7
131     replace var9 = "Statoil" in 8
132     replace var9 = "Total" in 9
133     rename var9 Company
134     encode (Company), gen(Company1)
135     scatter RMSPEratio1 Company1, xlabel(1 2 3 4 5 6 7 8 9, valuelabel angle(90)) title(
    "Second Divestment in Statoil")
136     graph save "Statoil2ratio", replace
137     graph export "Statoil2ratio.png", replace
138
139 *** Merging the three grapfs for all four divestments into three graphs ***
140     graph combine "Telenor1ratio" "Telenor2ratio" "Statoil1ratio" "Statoil2ratio", cols(2)
     title("Post/Pre RMPSE-Ratio")
141     graph export "PostPreratio.png", replace
```

```
142         graph combine "Telenor1placebo" "Telenor2placebo" "Statoil1placebo" "Statoil2placebo",
        cols(2) title("In-Space Placebo Test")
143         graph export "Placebo.png", replace
144         graph combine "Telenor1diff" "Telenor2diff" "Statoil1diff" "Statoil2diff", cols(2)
       title("Treated - Synthetic")
145         graph export "Diff.png", replace
146
147
```