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The Economic Effect of Proximity on Plant Level Performance and Investment

Evidence from the opening of new airline routes in Norway

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Abstract

This paper empirically analyses the effect of direct airline routes on plant-level investment and productivity in Norway. I look at the effects of changes in proximity due to the opening of new direct flight routes between the locations of headquarters and plants. Improvement in proximity leads to lower monitoring costs for the headquarter, and may lower potential agency costs. This is a thoroughly studied topic on arms-length transactions, but little is known on intra-firm proximity.

Looking at Norwegian flight information from 2004 to 2014, and financial information on Norwegian headquarters and plants from 2002 to 2012, I find ten new flights opening between ten areas in Norway. This constitutes ten treated destinations with 375 firms having headquarter and plant located at either end of a route. As a control group, I find 667 companies with headquarter and plant located in different parts of Norway, that does not yet have a direct route connecting them.

My main analysis is on the difference in plants' return on assets, but I also look at the EBITDA-margin, operating margin, absolute investment from headquarters to plants, and the profitability deriving from that investment.

I find through several regional and year-specific analyses that there is strong evidence of increased profitability from proximity. I find that investment from headquarter decreases with proximity, leading to less but better investment overall.

Preface

This paper is the final work in a master's degree in financial economics from the Norwegian School of Economics. It represents the work of the last semester in a five year study of economics. This paper has challenged me and been an educational process. I have utilized much of my previous knowledge, and learned a great deal about statistical analysis and econometrics. Learning the coding-language of Stata has given me a very useful expertise in, for me, previously unknown areas.

I would like to thank my supervisor Cornelius Schmidt, for suggesting this topic and for providing me with guidance and knowledge. He has challenged me to work independently and develop the skills and knowledge needed, and I have learned so much from this paper with this guidance.

I would also like to thank The Norwegian Corporate Accounts and Avinor for providing me with indispensable data sets and materials on Norwegian firms and flight routes.

Oslo, June 2015

Susanne Elisabeth Kvilvang Daae

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1. Introduction

1.1 Basis for Analysis

This paper originates from the study “Proximity and investment: evidence from plant-level data” by Xavier Giroud (2012). Giroud analyzes the effect of proximity on plants in the United States. I wish to do a similar analysis on the air traffic and firms in Norway.

1.2 Background

The theory of the firm and agency costs (Jensen and Meckling, 1976) are the first steps of the theoretical background for my analysis. Agency theory and the idea that monitoring reduce agency costs are widely agreed upon. The economic effect of increased monitoring due to reduced monitoring costs is what I am interested in.

There are multiple studies on the effect of the geographical location of subsidiaries in relation to headquarter, in particular on multinational corporations. Lerner (1995) finds that venture capitalists, who monitor their investments closely, are more represented on board of directors of companies that are more closely located. This is to be expected as monitoring is less costly. Coval and Moskowitz (1999) find that mutual fund managers strongly prefer to invest in local firms where monitoring gives them abnormal returns. It is the combination of home bias and increased monitoring I wish to analyze in Norway.

In his study, Giroud (2012) finds that the improvement in proximity between headquarters and plats in manufacturing industries in the United States is closely related to plant-level performance. He looks at the investment and productivity of the plants. The relevant factor he looked at was improvement in domestic flight routes within the United States. The strength of this analysis is that it looks at travel time as the independent variable in monitoring costs, not the geographical location in itself. Wibeche Hansen (2014) did a similar analysis on new tunnels and bridges as the improvement in proximity in Norway. I take inspiration from both papers to analyze the effects of new direct flight routes in Norway on plant-level performance.

1.3 About Air Traffic in Norway

Norway is a long-range, mountainous country. It has many fjords and rivers, making roads expensive and complicated to build. It is widely known that Norway has a poor road standard. Because of this, air traffic is vital for long-distance transportation. On distances greater than 300km, 47% of the travelers chose to travel by air (Liam and Fuglom, 2015). This percentage increases with distance.

Domestic flights in Norway consist of a much larger portion of flights than in other European countries. Out of all air traffic in Norway, 29% is domestic flights (Halpern, 2013), whereas Eurostat reports an average of 18% domestic flights in Europe.

Travel habits are vital for my analysis. When identifying a new route I can be reasonably certain that this constitutes a realistic improvement for management.

The Norwegian aviation industry has gone through several changes during the last decades. Originally there were two main airline actors, SAS and Braathens. The two merged in 2002, and in addition a new airline, Norwegian Air Shuttle emerged as a low cost carrier in 2002. When starting my research I thought this development and the resulting routes would be an interesting starting point. For reasons stated later however, these structural changes fall outside my treatment window. Therefore, which airline operates which route is immaterial to my analysis, I look only at new routes and the number of flights in a given year.

1.4 Focus and Research Questions

I wish to analyze the effect of proximity on headquarters and plants in Norway. I look at the opening of a direct route between two areas previously travelled only by two or more flights, as an improvement in proximity. This makes it easier for management to travel to and from plants. I use reduction in travel time, or more precisely, the reduction in time having to be spent for the purpose of visiting the plant, as the exogenous variable affecting the cost of monitoring plants. I treat a reduction in cost of monitoring as increased ability to monitor, thereby possibly reducing agency costs.

The causal relationship between financial performance, investment and proximity is what I am interested in. To measure financial performance, I look at the return on assets, EBITDA-margin and operating margin of plants. I compare the performance of treated firms with the performance of control firms, to see the effect of increased monitoring. A treated firm is one where a direct route has opened between plant and headquarter in the relevant time window.

Changes in investment from treatment is something I wish to analyze as well. Here I look at both the absolute level of investment of headquarters to plants, and the relative profitability derived from that investment.

I raise the following research question and sub-questions:

1: What is the economic effect of proximity on plant-level performance and investment in Norway?

Sub-questions:

2a: Are changes in performance more prominent in certain industries or areas?

2b: Does proximity lead to more, or better investments in plants?

2. Theoretical Background

2.1 Corporate Governance and Agency Costs

One of the most thoroughly researched topics in economics is Corporate Governance and Agency Costs. Berk and DeMarzo (2014) defines corporate governance as conflicts of interest and the attempts to minimize them. When a firm has a plant or subsidiary, the headquarter owns the plant, but the plant must have some freedom to make decisions.

The separation of ownership and control in a corporation leads to conflict of interests, agency costs. The principal-agent relationship is when one party (the principal) engages another party (the agent) to act in some way on the principal's behalf (Berk and DeMarzo, 2014).

Jensen and Meckling (1976) define agency costs as the sum of:

i) The monitoring expenditures by the principal,

ii) The bonding expenditures by the agent

iii) The residual loss.

The principal is the owner or headquarter, and the agent is the plant or subsidiary. The monitoring expenditures are the cost the principal incurs from looking over the agents shoulder or giving instructions. The monitoring costs by the principal are the main focus in this paper. Bonding costs are costs that a principal will pay an agent to avoid an undesirable action. In addition to those costs there will be some divergence from the actions taken and the optimal outcome for the principal. This cost is the residual loss.

Even though delegating decision making is costly, it can be in perfect accordance with optimal decision making (Jensen and Meckling, 1976).

2.1.1 Profit Maximization – Why there are Agency Costs

Agency costs are market imperfection (Benz and DeMarzo, 2014). They stem from a conflict of interests between principal and agent. The conflict is that every actor is maximizing its own utility. The plant manager may get prestige or get paid in accordance with the size of his plant, and therefore takes actions that benefit the plant more than the company as a whole. He is risking the headquarter's money and the potential upside is greater than the potential downside. Therefore, one can assume he would not act completely as he would if he was maximizing the whole firm's utility, or acting out the goals of the principal.

How closely aligned the interests of the agent and principal are indicates the seriousness of the agency problem (Benz and DeMarzo, 2014).

2.2 Managing Subsidiaries

Increased information about agent behavior through monitoring reduces the risk of undesirable behavior (Holmstrøm, 1979). Monitoring can be defined as the action of acquiring information about the behavior and decisions of subsidiary management (O'Donnell, 2002). The most direct form of monitoring is personal supervision. Proximity makes obtaining this information through direct supervision cheaper and easier.

Building on resource dependence theory and self-determination theory, Ambos et. al. (2010) argues that the two basic goals of subsidiary managers are to achieve autonomy vis-à-vis corporate headquarters and influence over other units. When analyzing subsidiary's initiative, they conclude that subsidiaries are only able to increase their influence through initiatives that get the headquarter's attention. Furthermore, initiatives drawing the headquarters' attention, again decrease the subsidiary's autonomy.

This is a clear conflict of interest. The subsidiary manager wants autonomy to invest as he wishes, while the headquarter wants the cheapest and easiest method of controlling the agent to follow its goals and strategies.

2.3 Home Bias – Evidence from Venture Capitalists and Mutual Funds

The presence of home bias in investment decisions is well documented and agreed upon. Home bias is investors' tendency to prefer home markets and domestic investments despite advantages of diversification and increased market integration worldwide (Wang et. a, 2010). Whether home bias is based on superior inside knowledge gained from proximity, or just an irrational overestimation of the advantage, is widely debated.

2.3.1 Investment Habits

In a study of Swedish investment habits Massa and Simonov (2006) look at hedging in portfolio choice. They treat hedging as diversification, as opposed to a home biased strategy. With factors including demographic and financial information on investor level, they show that investors prefer stocks located nearby. They find proof that their home bias is not a failure to hedge, but that the geographic proximity offers familiarity and a lower cost of acquiring information.

2.3.2 Mutual Funds

When analyzing the null hypothesis that no home bias persisted in mutual fund managers in the United States (Coval and Moskowitz, 1999), the hypothesis is rejected. They uncover not only persistent domestic home bias to the United States, but also to the local market and home town of the mutual fund managers. They find location and physical distance between the investment and mutual fund investor to be a key element in the portfolio choice.

2.3.3 Venture Capitalists

The venture capital (VC) industry is dominated by limited partnerships (Berk and DeMarzo, 2014). VC firms specialize in investing in young firms. It is a high-stakes investment with potentially high returns and a high volatility (Berk and DeMarzo, 2014). In addition to financing, they offer industry knowledge and expertise to young firms. Most often they chose to actively participate in the running of the firm they invest in. A direct way of monitoring the firms available to venture capitalists, is through the board of directors.

Sitting on the board of directors is used as a proxy for monitoring the firms in Lerner's (1995) study on venture capitalists. He looks at which private firms the VC chose to sit on the board of directors of, in relation to geographical proximity. He finds a strong relation between geographical proximity and membership on the board of directors. This is to be expected if the cost of monitoring closer investments is cheaper. Lerner (1995) also finds a strong correlation between the level of monitoring and times when the VC feels monitoring is most vital, when the chief executive officer is replaced. This article does not include information on whether the monitoring led to higher returns or increased productivity, it only reveals the presence of home bias in choosing which firms to monitor.

2.4 Intra-Firm Analysis

The presence of home bias in arms-length transactions has been thoroughly documented. Intra-firm analysis on the topic is less common. Giroud's (2012) study on the effect of proximity to headquarter on plant level management in the United States gives insight in home bias and the effect of management. He finds that investment in plants increases as proximity improves. Whether increased investment is due to a better insight into a plant's needs, or just investment in more familiar plants (home bias), is important. One can look at the financial performance of the plant to gauge the effect of increased monitoring (Giroud, 2012).

There is also the possibility of over-monitoring. If you invested heavily into monitoring a plant, you might feel the need to justify that investment by making changes. If that plant is already acting optimally, you would achieve a sub-optimal solution due to too much monitoring. If you take funds from one plant and invest them into the wrong plant solely due to monitoring, you also destroy value. Too much guidance from headquarter can also impair plant managers incentive to come up with new ideas and investment opportunities.

3. Empirical Strategy

3.1 Construction of Dataset

3.1.1 Plant-Level Data

From the Norwegian Corporate Accounts I am provided with a database on the plant level data. This database includes both descriptive and financial information on all companies in Norway from 1992 to 2012. This database is extensive, and is my main source of information on the companies I wish to analyze. In the financial database I look at net income, total assets, investment in subsidiaries, EBITDA margin, and operating margin for each year. In the descriptive database I extract information on both organization number, headquarter organization number, postal code and industry codes on each firm.

3.1.1.1 Descriptive Information

In the descriptive dataset the information is sorted on a company level, not group level. I need to connect each plant with its respective headquarter. I do this by connecting the headquarter information to the headquarter organization number listed on a plant observation.

I wish to analyze the impact of proximity on plant level data. I therefore connect all relevant information on headquarters to the relevant plant in the relevant year. I assume a company with a listed headquarter organization number is a subsidiary (plant), and those without are either single-unit firms or headquarters themselves. I do not take into account several layers within a group. A company can be both headquarter and plant at the same time. As I only look at company level, I do not consider this a major weakness. I look at the economic effect of headquarter monitoring on a plant, and whether that plant has a plant to monitor or not does not influence the first effect. It could however give a false significant result if a high number of the firms are within the same group and results may therefore be correlated within the group. I do not think this is a significant part of my dataset, or a major weakness.

The postal code is one of the most important pieces of information I need on both headquarter and plant. Different postal codes means that plant and headquarter is located in different parts of Norway, and I use this as a basis for calculating travel time.

3.1.1.2 Financial Information

I wish to analyze the economic impact of proximity on plants. I use total assets and net income to calculate plant level profitability. I also look at the EBITDA margin and operating margin to get a broader basis for analyzing trends and conclusions. In the company balance sheet I find investment in subsidiaries. Here I connect the headquarter figures to the plant and analyze it as “investment from headquarter”.

3.1.1.3 Plant-Level Treatment Window

An issue with the Norwegian Corporate Accounts database is missing values. There are no registration of postal codes prior to 1997. Headquarter organization numbers are missing before 2003. As these values are both vital to my analysis, this leaves me with a 10 year treatment window from 2003-2012.

3.1.2 Flight Route Information

3.1.2.1 Relevant Treatment Window

From Avinor I received a dataset with information on all domestic and international flights taking off from Norwegian airports from 2004 to 2014. I wish to identify routes that have been treated in the relevant sample period. My treatment window from plant-level data is from 2003-2012. As the oldest information on a flight I have access to is 2004, I look at flights that was introduced later than 2004. I wish to have at least one year of data prior to and after a treatment. This leaves me with a treatment window from 2005 to 2011.

3.1.2.2 Restrictions on Treated Routes

The information I am interested in is the number of flights between two destinations in Norway in a given year. In the first year of the opening of a new route, there are often significantly fewer flights than the years following. For a route to be considered as treated and accessible to a company, I require there be at least on average one flight per week in a given year. This eliminates the problem of sample years where a flight opens in the middle of a year; I only consider a route as treated the year it has 52 flights or more.

I eliminate a route if it has closed during the relevant time window, as this could influence my results. I also exclude a route if it has closed and reopened, as this could have induced the treatment result I am looking for at a different time than I am analyzing. I consider a route as closed if it has fewer than 52 flights in a given year.

There were no flights opening in 2011 that meets the requirements. Therefore my dataset consists of flights that have opened from 2005-2010, and have not closed before or in 2012.

Giroud (2012) included routes that got fewer stopovers or two shorter flights as treated routes. I choose not to do this, as most of Norway can be reached with two flights. Norway is also significantly smaller than the USA. Therefore a reduction in travel time caused by two shorter flights as opposed to two longer flights will be negligible.

3.1.3 Area Clusters

3.1.3.1 Postal Codes

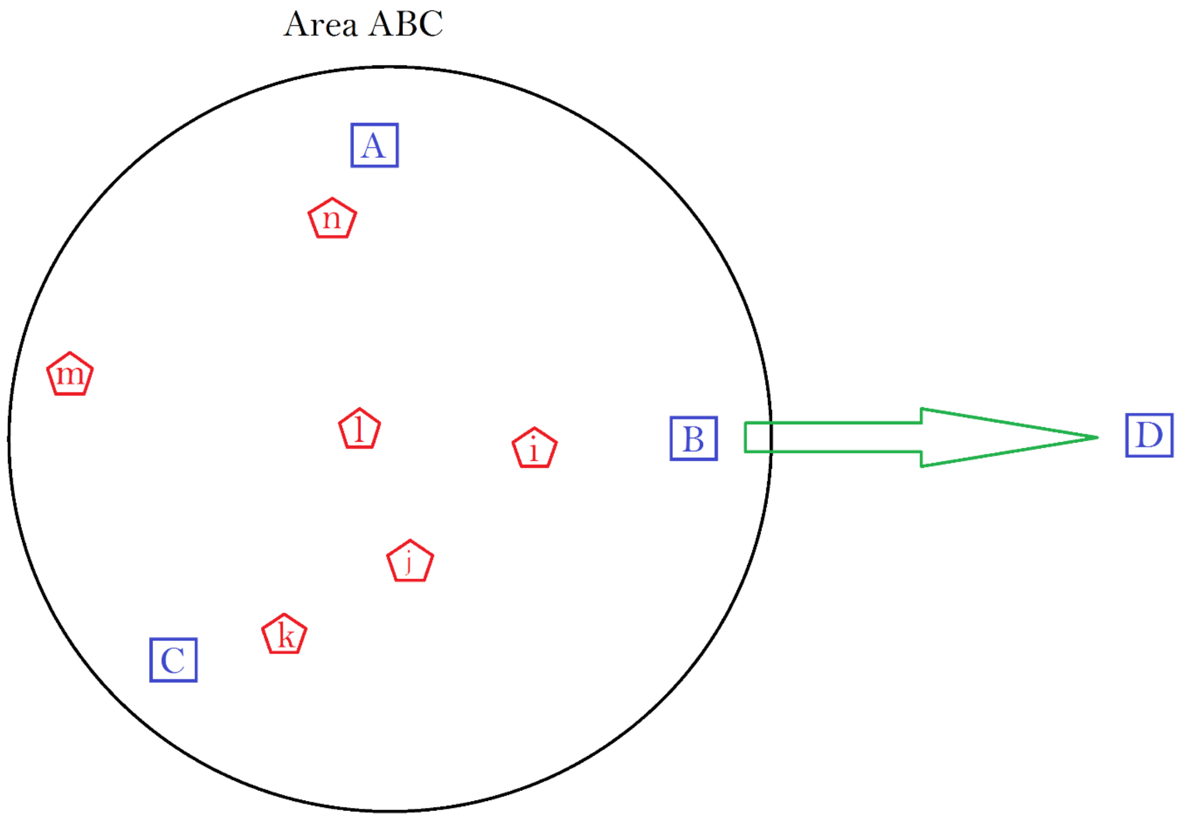
After identifying the airports at either end of the new routes, I need to connect the plants and headquarters with an airport. Bring (2014) provides me with a list of all postal codes in Norway, as well as a map with the postal code areas. Using this together with Google Maps identifies the closest airport to a postal code.

3.1.3.2 Identifying Treated Areas

Identifying which areas around an airport that benefit significantly from a direct route is subjective. When there are large areas between several airports and only one airport is treated, where the line between which areas are affected is drawn is highly subjective. I will illustrate this with an example.

You have three airports, A, B and C, and six headquarters between them that all have plants near airport D, in a different part of Norway (see illustration 1). Then airport B gets a direct route to D. All the firms between airports ABC can either drive to airport B, or take a flight from A or C to B. Firm *i* is clearly better off. Firms *j* and *l* are right in between B and C, and therefore benefits from the treatment as they would drive the same distance either way. Whether firms *k, n* and *m* are better off however, depends on the tradeoff from driving versus taking two flights.

Figure 3-1 – Example Plant Locations



The tradeoff of driving versus two flights, and its effect on treatment, depends on the size of area ABC. If it is the size of Finnmark and I am looking at the areas between the airports there, the impact on a 3 hours' drive versus a 3 hours and 30 minutes' drive to an airport is much less significant, than if ABC were three airports close together in the Oslo area and the 30 minutes reduction was from 40 minutes to 10 minutes.

I have attempted to be as thorough as possible when identifying the optimal route and which areas are significantly affected by a direct route. When finding the previous optimal travel time I have looked at both previously existing flights, and driving time to alternative airports. In general I have regarded a 30 minutes travel time reduction as a treated route. However between airports in closer proximity I allow a shorter time reduction, and in larger areas I require a larger reduction in travel time to constitute a treatment and significant travel time reduction. This is as stated a subjective assessment, and someone else might find different treated area clusters.

A big assumption at this point is that firms have access to all available information and chose the optimal travel route. Flight prices and which day of the week a manager prefers to travel are factors that I do not include. I include alternative flights and driving time by road when calculating travel time reductions. I do not include other public transport like trains or busses. I assume firms always chose the fastest travel route.

When assessing the tradeoff between driving and taking two flights, I use the same flight assumptions as Giroud (2012). In addition to flight time, I assume one hour spent at destination and outgoing airport combined, and one hour spent per stopover. I attempted to find data on average stopover time on flights in Norway, but the Norwegian air traffic control, Avinor, had no data on this. I believe that Giroud's assumptions hold in Norway as well. I only use these figures to identify the previous optimal route and therefore which areas are treated. They are not used in the analysis and therefore I believe these assumptions not to have an impact on my analysis.

3.1.3.3 Area Clusters

When I connect all the treated airports to an area, I get 10 treated clusters. I wish to connect all the plants in my dataset to a cluster. Therefore I connect the rest of the postal codes to its closest airport. If several airports in an area has no direct route to a treated airport, I treat the whole area as one control area. I end up with 18 area clusters in Norway. See Appendix 1 for a full list of postal code areas.

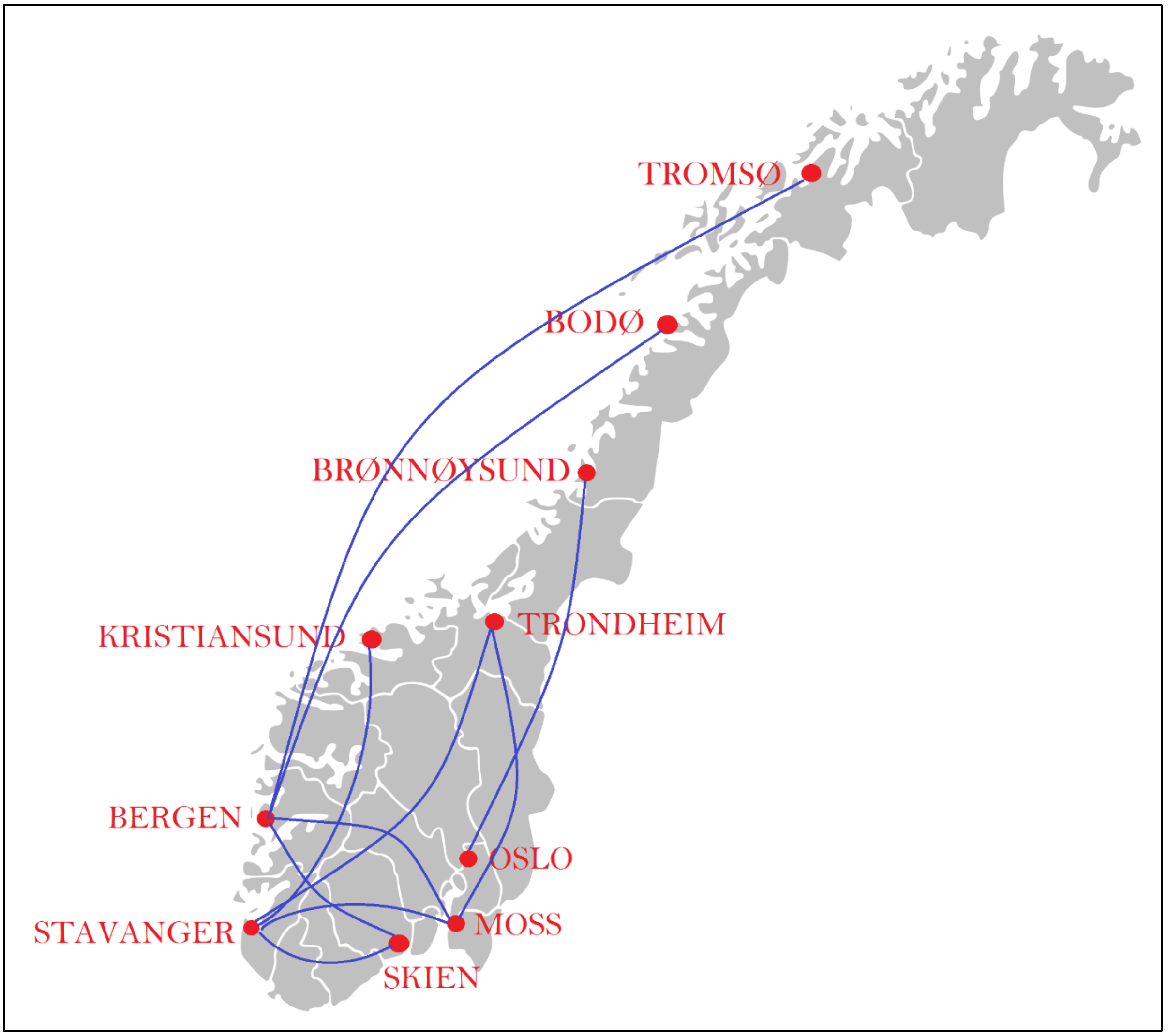
After I label all the postal codes with a cluster dummy variable, I find many companies that do not have a postal code that is listed in Bring's data set. Several companies have postal codes listed that no longer exist. After looking for old registries on postal codes I find another Bring (2014) data set with older postal codes. I believe the postal code was changed when an area changed name, as I cannot find the area names in the existing registry. I manage to match the old postal codes with existing postal codes by the municipality name, but I cannot know for sure that the postal codes are matched to the correct cluster, as municipalities often have several postal codes covering large areas. I assume this possibility to not affect my data set in a significant way.

3.2 Determining Variables

3.2.1 Treatment and Control Groups

There are 10 new direct routes that meet the requirements between 10 major cities. These routes are my 10 treated routes. Headquarters and plants located at either end of a treated route are in the treatment group.

Figure 3-2 – Treated Routes



The best comparison and control for a treated plant, is a plant which has its headquarter located within the same area, but with the plant at the end of a non-treated route. I use 18 area codes to identify clusters for both plant and headquarter location. I have 10 treated clusters that have one or more direct routes opening between them within the treatment window. The eight remaining clusters are control clusters that do not yet have a direct route to one or more of the treated areas. Control routes can either exist between two treated areas that do not yet have a direct route between them, or between a treated area and a control area.

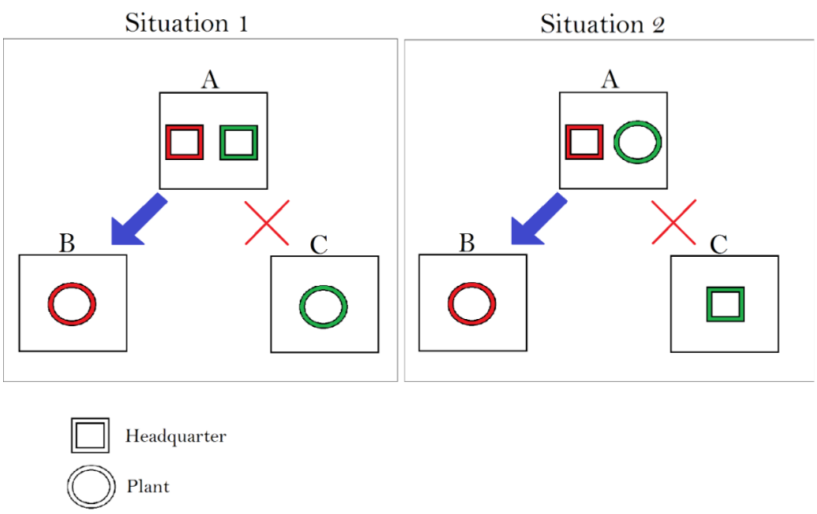
I combine the 18 area codes of both the plant and headquarter into dummy variables to identify on which route they are located. This gives me 61 dummy variable combinations from the treated areas to other treated areas, or control areas. In total I have 10 treated routes and 51 control routes, with 375 companies at either end of a treated route, and 667 companies in the control group. My dataset consists only of headquarters and plants where one part is located in a treated area, and the other entity is in another part of Norway. See appendix 2-4 for a full list of treatment and control routes, and the number of companies on each route.

3.2.1.1 Distinction Between Headquarter and Plant Location

I do not distinguish between whether the plant or the headquarter is located in the treated area. I illustrate why with a simple example.

You have three areas, A, B and C. You have two companies, Red (R) and Green (G). In Situation 1 both headquarters are located in A, and the plants are located in B or C. Then a direct route opens between A and B. Company R is then treated while G is not. In Situation 2, G's headquarter is in area C while its plant is in area A. The situation is unchanged; R is treated while G is not. The situation would also be the same if both plants were in area A and the headquarters were in areas B and C. Therefore I do not distinguish between at which end of a route the headquarter or plant is when comparing routes.

Figure 3-3 – Example Headquarter-Plant Locations



For simplicity when describing a route, I will from now on refer to one area as where the headquarters are located and the other end as where the plants are located, but it could just as easily be a combination of headquarters and plants at either end.

3.2.1.2 Clarification on Clusters and Groups

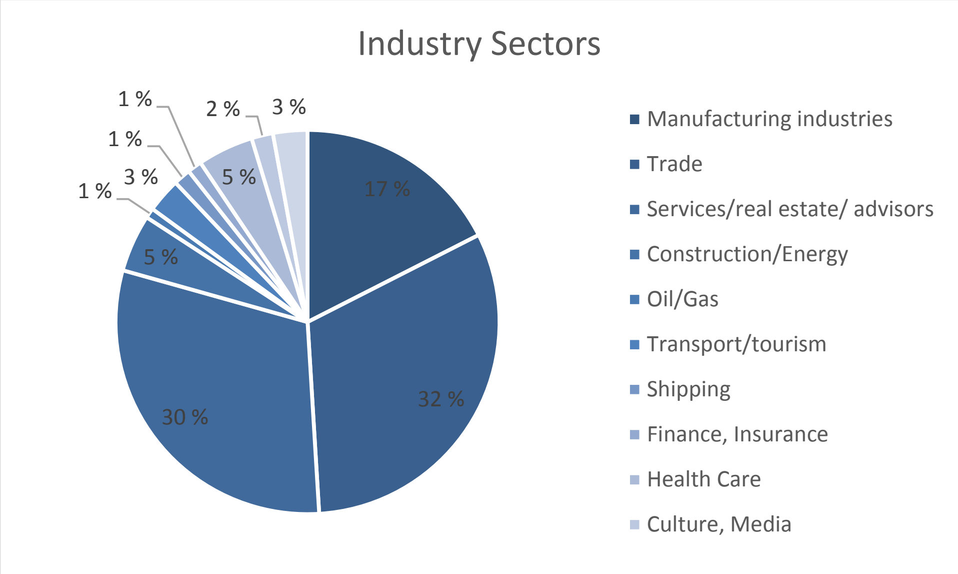
It is important to distinguish between clusters and treated- or control-groups. The clusters are the 18 area codes that I have divided Norway into according to relevant airports. There are 10 clusters that are on the end of one or more treated routes. There are 61 routes between clusters that have either been treated or still is untreated. Out of those 61 routes, 10 are treated and 51 are control-routes. The firms at either end of a route are either in the treatment group or the control group. A cluster area can therefore contain firms from different treated routes, and control firms.

3.2.2 Industry Codes

The Norwegian Corporate Accounts database includes information on which industry the firm operates in. There are two sets of industry codes, SN2002 and SN2007. They are two- or five-digit numbers representing the industry code. SN2007 replaces the initial classification. My dataset includes both classifications for the relevant sampling period. There are however some missing classifications in SN2007 in the early years of my sampling period. There are no missing values on SN2002, and therefore I use the 5-digit SN2002 to cassify my firms.

There are 12 industry groups in SN2002. I assign 12 dummy variables to the firms according to the industry group. The three largest industry groups are manufacturing, trade, and services/real estate/advisors. They make up 79% of my dataset. They are, however, quite dissimilar industries, and analyzing only those three industries will in my opinion not give a better sample dataset than by using all 12 industries. Giroud chose to only look at the manufacturing sector in the USA in his study. Norway is a smaller country and I have a significantly smaller sample. I therefore chose to initially include all firms in my analysis, and then do individual analyses on relevant sectors as well. See appendix 5 for a list of all the SN2002 industry codes and groups.

Figure 3-4 - Distribution of Industries in Dataset



3.3 Methods of Calculating Profitability and Investment

I have a limited number of observations in my sample. I therefore wish to look at different variables and measures for profitability to get a broader basis for drawing conclusions.

3.3.1 Return on Assets

The main focus of my analysis is on the return on assets. The return on assets (ROA) of a firm measures its operating efficiency in generating profits from its assets (Damodaran, 2002). This ratio combines the profit margin and asset turnover, indication both the profit-generating strength and efficiency in utilizing assets (Needles and Powers, 2011). I calculate ROA as:

$$\frac{\text{Net Income}}{\text{Net Sales}} \times \frac{\text{Net Sales}}{\text{Average Total Assets}} = \frac{\text{Net Income}}{\text{Average Total Assets}}$$

$$\text{Profit Margin } \times \text{Asset Turnover } = \text{Return on Assets}$$

$$\text{Return on Assets} = \frac{\text{Net Income}}{\text{Average Total Assets}}$$

Equation 3-1 Return on Assets

(Needles and Powers, 2011).

ROA consists of two parts. From the income statement I find the numerator net income, which is a measure of the firm's profitability during the period (Berk and DeMarzo, 2014). For the denominator I calculate the average total assets as the year average, where I use the closing balance of the previous year as opening balance. The closing balance is the relevant closing balance in that year (Powers and Needles, 2011). I include the closing balance of 2002 as the opening balance of 2003 to keep 2003 in my sample.

An advantage to ROA as a performance measure, is that it is less sensitive to leverage than return on equity (Berk and DeMarzo, 2014). ROAs mayor strength is that it reflects both the profit margin and asset turnover, and is why it is one of the most widely used measures of profitability (Needles and Powers, 2011). A potential weakness is if a plant has substantial current assets, which understated the profitability of the plant. This can be solved by looking at industry-average ROAs to compare ROAs from similar industries (Needles and Powers, 2011).

3.3.2 Operating Margin and EBITDA Margin

The Norwegian Corporate Accounts (NCA) database includes some generated variables as well. As I have a limited sample set, I wish to look at several measurements of profitability to look for trends. Two measurements I wish to look at are the EBITDA margin and operating margin. The NCA calculates them as:

Equation 3-2 EBITDA margin

$$\text{EBITDA Margin} = \frac{\text{EBITDA}}{\text{Total Income}}$$

Equation 3-3 Operating Margin

$$\text{Operating Margin} = \frac{\text{Operating Profit/Loss}}{\text{Total Income}}$$

Where:
Total Income comprises of all income the company receives during the period.
Operating Profit/Loss is total income minus all operating expenses.
EBITDA is earnings before interest, tax, depreciation and amortization.

My three measurements of profitability are highly correlated, but gives different insights. The operating margin or profit margin shows how much remain in the company per NOK in revenues after all costs linked to operations are covered, but before the financial items (NCA, 2013). EBITDA is the operating profit/loss plus depreciation and amortization. Net Income includes all income and expenses, and is the total profit/loss for the company.

3.3.3 Plant Investment and Profitability

Giroud (2012) looked at investment as a function of total capital expenditures divided by capital stock. NCA includes information about plant level investment, as investment in subsidiaries. This is interesting to look at in relation to treatment. I wish to look at investment both in absolute terms and the profitability of investment in relative terms. The NCA dataset contains information on income from investments in subsidiaries, which could be used to measure profitability. Unfortunately the dataset has very few registered observations on this. Therefore to get investment in relative terms to compare, I measure this profitability as a function of plant profits and headquarter investment. My function on profitability is:

Equation 3-4 Profitability

$$\text{Investment Profitability} = \frac{\text{Net Income}}{\text{Investment in Subsidiary}}$$

Here I look at the direct investment from headquarters (input), in relation to net income (output). The profitability measure shows how well the plant utilizes the investment it receives from the headquarter.

3.3.3.1 Weakness in Plant level Investment

Here I must recognize a significant weakness in my sample set. In the NCA database all information is linked to the specific company. Each plant has one headquarter listed. Identifying a plant's headquarter is therefore simple. When looking at plant investment however, I must find the information in the headquarters' financial statement listed as "investment in subsidiary", and link it to the plant and define it as "investment from headquarter". The problem is that while one plant can only have one headquarter, a headquarter can have several plants. Linking the investment to the correct plant to reflect whether it represents an investment in a treated or control route, is therefore difficult. The database contains no information on subsidiary organization numbers, or the number of subsidiaries one particular headquarter owns.

To bypass this problem, I look for duplicates in headquarter organization numbers (Baum, 2009). I identify plants that have a unique headquarter organization number. When there is only one headquarter organization number registered to one plant in my dataset, I assume that the headquarter only owns one plant, and that the investment is going to that plant. There is no way of knowing whether the investment goes to that precise plant, but I think it is a reasonable assumption and that any deviations do not affect my results.

This limits the number of companies in my dataset. Because I can not know how the investment is divided if there is more than one plant with the same headquarter, and therefore can not single out the effect of treatment, I drop any duplicate observations.

To avoid narrowing down my entire dataset, I use different datasets when I analyze profitability, and when I analyze investment. The investment dataset without headquarter duplicates contains 1905 observations from 441 companies, where the major dataset contains 5030 observations from 869 companies.

4. Methodology

4.1.1 Difference-in-Difference

To examine the effects on plant-level investment and profitability, I use a difference-in-difference approach. The Difference-in-difference (DID) approach is a method used for calculating the difference between two groups where one has been randomly selected to receive a treatment. It is commonly used to analyze the effect of a policy or law on a population. Card and Krueger (1994) analyzed the effect of minimum wage on labor demand using a DID-methodology.

DID-estimation looks at two groups that in nature are similar, where one is treated and the other is not (Wooldridge, 2012). You wish to single out the effect of the treatment. You look at the point in time when one group was treated, and compare the means of the treated group before and after treatment, with the means of the control group before and after the time of treatment. Subtracting the treated group difference with the control group difference, you get a difference-in-difference estimator (Stock and Watson, 2010). This DID-estimator, δ is what I am looking for.

A key element of the DID-analysis is dummy variables that identify the group and time of the observations (Albouy, 2005). I have two sets of dummy variables.

Treatment = 1 if observation is in the treatment group, 0 if in control group.
After = 1 if the observation is from a year after the treatment has occurred, 0 if before.

This gives a third dummy-variable, the interaction variable:

Interaction = Treatment x After = 1 if an observation is both in the treatment group, and after the treatment has occurred.

Combining the DID-estimator and dummy variables I get the following regression model:

Equation 4-1 Regression Model

$$Y_{it} = \alpha + \beta_i + \gamma_t + \delta \times interaction_{it} + \varepsilon_{it}$$

- Y_{it} is the dependent variable of interest (plant investment or profitability)
- i indexes plants
- t indexes years
- α = constant term
- β_i = plant fixed effects
- γ_t = year fixed effects
- δ = true effect of treatment
- $interaction_{it}$ is the dummy variable *Treatment x After*
- ε_{it} is the error term

There are many steps taken before I get to this regression model. However, I find presenting the model before explaining the different elements to get there, gives a better insight to my approach.

4.1.2 Difference in Difference Estimator, δ

To assertain the effect of the treatment, I need to fint the DID-estimator. Each observation falls into one of four categories within two dimensions, treated and non-treated (control), and before and after the treatment. Each observation can have four elements affecting it (Albouy, 2005).

- α is the starting point of the observation, the constant
- β accounts for the average permanent differences between the treatment and control group
- γ is the time trend common to the control and treatment group, the time difference before and after treatment
- δ is the effect of the treatment

I am interested in the average of the observations in each of the four categories.

$\bar{Y}^{control,before}$ $= \alpha$
$\bar{Y}^{treatment,before}$ $= \alpha + \beta_{treatment}$
$\bar{Y}^{control,after}$ $= \alpha + \gamma_{After}$
$\bar{Y}^{treatment,after}$ $= \alpha + \beta_{Treatment} + \gamma_{After} + \delta$

4.1.1.1 Simple Treatment-Control Estimation and Causality of Airline Routes

If I look only at the differences between the control- and treatment-group, while ignoring the pre-treatment outcomes, I get:

$$\delta 2 = (\bar{Y}^{treatment,after} - \bar{Y}^{control,after})$$
$$\delta 2 = [\alpha + \beta + \gamma + \delta] - [\alpha + \gamma] = \beta + \delta$$

Equation 4-2 – Difference in Groups

The estimation will be biased if $\beta \neq 0$. If there is an inherit difference between the control- and treatment-group, this will influence the treatment effect I find (Albouy, 2005). One thing that is important to consider here in relation to my analysis is the causality between location of plants, and the opening of new airline routes. The DID-approach requires groups to be randomly selected (Stock and Watson, 2010). If one group is chosen because of certain characteristics, this influences the causality between the treatment-group and treatment effect found. The groups need not have the same average or starting point before treatment, but the groups cannot be chosen on the basis of the starting point or on the level of predicted effect of the treatment.

Assuming that the choice of destinations of new airline routes (and thereby defining two connected areas as treated) is completely random would be naïve. An airline opens a new flight route depending on where it assumes it can get the highest profit, where most people assumingly will travel to or from. An area with thriving business will probably have a higher growth rate, and attract airlines more than sparse areas will. This could lead to a false positive result when analyzing the interaction effect, as the direct route could have nothing to do with for example a higher return on assets in the treatment group.

One thing that could counteract the effect of difference in the groups, is the fact that the location of plants are choice variables. All the companies in my sample are located at either end of routes that were untreated at some point in my sample period. Each headquarter chose the location of the plant it thought optimal. It chose not to locate it at the end of a direct route. I assume that the headquarters are profit maximizing and rational actors, and therefore that their choices of locations reflect a similar environment for treated- and control-groups. I assume any inherent differences in the control- and treatment-group are small and do not affect my analysis.

4.1.1.2 Simple Before-After Estimation

If I look only at the differences in averages before and after the treatment, in only the treatment group, I get:

$$\delta 1 = \left(\bar{Y}^{treatment,after} - \bar{Y}^{treatment,before}\right)$$

$$= [\alpha + \beta + \gamma + \delta] - [\alpha + \beta] = \gamma + \delta$$

Equation 4-3 - Difference in Treatment Group

This means that the estimation will be biased as long as $\gamma \neq 0$. If there is a time trend affecting$\bar{Y}^{treatment,after}$, this will be considered as part of the treatment effect (Albouy, 2005).

4.1.1.3 The Unbiased DID-estimator

Using the DID-estimator has the advantage of eliminating pre-treatment differences in Y between the treatment and control group (Stock and Watson, 2010). When taking the difference in averages between both the groups and time periods, you get the unbiased effect of the treatment, δ:

$$\delta = \left(\bar{Y}^{treatment,after} - \bar{Y}^{treatment,before}\right) - (\bar{Y}^{control,after} - \bar{Y}^{control,before})$$

$$\delta = \Delta\bar{Y}^{treatment} - \Delta\bar{Y}^{control}$$

Equation 4-4 The DID-Estimator

Illustration of DID-estimator, δ

	Before	After	After – Before
Treatment group	$\alpha + \beta_{Treatment}$	$\alpha + \beta_{Treatment} + \gamma_{After} + \delta$	$\gamma_{After} + \delta$
Control group	α	$\alpha + \gamma_{After}$	γ_{After}
Treatment – Control	$\beta_{Treatment}$	$\beta_{Treatment} + \delta$	δ

(Wooldridge, 2012)

4.2 Econometric Issues

I now have the regression model:

$$Y = \alpha + \delta \times interaction + \varepsilon$$

Equation 4-5 - Simple Regression Model

Here I state that the return on assets is only dependent on a constant starting point, the effect of treatment, whether or not a firm is treated, and the error term. Assuming that these are the only affecting factors determining the return on assets is not reasonable. To be sure any results I find in my analysis are correct and represent the actual treatment effect, I need to do several tests and adjustments to my regression model. Ignoring these issues can overestimate the test statistics and give biased and false results.

4.2.1 Plant and Year Fixed Effects

Fixed effect regression is a method to control for omitted variables affecting panel data (Stock and Watson, 2010). Panel data is a dataset in which entities are observed across time. Panel data allows you to control for variables you can not observe or measure, and account for individual heterogeneity (Baltagi, 2008). If I believe there is correlation between an unobservable effect and the explanatory variables in my panel data, I need to adjust for these effects. There are two relevant fixed effects I need to consider; firm fixed effects and time fixed effects.

Firm fixed effects are effects that vary across entities (plants), but remain constant over time (Stock and Watson, 2010). An example of a firm specific trait can be an exceptionally good location of a store. This location does not vary over time, but leads to abnormally high returns for that particular store. This must be singled out from the treatment effect. To control for fixed effects for each of my plants, I get N binary (or indicator) variables that absorb all omitted variables that vary across entities, but remain constant over time (Stock and Watson, 2010). These give me N different intercepts, one for each entity:

$$\beta_i = \mu + \beta_1 Z_i$$

Equation 4-6 Plant Intercepts

I wish to incorporate firm specific effects into my regression model. I ignore the constant and the error term for a moment to simplify the model, and get:

$$Y_i = \delta \times interaction + \mu + \beta_1 Z_i$$

Y_{it} is the dependent variable, and I wish to estimate δ, the effect on Y_{it} of $interaction$, holding constant the firm characteristics Z (Stock and Watson, 2010). Simplified, I wish to analyze the effect of treatment (δ), on ROA (Y_{it}), from being treated (identified by the dummy-variable *interaction*), holding constant all firm-specific effects. This gives me the fixed effect regression model:

Equation 4-7 Regression Model with Firm Fixed Effects

$$Y_i = \alpha + \beta_i + \delta \times interaction_{it} + \varepsilon_i$$

Where $\beta_1 \ldots \beta_n$ are treated as unknown intercepts to be estimated, one for each plant (Stock and Watson, 2010).

Time fixed effects are the same as firm fixed effects, only they are effects that remain constant across firms and changes over time. These are economic trends like booms and recessions that affect all firms over time. Like with firm fixed effects, I use binary variables that indicate different sample years. This gives me the regression model:

Equation 4-8 Regression Model with Firm and Time Fixed Effects

$$Y_{it} = \alpha_{it} + \beta_i + \gamma_t + \delta \times interaction_{it} + \varepsilon_{it}$$

For $t = 1,...,T$ and $i = 1,...,N$

Where γ_t is the year fixed effect following the same logic and method as firm fixed effects do. You can see that the firm fixed effects only varies across firms, *i*, and time fixed effects only varies across time, *t*.

4.2.2 Random Effects Model

There are two assumptions about individual specific effects, the random assumption and the fixed assumption. In the fixed effects model, the goal is to eliminate firm and year fixed effects influencing the model, because it is assumed to be correlated with one or more of the independent variables. If however the individual specific effects are uncorrelated with each explanatory variable across all time periods, using a transformation to eliminate the unobserved effect will result in inefficient estimators (Wooldridge, 2012). If I assume no correlation, the random effects regression model would include all the fixed effects assumption, plus the additional assumption of zero correlation.

To determine whether random effects assumptions need to be added to my regression model, I look at the nature of my panel data. If for example the key explanatory variable is constant over time, I can not use fixed effects to estimate its effect on the dependent variable (Wooldridge, 2012). If the unobserved variable (fixed effect) is unchanging over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics (Stock and Watson, 2010).

Using random effects when the interest is in a time-varying explanatory variable, is rarely the right choice. A situation where the covariance is zero is the exception to the rule (Wooldridge, 2012). As I am comparing data before and after an event, it is reasonable to assume that there are fixed effects that correlate with my explanatory variables.

To be sure that a fixed effects model is the right choice, I do a Hausman test on my data set (Baum, 2008). In the Hausman test, the null hypothesis is that the unique errors are not correlated with the regressors (the difference in coefficients is not systematic). If FE estimation is sufficiently close to RE estimation, one is indifferent to which is used. Random effects estimates are used unless the Hausman test is rejected (Woodrige, 2012). Fixed effects would still be correct, but inefficient.

When conducting the Hausman test, I find a statistically significant (to the fifth percentile) difference in random and fixed effects. Therefore, using the fixed effect regression model is correct for my dataset.

4.2.3 Testing for Time Fixed Effects

I need to test whether there are any time fixed effects that I need to include in my fixed effects model. I test whether the dummies for all years are equal to zero (Baum, 2008). The null hypothesis is the all the year-dummies are zero, and therefore no time fixed effects are needed. I find that the dummies are statistically different than zero to the one-percentile. Therefore I reject the null-hypothesis, and keep the time-fixed effects in my regression model.

4.2.4 Testing for Serial Correlation

The standard errors of the coefficients can appear to be smaller than they are, and the R-squared higher, if there is serial correlation present in the dataset. If the errors are correlated over time, they suffer from serial correlation (Wooldridge, 2012). Usually serial correlation applies to macro panels with long time series (20-30 years), and is usually not a problem in micro panels. However with difference-in-difference estimations, serial correlation is an important concern (Giroud, 2012). There are three factors that make serial correlation with DID-analysis an important issue (Bertrand et.al. 2004):

1. It often relies on long time series.
2. Serial correlation between dependent variables
3. Treatment variables changes little within time window

Furthermore, Bertrand et. al. points out that these three factors reinforce each other. The standard error for the estimated treatment effect could significantly understate its standard deviation and overestimate the test statistics. I do a Wooldridge test for autocorrelation in panel data to test for serial correlation, where the null is no serial correlation. This test shows a strong presence of serial correlation in my dataset. I include clustered standard errors in my regression model to account for serial correlation.

4.2.5 Testing for Heteroskedasticity

I need to test for heteroskedasticity in my dataset. If the variance of the error term, ε_{it}, is the same given any value of the explanatory variables, there is homoskedasticity (Wooldridge, 2012). If the error ε_{it} has a different variance given any value of the explanatory variables, there is heteroskedasticity present in my dataset (Stock and Watson, 2010), and I need to adjust for this in my regression model.

I do a Modified Wald test for group wise heteroskedasticity in fixed effect regression model to test for heteroskedasticity. The null hypothesis is constant variance (homoskesdasticity). I reject the null, and find heteroskedasticity in my dataset. I include heteroskedasticity-robust standard errors (Wooldridge, 2012) into my regression model.

4.2.6 Clustered Robust Standatrd Errors

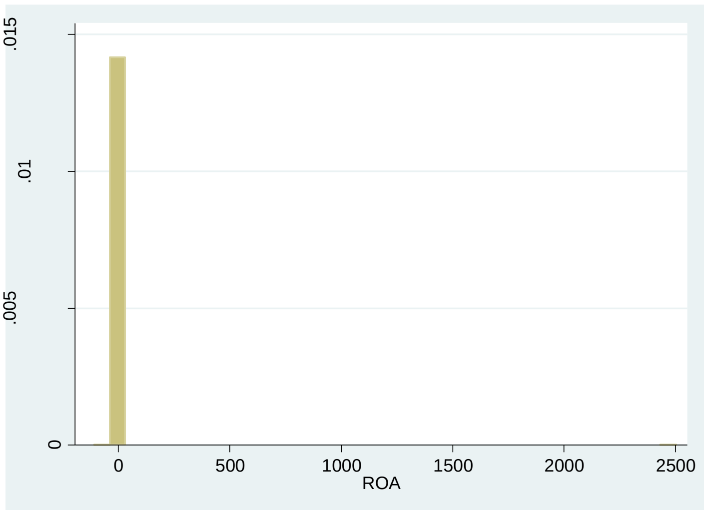
Like Giroud (2012), I cluster standard errors to account for the presence of serial correlation. This accounts for both serial correlation within same plant, and correlation of the error term across plants in a given year, as well as over time (Giroud, 2012). My robust clustered standard errors accounts for both heteroskedasticity and serial correlation, and is close to the true standard error. I cluster standard errors at the postal code area cluster level. This takes any correlation pattern within a geographical area into account.

4.2.7 Winsorization of Variables

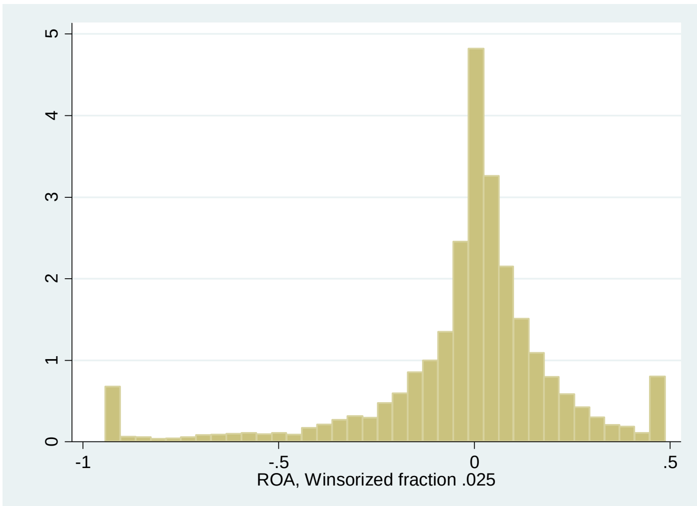
To account for outliers in datasets there are several methods to insure the results reflect the dataset as a whole as much as possible. Analyses on datasets with long tails can give skewered results. One method is to simply drop any observations exceeding an absolute limit or relative to the dataset. Another method is Winsorization of the dataset. This can reduce the effect of outliers on statistical analysis (Shete et. al. 2004).

When Winsorizing a dataset, you take any observations exceeding a pre-determined level, and gives it the value of the observation *at that level* for a more representative dataset. For example if you wish to change the one percent highest and lowest observations in a dataset, all those observations take the value of the 99% and 1% observations. I Winsorize my dependent variables at the 2.5th and 97.5th percentile. This gives me a significantly more representative dataset, as is illustrated by before and after Winsorization of my return on assets:

ROA before Winsorization:



ROA after Winsorization:



When winsorizing the dataset in the profitability analyses, I winsorize after calculating the ROA or finding the operating margin and EBITDA-margin, to better reflect the firm's numerator and denominator in a given year. With the investment from headquarter, I only have one figure. I therefore winsorize the investment from headquarter before I analyse, to deal with outliers. When calculating the profits deriving from said investment, I first calculate the profitability in each year using the original investment figures, then winsorize the results afterwards.

4.2.8 Criticism of Methodology

To fit the analysis I wish to do into the scope of a master thesis, I have made some simplifications that can affect my results. It is important to recognize the weakness this puts on my results.

4.2.8.1 Travel Time Reduction

I analyse the effect of reduced travel time on the managing of and investment in plants. I have defined a plant as treated or non-treated and analysed it based on this distinction. To find the true effect of reduction in travel time per hour or minute, I must include time-effects according to the reduction in travel time for each firm in my analysis. I could then see if a larger reduction in travel time has a greater impact than a small reduction. This would be very time-consuming to add as a factor for each firm, and therefore I have not made this distinction. I try to define a firm as treated in accordance with logic and previously optimal travel route, to see if a new flight route constitutes a true improvement to a firm.

4.2.8.2 Industry-Adjusted Codes

The Norwegian Corporate Accounts includes information on industry codes. There are two-digit and five-digit codes defining in which industry a company operates in. Some industries hold more fixed assets than others, and therefore has a different return on assets than others. As return on assets vary across industries and is cyclical, including industry-adjusted ROAs over time will give a better basis for comparisons. Subtracting the industry-median in a given year will single out the true effect (Giroud, 2012). I have ten years of financial data. In NCAs dataset there are 966 different groups in the five-digit category, 59 different groups in the two-digit category, and 12 different industry groups that the five-digit industry codes are divided into (see appendix 5). Including this in my data set would give me:

For five-digit: 966*10 = 9 660 industry-adjusted codes

For two-digit: 59*10 = 590 industry-adjusted codes

For 12 different groups: 12*10 = 120 industry-adjusted codes

Equation 4-9 Industry Adjusted Codes

This has to be done for each of the effects I wish to analyse; ROA, EBITDA margin, operating margin, investment level and investment profitability. This is unfortunately beyond the scope of this paper, and needs to be recognized as a weakness that could occur. I use the 12 different groups based on the five-digit SN02-codes in my analysis. I do individual analyses on the three largest groups (manufacturing, trade, services/real estate/advisors) to find trends, to mitigate the weakness of not including industry-adjusted factors in my regression.

4.2.8.3 Several Treatments in one Area

An area in my analysis, is the geographical area where the firms within are affected by the routes offered at a nearby airport. An airport can open several new routes to different destinations, within my treatment window. Therefore firms in that area can be treated at different times. The control companies are those that are not treated at all, that have a plant located at an area that does not have a direct route in my relevant time window. Because of this, the treatment can occur at different times for different companies, while the control companies stay the same. The inclusion of time-fixed effects takes care of this problem. It does not matter that for example, a firm A can be treated in 2008 and be compared with firm X in 2008, a firm B can still be treated in 2010 and be compared to firm X in 2010.

4.2.8.4 Number of Clusters

The clustered robust standard errors may be biased if the number of clusters is too small (Petersen, 2005). I have 18 area clusters that I cluster the standard errors in. According to Petersen, 10 clusters is too small and 500 is sufficient. Giroud (2012) had over 500 clusters, while I have only 18. This number is too small, and this weakness can lead to understated standard errors in my analysis.

5. Empirical Analysis

5.1 Reasons for New Flight Routes

The simple answer to the motivation of opening a new flight route, is profits. Airlines are profit-maximising companies that open new routes where they think they can get the highest profits, where they assume most people will want to travel to and from. Beyond this point, there are three factors to consider: the restraint in number of airplanes, competition on a route, and air rights.

5.1.1 Restraint in Number of Airplanes

Airplanes are not built overnight. There is a large backlog and waiting time for airplanes to be delivered. Norwegian Air Shuttle is waiting for 240 planes to be delivered (Lorentzen, 2015). A limited number of airplanes in the fleet puts a restraint on how many routes you can operate and how often a route is travelled. The airlines try to optimize the profit given this restraint, offering the most profitable routes often, but still offering a wide network of routes.

5.1.2 Competition on Individual Routes

There are finite numbers of people wishing to travel on a route. This number is divided among the flights offered within a relevant time period. In addition to the factors of Bonus Points and personal preferences, customers are price sensitive and usually chose the cheapest flight offered. For an airline, the fixed costs involving a single flight is hefty, while the cost for each additional passenger is very low. The cost of flying with empty seats is therefore great. When opening a new route, or increasing the number of flights on an existing route, an airline therefore needs to consider the competition on that specific route. Flooding the market on profitable routes lowers the price, and the profits.

5.1.3 Air Rights

Opening a new route is not a simple process. Air traffic is highly monitored and taxed by the government. The rights to operate a route need to be purchased or granted. This can be a difficult process, especially on international routes where domestic firms are often favoured.

5.1.4 Lobbying by Companies and Private Jets

One thing to consider with causality between the opening of direct routes and increased monitoring, is whether the firms themselves have influenced the decision to open a new airline. More densely populated areas and areas with more business are preferred destinations for airlines. If however, the companies with plants at either end of a route have affected this choice through lobbying to the airlines, this could dilute the effect of proximity on profitability. The causality needs to be established. When looking at my final data set, I do not believe the few companies at either end have influenced the choice in the treated routes. Cities where the most influential and numerous companies are located, like Oslo, Bergen and Trondheim, already have numerous direct flights between them. I do not believe this affects my findings.

Private company jets are substitutes to public transport, a substitute to using the airline routes in my data set. If the use of private jets to transport management was widespread in Norway, this could undermine my findings. This is, however, a luxury few private persons or companies have access to. I do not think the use of private jets in Norway affects my analysis.

5.1.5 Tourism and Technology

In the dataset I received from Avinor, it was specified that the flight information I had access to did not include charter flights. The dataset only includes information on flights transporting people, not charter or goods transport. When I analyse the effect of the opening of a new direct air route, I therefore know that the effect is not due to the increased transportation of goods and equipment, but of people.

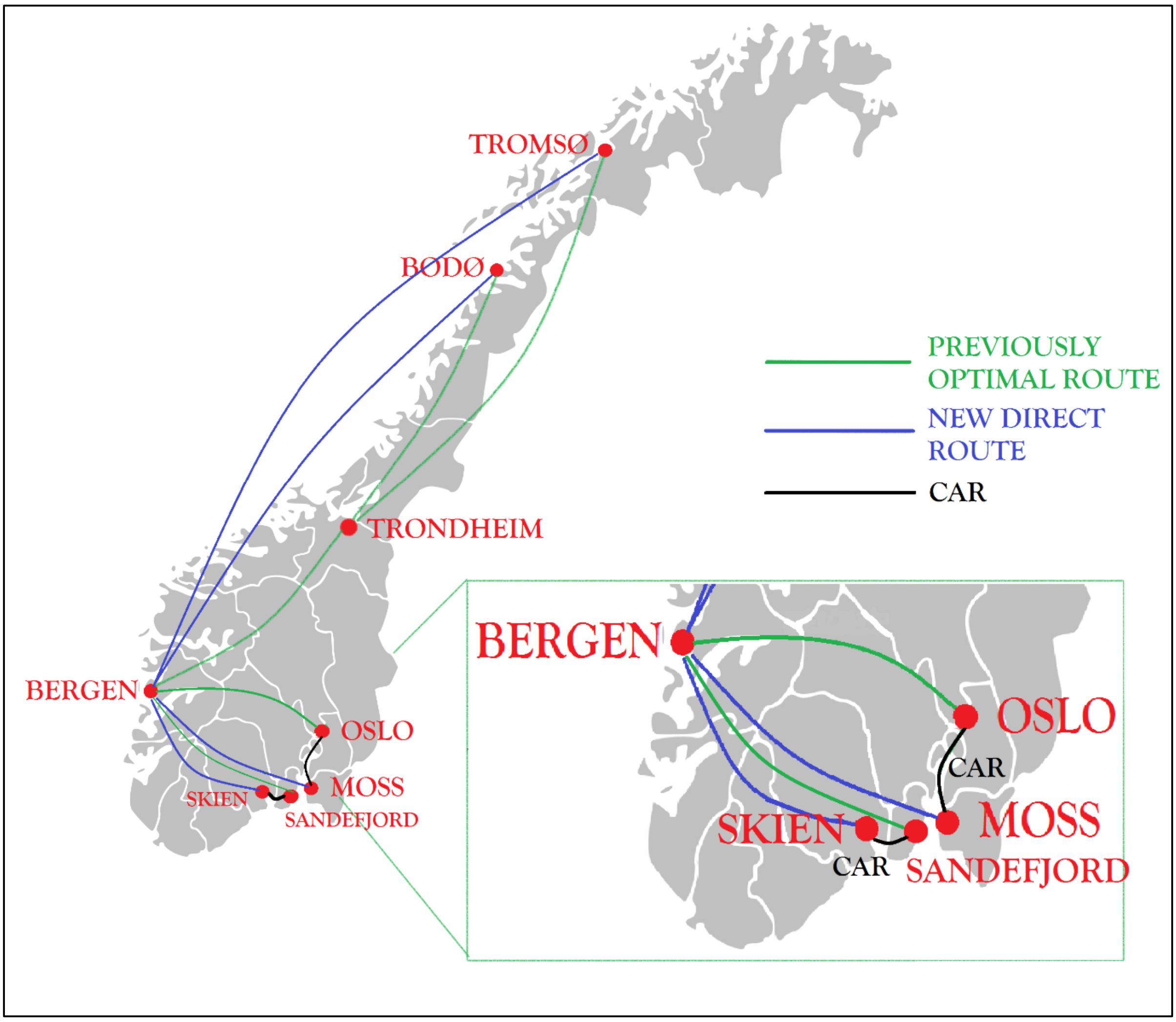
Improvements in technology like videoconferences and electronic monitoring systems, can over time reduce the need and effect of personal monitoring. In his study, Giroud (2012) covered the period 1977-2005. During this time, improvements in technology were significant and he found that the treatment effect of personal monitoring was higher in the earlier years of his study. My time period of ten years is significantly narrower. Though technology has improved since 2005 (my first treated flight), I do not believe it to have affected my results in a significant way.

5.2 Example: Bergen Airport, Flesland

The route Bergen-Oslo is the second most travelled route in Norway, between Oslo-Trondheim and Oslo-Stavanger (from flight route statistics dataset). Bergen, Flesland is the second largest airport in Norway, with 19 domestic routes transporting over three million passengers in 2014. Bergen is a key part in my analysis. Four out of the ten routes opening in my time window include Bergen as one of the two relevant areas. In 2004 there were 13 routes, while five routes have opened and closed or have fallen outside my treatment window. With Bergen being a large city with a substantial population, finding routes connected to Bergen is central to gaining a sufficient number of treated firms.

The four treated routes connected to Bergen, and their previously optimal routes, are:

Figure 5-1 – Treated firms - Bergen



In figure 5.1, the blue lines represent new routes, while the green lines represent the previously optimal routes for those four destinations. The two northern cities Bodø and Tromsø were previously both reachable through Trondheim and a direct flight from there. Bergen-Skien and Bergen-Moss are special cases. This is because the new routes came from the opening of new airports, Moss Rygge and Skien Geiteryggen. The previous optimal route therefore entailed flying to the closest airport, then driving by road from there. The relevant reduction in travel time is therefore the driving time to the closest airport. This is not the actual reduction in travel time for all companies, as they are located widespread around the treated airport. As previously discussed this does not affect my analysis as I only use the location to identify which routes a company is affected by, not as a function of reduction in travel time.

Figure 5-2 – Travel time reductions – Bergen

Area 1	Area 2	Opening year	Previous Destination	After Treatment	Before Treatment	Time saved
Bergen	Moss	2008	Oslo (car)	55	131	76
Bergen	Skien	2005	Sandefjord (car)	55	101	46
Bergen	Bodø	2008	Trondheim	110	180	70
Bergen	Tromsø	2007	Trondheim	140	225	85

In addition to these four treated routes, my Bergen-dataset includes three control routes to Brønnlysund, Harstad/narvik and Alta/Finmark that does not yet have a direct route from Bergen. This dataset consists of 128 companies with 845 observations, giving an average number of 6,6 observations per plant. The number of clusters are Bergen + Treated + Control = 1+4+3 = 8 clusters. I do my entire analysis on the Bergen-dataset, and get some interesting results.

5.2.1 Profitability Measurements

One of the most interesting findings from this example, is the return on assets. Return on assets shows a firm's ability to allocate its resources to generate profit. In my analysis of Bergen, I find a DID-estimator of 3.86%. This means that through the differences in differences analysis, I find a positive increase in the return on assets derived from being treated, of 3.86%. This result is significant to the 5th percentile, and constitutes the real increase in return on assets (within the limits of my analysis). This finding is very interesting. It shows the overall improvement of plants in the Bergen region from closer proximity to headquarter. It shows economic growth in a geographical area, and represents the economic benefits of having an airport with direct flight routes for an area.

I did the same analysis on the EBITDA- and operating-margin. I find a 4.60% increase in the EBITDA margin, and a 1.18% increase in the operating margin. This strengthens my previous finding that proximity through direct flights improves profitability, but unfortunately neither of these results were statistically significant. This means that I cannot conclude that these increases come from the treatment effect.

I present my findings in a table below. I chose not to include all year fixed-effects in the figure, simply for an easier presentation of the key findings for each analysis.

Figure 5-3 – Bergen Profitability Results

	ROA	EBITDA Margin	Operating Margin
Treatment Effect	0.0386**	0.0460	0.0118
	(0.0166)	(0.0788)	(0.1277)
Constant	0.0489**	0.0093	-0.0705
	(0.0171)	(0.0743)	(0.0745)
Number of observations	845	734	734
Number of groups	128	118	118
Avg. plant-year obs.	6.6	6.2	6.2
R2 within	0.0328	0.0164	0.0106
R2 between	0.0070	0.1344	0.1707
R2 overall	0.0159	0.0287	0.0194

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

I do all three profitability analyses on each of the three largest industries as well. I find that for example, for real estate/services/advisors, there is an improvement of 2.09% in the operating margin. All nine analyses show similar trends for the three groups and profitability measures. The number of firms in each industry in Bergen is small however. Neither of the groups have more than 50 firms, and none of the results are statistically significant in the Bergen area alone.

5.2.2 Investment Level

In the investment level analysis I look at the investments in subsidiaries that the headquarters state in their financial report. I look at both the changes in investment in NOK, and the relative profitability derived from the investment the plant receives. Not knowing which plant receiving an investment, limits my data set to headquarters with just a single plant, assuming that this plant receives the whole investment.

Here I find another interesting result; the investment in NOK-terms when a firm is treated decreased by over NOK 120 000. This is highly statistically significant, to the 1^{st} percentile. This means that when the proximity between headquarter and plant increased, the investment in the plant decreased. This is different from what Giroud (2012) found in his analysis. He found that investment increased when measured as capital expenditure over capital stock. I have used the figure the headquarter itself has listed as investment in subsidiaries, and that has decreased with treatment. Possible reasons for this effect will be discussed under my main analysis.

I did a regression on the profitability deriving from the investment from headquarter, as a function of net income over received investment. This profitability shows how well the plant utilizes the investment it receives, and allocates it to gain profits. I found that profitability increased with 5.31% from the treatment. This was not statistically significant, and I can therefore not conclude that the increased profitability stems from the treatment. But if it did, this would mean that proximity lead to less, but better investment.

Figure 5-4 – Bergen Investment

	Investment	Profitability
Treatment Effect	-120 137***	0.0531
	(32 397.52)	(0.0281)
Constant	17 450	-0.3377
	(33 430.25)	(0.2797)
Number of Observations	351	351
Number of Groups	79	79
Avg. plant-year obs.	4.4	4.4
R2 within	0.1082	0.0485
R2 between	0.0757	0.0125
R2 overall	0.0637	0.0136

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

5.3 Main Results

In this paper I have done several analyses on profitability and investment. I look at both a national and a regional level, as well as at the three largest industries in my sample. I use a differences in differences approach to compare two groups of firms before and after a treatment. The treatment is the opening of a new direct airline route between the firm's headquarter and plant. A direct route means that management can travel faster to and from the plants, and therefore can monitor the plants more easily. This improvement in proximity has different effects that I wish to analyze. I have found several interesting trends that I will now present.

5.3.1 Return on Assets

When I analyze the return on assets on the national level on my whole dataset, I find that the result are not statistically significant. To be able to uncover trends and conclude, I therefore do several different analyses. I do ten analyses on the ten different treated regions, five analyses on the five different years flights were opened, and three analyses on the three largest industries. This gives me a good basis to uncover significant trends on different grounds and groups. Because I do the different analyses on different groups, the combination of treatment and control groups vary, giving different grounds for comparisons. See appendix 6-8 for a full list of the ROA regression results.

5.3.1.1 Ten Analyses on Regional Level

With the regional analyses, like in the Bergen example, I look at all the treated and control routes that origins from one treated airport. All the firms in these analyses has either its plant or headquarter in the relevant region. These analyses are therefore the closest comparisons of companies with similar location-specific economic factors. Most of the analyses show a positive trend following treatment. Five of the ten regional analyses are statistically significant, whereas three, Skien, Bergen and Tromsø, show a positive result of a 3-9% increase in ROA. Two areas, Kristiansund and Bodø has a negative effect of 5% on ROA after treatment (See appendix 6 for all results).

5.3.1.2 Five Year-Specific Analyses

In the year-specific analyses, I compare the firms being treated in a specific year, with all the control companies in the whole dataset. These are therefore done with a larger control group.

In some years only one route is opened, while in for example 2008, four different routes were opened. I do the regressions on all the years I have plant level data on, the year-specific analysis only defines which treated companies are included in each analysis. The treatment effects on return on assets in these analyses, are for most between 0.4% and 1.8%. One is -1.3% but is not statistically significant. All the constants are statistically significant to the 1^{st} percentile, but only the treatment effect on the routes opening in 2007 were statistically significant. The route opening between Bergen and Tromsø in 2007 had an increase in ROA of 10.52%, which was statistically significant to the 1^{st} percentile (See appendix 7 for all results).

5.3.1.3 Three Industry Specific Analyses

I do three analyses on the three largest industry groups; manufacturing, trade, and services/ real estate/ advisors. I find a treatment effect of -0.1% to 3.8%, but none of the results are statistically significant, and therefore does not give additional insight to the treatment effect on return on assets (See appendix 8 for all results).

5.3.1.4 Treatment effect on Return on Assets

The main findings on the 18 ROA-analyses, are those of the five statistically significant treated areas, and the route opening in 2007. The route Tromsø-Bergen, opening in 2007, is both the only treated route from the Tromsø-area, and the only treated route that opened in 2007. I find a positive increase of about 10% for both analyses (significant to the 1^{st} percentile). That means that both compared to the other control firms in Tromsø, and compared to the entire dataset, this route had a significantly positive effect on the return on assets. There were two routes opening in 2005, both from the Skien-area. Looking only at the Skien-area I find a significant positive effect of 7.5%. When analysing both these routes with the whole dataset, I find an increase of 1.7%. That is however only significant to the 20^{th} percentile, and therefore can not be given too much weight. In the Bergen area, with three treated routes, I find a positive increase of 3.9%.

Looking at all the analyses together, I find strong evidence that the opening of a direct route between two areas leads to a positive effect on the return on assets.

There are two areas that have a significant negative treatment effect when compared to firms in the same area; Kristiansund and Bodø. There can be several reasons to why improvement in proximity can lead to lower profitability. If irrationally based home-bias leads management to invest in plants, solely on the basis that they are more familiar with it, that can lead to suboptimal allocation of funds. Over-management can also be a reason. If a manager visits more often, and needs to justify his monitoring with making changes to the plant, he can take the plant away from an optimal strategy.

5.3.1.5 Different regression model

I try a different regression model to test if there are assumptions or parts of my regression model I can exclude and get significant results on a national level. I run a regression on my whole dataset, with my model and the year fixed effects, but excluding the firm fixed effects. I get statistically significant results to the 1^{st} percentile, of a positive treatment effect of 2.81% (See appendix 18). This means that there is an overall positive difference in ROA of the two groups before and after the treatment (DID-analysis). Because I excluded the plant-specific effects this effect may come from an inherent difference in the firms. Whether this inherent difference comes from the treatment, or the airlines chose the destinations based on this difference in groups, the effect is still there. The causality of the difference in firms (firm-fixed effects) and the treatment result aside, the treated firms have a 2.8% higher return on assets.

5.3.2 Operating Margin and EBITDA Margin

I calculated the return on assets for all firms for all years using plant level data. The Norwegian Corporate Accounts calculated the operating margin (OM) and EBITDA margin (EM) and listed it in their database. I did the same 18 analyses on all three profitability measures. See appendix 9-11 for results on OM, and appendix 12-14 for the regressions on the EM. Unfortunately, very few of the analyses on either OM or EM were statistically significant. The only results that provide additional insight to the trends presented in the ROA-analysis, are that of Bodø and Kristiansund. They both had a negative ROA-effect of 5-6%. I find a negative effect on the OM of 11-12% (statistically significant to the 1^{st} percentile for both), and a negate effect on the EM of 6-9% (significant for Bodø). These findings give weight to the fact that there is a negative effect of treatment on profitability in those two areas.

I find positive effect on both OM and EM for routes opening in 2010. Only one route opened that year, Oslo-Brønnøysund. I find no statistically significant improvement of EM or OM for those areas in either of the area-analyses, showing that this effect is only apparent when comparing to the dataset as a whole, not on a regional level.

I run the regression model excluding the firm-specific effects on OM and EM as well. Both analyses give a positive result on a national level (see appendix 18). The operating margin has a statistically significant 4.0% treatment effect. Again this does not mean that the treatment had a 4% effect on OM, only that there is a 4% higher OM in the treated group after treatment, compared to the control group. This effect may come from inherent differences in the firms, but supports my hypothesis of improved profitability from closer proximity.

5.3.3 Investment

The investment analyses looks at the effect of treatment with regards to the amount of NOK a headquarter invests in a plant. Looking at the investment in subsidiaries in single-plant firms, I see how the level of investment changes with closer proximity and therefore increased monitoring. I find a strong effect of decreased investment in subsidiaries, on a national level. This effect is persistent at a regional level (the Bergen example), and within industry groups (see appendix 15-17). This effect is surprising, and not the same result at Giroud (2012) found. Overall, at a national level, the treatment effect of investment is on average NOK -31 140. When looking at year-specific analyses, the years containing seven of the ten treated routes are all significant and negative. At industry level, two of the three industries are significant and negative. Out of all the analyses, the industry of real estate/ services/ advisors has the highest negative treatment effect of NOK -169 873. At a regional level five of the ten areas are significant, with four showing a negative trend, and only Stavanger having a positive treatment effect.

All these analyses put together show a strong negative treatment effect on investment. A possible explanation to this, is that the increased monitoring has led to either a loss of faith in the plant, or to the implementation of a better, cheaper strategy. Perhaps increased monitoring has led to a better control and overview of a plant's investment needs, and therefore less but more strictly monitored investment. Uncovering inefficiencies in plants may lead headquarters to choose to have more in-house activities. Headquarter managers may have knowledge and expertise that uncover potential cost saving and better strategies for a plant. Monitoring and advice from these can therefore lead to less investment.

It is important to remember the assumption that "investment in subsidiaries" listed in a headquarter's financial statement, reaches a plant when it is the only plant in my dataset with that particular organization number as headquarter. If this assumption does not hold, there might not be a connection between investment and a direct route between headquarter and plant. Due to the strong statistical evidence on several different grounds, I believe my assumption to be correct, and that proximity leads to less investment in subsidiaries in Norway.

5.3.3.1 Profitability from Investment

I calculate the profitability deriving from investment, of net income divided by the investment received from headquarter. An increase in this profitability measure would show that even though investment goes down with treatment, the investment is more optimally placed and utilized by treated firms. I run all 18 analyses on this profitability measure, and even though they show a positive trend, none are statistically significant to the 10th percentile. I can therefore not say whether treatment has an effect on the profitability deriving from investment from headquarter.

Figure 5-5 – National Investment

Overall Analysis	Investment	Productivity
Treatment Effect	-31 140***	0.0767
	(12 082.6)	(0.1099)
Constant	76 755***	-0.0939
	(11 000.0)	(0.1000)
Number of Observations	1905	1904
Number of Groups	441	441
Avg. plant-year obs.	4.3	4.3
R2 within	0.0108	0.0127
R2 between	0.0001	0.0044
R2 overall	0.0003	0.0026

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01 ,

5.3.4 Lifespan of Plants

I want to see if there are any statistical difference in the probability of bankruptcy or lifespan associated with treatment. I calculated the number of years a plant listed financial data, using this as a proxy of being “alive”. I divided the firms into two analyses based on two assumptions; the lifespan of the ones that were active at the beginning of my sample (2003) and then went bankrupt, and the lifespan of the firms that were still active in 2012. For the firms that went bankrupt during my time period, I find an average lifespan of 3.65 years (after 2003) that is statistically significant to the 1st percentile. I find no statistical difference between the control and treatment groups.

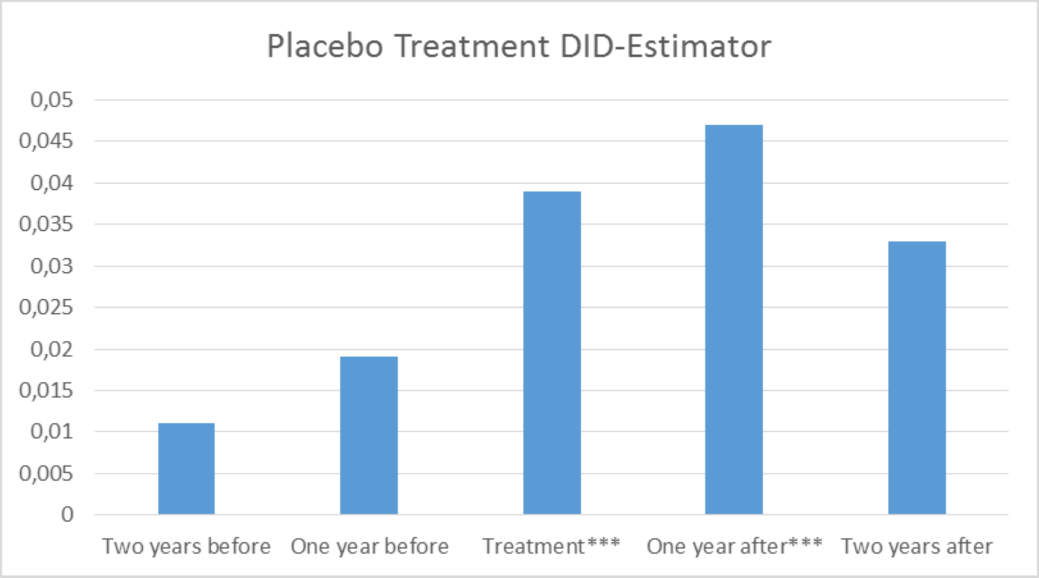
For the firms that were still active in 2012, I find an average lifespan of 5.36 years (after 2003) that is statistically significant to the 1st percentile. I find no statistical difference between the control and treatment groups.

5.4 Placebo analysis

To see whether the treatment effect found in a regression is representative of the results found, one can do a placebo analysis. One can for example see if the effect uncovered is persistent if looked for at a non-treated time. This placebo analysis should prove that the treatment effect is zero if analyzed at a time the treatment effect should not be affecting the group. Because I do several analyses to uncover significant results, I can not do a sensitivity analysis on my whole dataset and draw conclusions from it. On the ROA analysis the Bergen area had four routes opening at three different years; 2005, 2006 and two in 2008.

I do a placebo analysis on the Bergen area to see if the 3.9% treatment effect I found on return on assets is unique to the treated years. I use two new dummy variables to create a false treatment effect. I change the “after treatment”-dummy to be 1 when an observation is two years prior to the actual opening of the route. Combining this with the “treatment”-dummy from my main regression gives me a “placebo-intereaction”-dummy that is 1 when an observation is in the treatment group, and in a year after *two years before* the actual treatment.

Running my regression model, including firm fixed effects, year fixed effects and robust clustered standard errors, with this “placebo-interaction”-dummy, will give me a new DID-estimator. If my previously found treatment effect is the actual effect of a treatment, the DID-estimator should be close to zero, signaling no difference in the treatment and control groups before and after “treatment”. I make four different sets of placebo dummy-variables, for 1-2 years before the actual treatment and 1-2 years after. This gives me these DID-estimators:



I find no significant treatment effect prior to when the four treated routes are opened. The two prior DID-estimators are 1-2% but not statistically significant. I find a significant positive treatment effect both the year the routes are opened, and the year after. This is to be expected, as travel habits need time to adjust and to take advantage of new available routes. A direct route constitutes a continues improvement in proximity for treated firms compared to control firms, not just in the year it was introduced. Two years after the treatment the effect is lessened and no longer statistically significant.

This placebo analysis strengthens my findings, and that the treatment effect in ROA comes from the actual opening of the four direct routes.

5.5 Suggestions for Further Research

One of the simplifications I do is to exclude industry-adjusted factors. I do not find any significant results or differences in the three major industries I analyze. Including industry-adjusted factors could uncover the trends I was looking for, and would be interesting to research further.

I use the reduction in travel time only to identify the treated and control areas. Including the actual travel time reduction in the model could give a more precise representation of increased profitability as a factor of reduced travelling time, and could be an interesting angle for further research.

My treatment window is limited both by the company-data I have access to, and the flight information I have access to. If one could gain access to data further back in time, it would be interesting to look at the effects after the SAS-Braathens merger or the introduction of Norwegian.

6. Conclusions

Throughout this paper I have analysed the headquarter-plant relationship in Norway on the basis of the following three research questions:

1: What is the economic effect of proximity on plant-level performance and investment in Norway?

Sub-questions:

2a: Are changes in performance more prominent in certain industries or areas?

2b: Does proximity lead to more, or better investments in plants?

I have looked at financial and descriptive plant level data to find trends and effects of direct flight routes between headquarter and plant. Using a reduction in travel time from a direct route as a proxy for improved proximity between headquarter and plant, I look at the effect of cheaper and increased monitoring on plant level performance and investment. I look for the presence of rational or irrational home bias, and the effect of increased plant level-knowledge on investment from headquarter.

Using a difference in difference analysis on a treated- and control group before and after treatment, I have attempted to answer my three research questions.

6.1 The Economic Effect of Proximity on Plant-Level Performance and Investment in Norway

Using the return on assets, operating margin and EBITDA-margin and over 50 analyses on different groupings of the firms, I find a strong positive economic effect from treatment. The statistically significant analysis with the highest number of firms and observations is that of Bergen, including four of the ten treated routes, showing an increase in ROA of 3.9%. With a placebo analysis I show that the treatment effect stems from the actual flight route openings. Even though I have limited sample of plants, I conclude that overall on the basis of these numerous analyses, there is a significant positive effect from increased proximity between headquarter and plant.

6.2 Are changes in performance more prominent in certain industries or areas?

I look at ten different areas in Norway to find evidence of economic improvement in different regions. I find a significant positive result on ROA in the three areas Bergen, Skien and Tromsø. Five of the ten treated routes are included in one or more of these areas. I conclude that improved proximity and increased monitoring has had a positive effect on the plants in these regions.

Two of the areas, Bodø and Kristiansund, have significantly lower profitability after treatment, both in ROA, operating margin and EBITDA-margin. I conclude that for these areas, monitoring can have led to either irrational home bias, or over-monitoring and suboptimal decision making.

The three largest industries in my sample make up almost 80% of my dataset. I analyse the industry groups individually to uncover trends, but none of the regressions prove statistically significant. Therefore I can not conclude whether the changes in profitability from treatment differ in various industry groups.

6.3 Does proximity lead to more, or better investments in plants?

I find a significant negative effect on investment from treatment. To support this conclusion, I run the regression on all areas, industry groups and years the new flights open. Throughout these I find a strong and negative effect. This means that while plant profitability (ROA) increases, the NOK investment the plant receives lessens with treatment. This can be due to the development of better and cheaper strategies by management through better knowledge and expertise. It can also come from management uncovering sub-optimal utilization of funds, leading to more in-house activities.

I analyze profitability depending on the direct investment received from headquarter, but none of these analyses prove statistically significant.

Overall conclusion: Proximity leads to less direct plant-investment, and increased plant-level profitability in Norway.

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Appendix

Appendix 1 - Treated Areas

Areacode	City/Area	Airport	Airportcode	Postal Code
1	Moss	Rygge	RYG	1501-1803, 1805-1816, 1823-1859, 1870-1893
2	Skien	Geiteryggen	SKE	3665, 3600-3619, 3646-3648, 3670-3799, 3800-3855,3883,3900-3999
3	Stavanger	Sola	SVG	4001-4398, 4440-4443, 5501-5598
4	Bergen	Flesland	BGO	5000-5499, 5600-5995
5	Kristiansund	Kvernberget	KSU	6408, 6430-6433. 6440-6447, 6490-6599, 6628-6699
6	Trondheim	Værnes	TRD	7003-7797, 2500-2555
7	Oslo	Gardermoen	OSL	0001-2391, 2401-2418, 2435-2438, 2601-2629, 2635-2637, 2649-2657, 2711-2893, 2900-2937, 3001-3491, 3500-3539, 3601-3628, 3646-3648, 3665, 3671-3853, 3901-3999
8	Brønnøysund	Brønnøy	BNN	7800-7994, 8680, 8681, 8800-8880, 8900-8985
9	Bodø	Bodø	BOO	8001-8398
10	Tromsø	Langnes	TOS	9000-9148, 9240-9306, 9370-9389

Control Areas

Areacode	City/Area	Airport	Airportcode	Postal Code
11	Ålesund, Molde	Vigra, Årø	AES, MOL	6000-6399, 6401-6407, 6409-6429, 6434-6436, 6450-6488, 6600-6622
12	Kristiansand	Kjevik	KRS	4400-4438, 4460-4745, 4760-49999
13	Alta	Alta	ALF	9150-9197, 9500-9999
14	Harstad, Narvik	Evenes	EVE	8400-8599, 9400-9499, 9310-9365, 9201-9220
15	Florø, Førde, Sogndal	Florø, Bringenes	FRO, FDE, SOG	6700-6999
16	Røros, Fagernes	Røros, Leirin	RRS, VDB	2420-2432, 2440-2485, 2560-2584, 2630-2634, 2639-2648, 2658-2695, 2939-2985, 2638, 2490
17	No major	None		3540-3595, 3629-3632, 3650-3661, 3666, 3854-3895, 4747-4756
18	No major	None		8600-8672, 8690-8799, 8842-8852, 8890-8899

Appendix 2 – Treated Routes

Treated Routes

#	Airport 1	Airport 2	Year treated	Previous optimal route	Time saved	Firms on route
1	Moss	Bergen	2008	Oslo (car)	76	33
2	Moss	Stavanger	2008	Oslo (car)	70	49
3	Moss	Trondheim	2008	Oslo (car)	70	39
4	Oslo	Brønnøysund	2010	Trondheim	58	42
5	Stavanger	Trondheim	2006	Bergen	90	101
6	Stavanger	Kristiansund	2006	Bergen	80	22
7	Stavanger	Skien	2005	Sandefjord (car)	51	40
8	Bergen	Skien	2005	Sandefjord (car)	46	24
9	Bergen	Bodø	2008	Trondheim	70	12
10	Bergen	Tromsø	2007	Oslo	85	13

Appendix 3 – Control Routes Between Treated Airports

Control routes between treated airports

#	Airport 1	Airport 2	Firms on route
1	Moss	Brønnøysund	0
2	Moss	Kristiansund	21
3	Stavanger	All North	100
4	Bergen	Brønnøysund	12
5	Skien	Trondheim	37
6	Skien	Brønnøysund	0
7	Skien	Bodø	1
8	Skien	Tromsø	4
9	Kristiansund	Brønnøysund	9
10	Kristiansund	Bodø	2
11	Kristiansund	Tromsø	3
12	Brønnøysund	Bodø	13
13	Brønnøysund	Tromsø	6
14	Skien	Kristiansund	1

Appendix 4 - Control Routes Between Treated and Non-Treated Areas

Control rotes from treated areas to non-treated areas

#	Airport 1	Airport 2	Firms on route
15	Skien	Only Ålesund	8
16	Kristiansund	Only Ålesund	27
17	Moss	Ålesund, Molde	17
18	Brønnøysund	Ålesund, Molde	10
19	Bodø	Ålesund, Molde	9
20	Tromsø	Ålesund, Molde	23
21	Moss	Kristiansand	33
22	Trondheim	kristiansand	51
23	Brønnøysund	Kristiansand	3
24	Bodø	Kristiansand	6
25	Tromsø	Kristiansand	6
26	Moss	Florø, Førde, Sogndal	8
27	Skien	Florø, Førde, Sogndal	4
28	Stavanger	Florø, Førde, Sogndal	21
29	Kristiansund	Florø, Førde, Sogndal	5
30	Trondheim	Florø, Førde, Sogndal	15
31	Brønnøysund	Florø, Førde, Sogndal	3
32	Bodø	Florø, Førde, Sogndal	4
33	Tromsø	Florø, Førde, Sogndal	12
34	Moss	Røros, Fagernes	6
35	Skien	Røros, Fagernes	3
36	Kristiansund	Røros, Fagernes	4
37	Trondheim	Røros, Fagernes	12
38	Brønnøysund	Røros, Fagernes	1
39	Bodø	Røros, Fagernes	0
40	Tromsø	Røros, Fagernes	0
41	Moss	Alta, Finmark	3
42	Skien	Alta, Finmark	1
43	Bergen	Alta, Finmark	29
44	Kristiansund	Alta, Finmark	6
45	Trondheim	Alta, Finmark	18
46	Brønnøysund	Alta, Finmark	4
47	Moss	Harstad, Narvik	10
48	Skien	Harstad, Narvik	2
49	Bergen	Harstad, Narvik	16
50	Kristiansund	Harstad, Narvik	1
51	Brønnøysund	Harstad, Narvik	9

Appendix 5 – SN02 Industry Codes

Industry Groups (SN02)	Code From	To	Number of firms
Primary Indusries	0	10000	34
Oil/Gas	11000	12000	7
Manufacturing industries	10000	11000	145
	12000	40000	
Construction/Energy	40000	50000	40
Trade	50000	60000	261
Transport/tourism	60000	65000	24
Shipping	60300	60400	12
	61100	61200	
Finance, Insurance	65000	70000	10
Services/real estate/ advisors	70000	75000	251
	90000	91000	
Health Care	85000	90000	39
Culture, Media	92000	95000	15
IT/Telecom	30020	31000	24
	64200	65000	
	71330	71340	
	72000	73000	

Appendix 6 – Return on Assets in Different Areas

ROA	Moss	Skien	Stavanger	Bergen	Kristiansund	Trondheim	Oslo	Brønnysund	Bodø	Tromsø
Treatment Effect	0.0182	0.0752*	-0.0274	0.0387**	-0.0598**	-0.0073	0.0380	-0.0053	-0.0527***	0.0949***
	(0.0280)	(0.0416)	(0.0246)	(0.0166)	(0.0247)	(0.1340)	(0.4712)	(0.0669)	(0.0092)	(0.0188)
Constant	-0.0039	0.1796	-0.0083	-0.0490**	-0.0538**	-0.0363**	-0.1331	-0.1147***	-0.1169***	-0.0546***
	(0.0246)	(0.0253)	(0.0106)	(0.0171)	(0.0173)	(0.0148)	(0.0397)	(0.0298)	(0.0208)	(0.0204)
Number of Observations	1231	786	1965	845	592	1594	222	678	349	475
Number of Groups	195	120	318	128	81	259	36	103	51	81
Avg. plant-year obs.	6.3	6.5	6.2	6.6	7.3	6.2	6.2	6.6	6.8	5.9
R2 within	0.0223	0.0116	0.0092	0.0328	0.0446	0.0102	0.0860	0.0230	0.0237	0.0213
R2 between	0.0086	0.0390	0.0007	0.0070	0.0297	0.0012	0.0165	0.0000	0.0011	0.0077
R2 overall	0.0171	0.0235	0.0001	0.0159	0.0055	0.0058	0.0449	0.0115	0.0017	0.0185

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 7 - Return on Assets in Different Years with Flight Openings

ROA	2005	2006	2007	2008	2010
Treatment Effect	0.0177	0.0042	0.1052***	-0.0130	0.0106
	(0.0146)	(0.0188)	(0.0103)	(0.0185)	(0.0356)
Constant	-0.0345***	-0.0373***	-0.0430***	-0.0380***	-0.0439***
	(0.0125)	(0.0104)	(0.01430)	(0.0130)	(0.0140)
Number of Observations	3563	3944	3237	3960	3430
Number of Groups	558	617	507	627	536
Avg. plant-year obs.	6.4	6.4	6.4	6.3	6.4
R2 within	0.0057	0.0078	0.0098	0.0103	0.0077
R2 between	0.0042	0.0001	0.0007	0.0042	0.0000
R2 overall	0.0054	0.0039	0.0054	0.0062	0.0036

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 8 - Return on Assets in Different Industries

ROA	Manufacturing	Trade	Services/ Real Estate/ Advisors
Treatment Effect	-0.0164	-0.0295	0.0382
	(0.0193)	(0.0203)	(0.0334)
Constant	-0.0117	-0.0211	-0.0285
	(0.0177)	(0.0143)	(0.0295)
Number of Observations	1069	1618	1454
Number of Groups	145	261	251
Avg. plant-year obs.	7.4	6.2	5.8
R2 within	0.0170	0.0104	0.0051
R2 between	0.0058	0.0010	0.0003
R2 overall	0.0036	0.0052	0.0072

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 9 - Operating Margin in Different Areas

Operating Margin	Moss	Skien	Stavanger	Bergen	Kristiansund	Trondheim	Oslo	Brønnysund	Bodø	Tromsø
Treatment Effect	-0.0827	-0.0010	-0.0563	0.0118	-0.1160***	0.0161	0.0276	0.1840	-0.1280***	0.1437
	(0.0825)	(0.1018)	(0.0410)	(0.1277)	(0.0337)	(0.0444)	(0.4976)	(0.1182)	(0.1986)	(0.1136)
Constant	-0.0127	-0.0038	-0.0004	-0.0705	0.0161	0.0235	-0.1453	-0.2749	-0.4324***	-0.1531**
	(0.0216)	(0.0800)	(0.0370)	(0.0745)	(0.0094)	(0.0242)	(0.4457)	(0.1663)	(0.0633)	(0.0510)
Number of Observations	1060	668	1720	734	520	1342	176	569	305	411
Number of Groups	171	108	299	118	73	222	31	93	47	74
Avg. plant-year obs.	6.2	6.2	5.8	6.2	7.1	6.0	5.7	6.1	6.5	5.6
R2 within	0.0039	0.0221	0.0093	0.0106	0.0442	0.0115	0.0317	0.0113	0.0383	0.0243
R2 between	0.0116	0.0150	0.0026	0.1707	0.0099	0.0030	0.0316	0.0005	0.0040	0.0329
R2 overall	0.0018	0.0148	0.0001	0.0194	0.0267	0.0090	0.0154	0.0005	0.0134	0.0213

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 10 - Operating Margin in Different Years with Flight Openings

Operating Margin	2005	2006	2007	2008	2010
Treatment Effect	-0.0870	-0.0558	0.0014	-0.0730	0.1616**
	(0.1617)	(0.0505)	(0.0912)	(0.0459)	(0.0714)
Constant	-0.1232**	-0.0925***	-0.1294	-0.1047	-0.1348***
	(0.0327)	(0.0283)	(0.0285)	(0.0233)	(0.0305)
Number of Observations	3035	3356	2732	3379	2889
Number of Groups	505	554	453	562	479
Avg. plant-year obs.	6.0	6.1	6.0	6.0	6.0
R2 within	0.0038	0.0048	0.0051	0.0041	0.0058
R2 between	0.0104	0.0004	0.0070	0.0030	0.0020
R2 overall	0.0026	0.0002	0.0032	0.0014	0.0012

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 11 - Operating Margin in Different Industries

Operating Margin	Manufacturing	Trade	Services/ Real Estate/ Advisors
Treatment Effect	0.0081	-0.0027	-0.0433
	(0.0468)	(0.0513)	(0.0855)
Constant	-0.0254	-0.0854	0.0314
	(0.0408)	(0.0345)	(0.0692)
Number of Observations	957	1539	1117
Number of Groups	134	254	208
Avg. plant-year obs.	7.1	6.1	5.4
R2 within	0.0145	0.0033	0.0104
R2 between	0.0318	0.0031	0.0006
R2 overall	0.0108	0.0006	0.0037

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 12 - EBITDA Margin in Different Areas

EBITDA Margin	Moss	Skien	Stavanger	Bergen	Kristiansund	Trondheim	Oslo	Brønnysund	Bodø	Tromsø
Treatment Effect	-0.0793	0.0086	-0.0380	0.0460	-0.0686	0.0107	0.1322	0.2000	-0.0910**	0.1265
	(0.0633)	(0.0806)	(0.0304)	(0.0788)	(0.0534)	(0.0482)	(0.4183)	(0.1223)	(0.0351)	(0.1121)
Constant	0.04672	0.0597	0.0748*	0.0093	0.1536***	0.0741**	-0.1018	-0.1393	-0.2770***	-0.0706
	(0.0203)	(0.0693)	(0.0316)	(0.0743)	(0.0246)	(0.0247)	(0.3645)	(0.1459)	(0.0563)	(0.0484)
Number of Observations	1060	668	1720	734	520	1342	176	569	305	441
Number of Groups	171	108	299	118	73	222	31	93	47	74
Avg. plant-year obs.	6.2	6.2	6.8	6.2	7.1	6.0	5.7	6.1	6.5	5.6
R2 within	0.0046	0.0228	0.0091	0.0164	0.0406	0.0127	0.0416	0.0138	0.0311	0.0214
R2 between	0.0162	0.0090	0.0005	0.1344	0.0086	0.0022	0.0298	0.0006	0.0079	0.0448
R2 overall	0.0048	0.0133	0.0007	0.0287	0.0215	0.0089	0.0173	0.0005	0.0145	0.0203

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 13 - EBITDA Margin in Different Years with Flight Openings

EBITDA Margin	2005	2006	2007	2008	2010
Treatment Effect	-0.0598	-0.0369	0.0084	-0.0598	0.1883 **
	(0.1293)	(0.0427)	(0.0891)	(0.0380)	(0.0693)
Constant	-0.0250	0.0033	-0.0270	-0.0141	-0.0340
	(0.0318)	(0.0279)	(0.0281)	(0.0223)	(0.0289)
Number of Observations	3035	3356	2732	3379	2889
Number of Groups	505	554	453	562	479
Avg. plant-year obs.	6.0	6.1	6.0	6.0	6.0
R2 within	0.0034	0.0043	0.0045	0.0042	0.0063
R2 between	0.0215	0.0004	0.0197	0.0123	0.0028
R2 overall	0.0041	0.0006	0.0033	0.0031	0.0012

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 14 – EBITDA Margin in Different Industries

EBITDA Margin	Manufacturing	Trade	Services/ Real Estate/ Advisors
Treatment Effect	0.0355	0.00376	-0.0269
	(0.0428)	(0.0460)	(0.0740)
Constant	0.0622	-0.0484	0.1679
	(0.0398)	(0.0314)	(0.0658)
Number of Observations	957	1593	1117
Number of Groups	134	254	208
Avg. plant-year obs.	7.1	6.1	5.4
R2 within	0.0192	0.0035	0.0074
R2 between	0.0452	0.0051	0.0003
R2 overall	0.0166	0.0010	0.0027

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 15 - Investment in Different Areas

Investment	Moss	Skien	Stavanger	Bergen	Kristiansund	Trondheim	Oslo	Brønnysund	Bodø	Tromsø
Treatment Effect	-58 473***	-38 884	32 165*	-120 136***	78 841	-86 824***	44 735	31 658	-10 406	-47 166**
	(25 021.4)	(37 070.9)	(19 535.5)	(32 397.5)	(113 175.2)	(27 041.85)	(50 005.9)	(29 008.2)	(9 805.4)	(23 598.1)
Constant	107 309***	74 029***	84 427***	17 450	88 953	78 191***	374 469***	231 091***	-406	62 525***
	(25 537.1)	(23 514.2)	(16 534.3)	(33 430.3)	(55 370.47)	(20 858.9)	(40 170.1)	(28 395.2)	(7 111.5)	(16 388.8)
Number of Observations	369	264	615	351	159	562	111	225	146	213
Number of Groups	83	60	145	79	39	130	23	60	31	47
Avg. plant-year obs.	4.4	4.4	4.2	4.4	4.1	4.3	4.8	3.8	4.7	4.5
R2 within	0.1023	0.1260	0.0537	0.1082	0.1548	0.0977	0.1139	0.1249	0.1756	0.1106
R2 between	0.0032	0.0085	0.0016	0.0757	0.0002	0.0011	0.0226	0.0043	0.0201	0.0051
R2 overall	0.0189	0.0231	0.0056	0.0637	0.0063	0.0099	0.0008	0.0023	0.0041	0.0107

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 16 - Investment in Different Years with Flight Openings

Investment	2005	2006	2007	2008	2010
Treatment Effect	-27 558	-51 058*	-74 600*	-51 667***	-34 405
	(36 142.3)	(26 182.2)	(38 537.7)	(17 307.2)	(29 151.3)
Constant	46 405***	62 743***	54 362***	64 566***	86 267***
	(15 005.7)	(15 016.8)	(16 221.2)	(14 102.9)	(16 009.2)
Number of Observations	1207	1308	1110	1309	1171
Number of Groups	280	305	253	303	268
Avg. plant-year obs.	4.3	4.3	4.4	4.3	4.4
R2 within	0.0838	0.0772	0.0880	0.0802	0.0786
R2 between	0.0012	0.0011	0.0012	0.0012	0.0001
R2 overall	0.0062	0.0048	0.0064	0.0055	0.0018

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 17 – Investment in Different Industries

Investment	Manufacturing	Trade	Services/ Real Estate/ Advisors
Treatment Effect	18 454	-6 487***	-169 873***
	(12 443.22)	(2 438.7)	(39 674.8)
Constant	95 823***	16 094***	349 148***
	(11 343.4)	(3 026.0)	(43 790.8)
Number of Observations	457	491	514
Number of Groups	93	120	128
Avg. plant-year obs.	4.9	4.1	4.0
R2 within	0.0665	0.1212	0.2126
R2 between	0.0000	0.0027	0.0119
R2 overall	0.0150	0.0044	0.0239

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01, p < 0.015

Appendix 18 – Regressions without Firm Fixed Effects

Without Firm Fixed Effects	ROA	OM	EM	Investment	Investment Profitability
Treatment Effect	0.0282***	0.0406*	0.0164	-44 785**	0.0350
	(0.0083)	(0.02419	(0.0212)	(19 606.1)	(0.0718)
Constant	-0.0155	-0.0542	-0.0430***	107 272***	0.0533
	(0.0119)	(0.0343)	(0.01430)	(30 513.1)	(0.1117)
Number of Observations	5530	4759	4759	1905	1904
R-sq	0.0057	0.0026	0.0025	0.0073	0.0043
Adj. R-sq	0.0042	0.0005	0.0004	0.0021	-0.0010

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01

Appendix 19 – Profitability in Different Industries

Profitability	Manufacturing	Trade	Services/ Real Estate/ Advisors
Treatment Effect	0.1452	0.0691	-0.1444
	(0.2086)	(0.2135)	(0.2752)
Constant	-0.0722	0.0404	-0.1919
	(0.1897)	(0.1819)	(0.2233)
Number of Observations	456	491	514
Number of Groups	93	120	128
Avg. plant-year obs.	4.9	4.1	4.0
R2 within	0.0196	0.0251	0.0189
R2 between	0.0351	0.0057	0.0076
R2 overall	0.0121	0.0143	0.0000

Robust standard errors in parentheses
*p < 0.10, ** p <0 .05, *** p < 0.01