A panel study of the nursing home sector in the City of Oslo:
Do operating structures have an effect on cost per bed and measured quality?

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Abstract

BACKGROUND: Recent national legislation, reforms and regulations of the nursing home sector has shown increased focus on quality of care. The tendencies have also been present in the City of Oslo, where a relatively comprehensive quality measurement system has been implemented. Oslo has three different operating structures in the nursing home sector; public, private and nonprofit. All nursing homes have been subjects to the same measurement system regardless of operating structure. The measured quality has shown variations across the nursing homes. The City of Oslo has produced cost reports which also show variations.

OBJECTIVE: The objective has been to find out if the variations of costs and quality were reflected in the type of operating structure. The study question has been; do operating structures have an effect on cost per bed and measured quality?

METHOD: Results from cost reports, quality measurements and operating structures was arranged into a panel data set for the period 2007 to 2009. A fixed and random effect model was constructed. Different quality results and cost per bed served as dependent variables and operating structure was the independent variable. A Hausman test concluded that the random effects model was consistent and efficient. The main hypothesis was: measured quality and costs per bed are not affected by operating structure.

RESULT: Private nursing homes had a significantly lower cost per bed compared to public and nonprofit, controlled for time effects. The significance level was 1%. Only one quality measurement, relative survey score, showed significant differences among the operating structures. The nonprofit nursing homes had a significantly higher score compared to public and private, this was on the 1% significance level.

CONCLUSION: Results suggested that operating structure might have an effect on costs and parts of the measured quality, solely the relative survey score. It is possible that less pension costs might be the reason for lower costs of private nursing homes. It is also possible that the status and reputation of nonprofit nursing homes results in a higher score among the patients relatives. A closer study of the quality results and cost reports is necessary to make further conclusions.
Acknowledgments

It has been challenging to write about the nursing home sector in Oslo; a subject that initially seemed simple, but proved to be increasingly complex the more I studied it. I have come to realize that this is probably the most common acknowledgment by any student who has written a thesis. When I found a solution to one problem, new problems appeared. Even though my study is on a Masters level I believe that I have had a small taste of what it is like to be a researcher; the study question has consumed me for the last six months. I have the deepest respect for scientists and researchers who study complex problems every day. One of them is my supervisor; Professor Tor Iversen. I have learned so much from his advice and knowledge. Thank you, Professor!

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To my kids, Karen and Sigurd; thank you for sleeping at night. To my husband; thank you for all your support, understanding and pep talks. This is for you, Even, now let’s get back to normal 😊
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1 Introduction

It is a public responsibility to provide nursing home services in Norway. Since the nursing home sector also constitutes a significant share of public budgets; costs, outsourcing and quality are repeatedly debated among politicians and the general opinion. The City of Oslo alone spent approximately 3468 MNOK on public, private and non-profit nursing home services in 2009 (Agency for Nursing Homes 2009). The debate about the quality, costs and outsourcing will only continue as Statistics Norway reports that the share of citizens over 67 years will increase from the current 13 % to 22 % in year 2050 (Statistics Norway 2008). The next generations of citizens over 67 will probably demand higher standards than today’s level. This forecast makes costs, operating structure and quality important aspects in the nursing home services. These services are relatively costly, the demand will increase and the quality expectations are high. The questions are how to get a higher quality out of the economic resources put into the nursing home sector, and the way the sector is organized.

In this study I take the City of Oslo’s perspective when investigating and discussing the research question: Do operating structures have an effect on costs per bed and the measured quality? The empirical analysis is based on the City’s cost reports and quality measurements in nursing homes. There is a defined political distinction when it comes to the cost and operating structure aspect in nursing homes. A common goal is to offer nursing home services of high quality, but opinions differ about how to achieve this. While left oriented parties have reservations against outsourcing nursing homes operations, the right oriented parties believe this as a way to reduce costs and raise quality. Both sides claim to prove the cost and quality aspect in favor of their own conviction. That is; quality is reduced due to profit maximizing private actors, or; quality increases due to competition. Although it exists much data in form of cost reports and quality measurement results in Oslo, little research has been conducted on the effects of operating structures on costs and quality.

The ongoing debate about how the City of Oslo can achieve higher quality out of the economic resources put into the nursing home sector, and the way the sector is organized, inspired me to write this thesis. The study is based on the assumption that quality and costs is in some way related to operating structure. I will use the results obtained by the measurement system in the City of Oslo as a measure of quality. This is the first time, of my knowledge, the quality results and cost per bed from Oslo is studied in the contexts of 3 operating structures. I
1.1 The study design

This study is based on a panel dataset with observations of quality, costs and operating structures from 48 nursing homes in Oslo from a period over 3 years (2007-2009). The nursing homes in Oslo can be characterized as 3 different operating structures: public, nonprofit and private. The focus on costs and quality has increased as the city of Oslo has introduced outsourcing (Mikkelsen, Blystad og Stenstadvold 2005). I will therefore study the effect of operating structure on quality and costs. I want to emphasize that it is the measured quality that is of interest here as I will use quality results obtained from the measurement system developed in Oslo. The costs are, in the City’s perspective, the yearly price paid per bed.

The City of Oslo publishes quality reports on every survey, registration of quality indicator or internal audit and occasionally final reports which sum up results from several measurements. It is consistently stated in every report that one must be cautious when interpreting the data. One single quality observation at a specific time must not be used to determine the overall quality level of one nursing home. The medical condition of one patient or his or her preferences can have an effect on the quality observations. A panel design that analyses these observations among groups of nursing homes and over time is therefore one appropriate approach to analyze the quality observations in Oslo’s nursing homes.

I assume that the quality results and costs per bed are dependent on operating structures, which are therefore set as the independent variables. My main hypothesis is based on the preliminary evaluations of outsourcing processes by Nesheim and Rokkan in 2001 which indicated that the outsourced nursing homes (private) had a greater focus on quality and reduced the costs per bed. For answering my research question; Do operating structures have an effect on costs per bed and measured quality, I want to test the following hypothesis:

Quality measurements and costs are not affected by operating structures.
(Main hypothesis)
I will test this hypothesis using a random and fixed effects regression model. The fixed effects model excludes the time invariant variable; operating structure, from the explanatory variables. I have modeled a fixed effects model with year dummies and performed a Hausman test to check if a random effects model is appropriate. The random effects model allows for time invariant variables like operating structure.

The study design is illustrated in figure 1. As I have 3 different quality measurement results, the regression estimation will be conducted separately for each of these dependent variables. The variables will be presented further in chapter 4: Data Collection.

*Figure 1: The study process*
1.2 Study limitations

First of all; quality can be a widely defined concept. When it comes to quality of a nursing home service, the concept is also highly individual depending on whom you ask. This study will only concentrate on the quality that is defined and measured in the established measurement system in Oslo. One must also take into consideration that the system is designed to measure the quality standards regulated by laws and political resolutions (Bystyresak 204/99 1999). This means that the system not necessary captures the cost driving indicators of quality or the parts of quality that may be most affected by operating structures. It is possible that a cost driving quality indicator, for example doctors-patients ratio, may show a strong relationship with high cost nursing homes. Due to data collection capacity I have chosen not to include more quality indicators to limit the scope of this study.

This study investigates the City of Oslo’s yearly costs per bed, meaning the yearly costs of producing the public nursing homes beds and the price paid to the private and nonprofit nursing homes per bed per year. The budgeted costs for each nursing home would introduce an interesting aspect, but these are not available. Budgets represent the priorities of heath care leaders and indicate what they plan to use. Budget as independent variable makes it possible to estimate if there is a relationship between the economic priorities of politicians/health care leaders and the resulting quality. But it may very well be a gap between budget and actual costs and these budget gaps may influence the quality results. Even so, yearly budgets that are comparable among nursing homes and time in addition to be adjusted for patient mix is not available.

The City of Oslo has undergone several reforms that have influenced the nursing home sector, mainly the decrease of city districts in 2004, and the founding of the central agency for nursing homes in 2007. This makes it challenging to convert data into comparable units for public, private and non-profit nursing homes. I use yearly observations that are comparable from 2007 to 2009, which is a relatively short panel, data on more years could strengthen the empirical results. Data from earlier years are either not comparable or available.

Many aspects of the nursing home sector, including the quality measurement system is unique for the City of Oslo, this is hardly a random sample of nursing homes in Norway. I will not make any generalizations based on the results as I believe the data is too limited and the
Norwegian nursing home sector needs more research on how operating structures relates to quality and costs.

1.3 The addressees

I have intended this study to give useful insights to politicians and leaders in the nursing home sector. As mentioned before; I will address the research question in the City of Oslo’s perspective, not in a patient or socio economic view. Both politicians and top management in Oslo has to strategically plan and adjust the nursing home services to meet the requirements of laws, regulations, efficiency, quality and public expectations. As politicians and health leaders want to achieve a high quality on the nursing home services, it is relevant to examine the effects the different operating structures have on quality. In other words; how the choice of operating structure relates to the measured quality and cost in each nursing home. If there is no significant relationship, it may be several important issues to discuss. These are mainly possible omitted variables, inaccurate measuring methods or weak data, I will return on these issues in the last chapter of this study. But it may also be that the measured quality indicators or costs actually are unaffected by operating structure. If so, results from the measurement system and cost reports give little useful information in, for example, an outsourcing process.

1.4 The expected result

I expect to find a relationship between quality, costs per bed and operating structures in the case of Oslo. The political left oriented belief is that outsourcing leads to lower quality and is not necessary cost saving. The political right’s belief is that one can achieve higher quality trough outsourcing and lower costs. I will test the hypothesis; Quality and costs per bed are not affected by operating structures, and expect the results to enable me to some extend address the two beliefs.

The lack of relationship may indicate that the measurement system is inaccurate when it comes to measuring the effect different operating structures have quality. It may also be that the kind of quality measured is dependent on other factors than operating structures. Still, one can never exclude that for example a low cost private nursing home may have a lower quality even if it does not show on the current quality results. A significant relationship may indicate that higher quality or lower costs can be achieved by a change of operating structure.
2 The case of nursing homes in Oslo

The current laws and regulations concerning the nursing home sector have led the City of Oslo to develop its own quality measurement. The introduction of outsourcing increased the need for consistent measurable indicators. The City council has processed two proposals that laid the premises for the quality system;

- City Government Proposal 12/04 New quality measurement system in nursing homes in Oslo (Bystyresak 12/04 2004).
- City Council Case 204/99 Quality and quality measurement in nursing and care services (Bystyresak 204/99 1999)

In this section I will give a more comprehensive presentation of how the nursing homes in Oslo are organized which I believe is necessary to understand the background of my research question.

2.1 Laws and regulations

The responsibility of elderly care and nursing homes are assigned to the municipality level in Norway. The municipalities have relatively high degree of freedom to organize the services the way they see fit. Still, the central government has passed several laws and regulations for the nursing home sector. Quality has become a more important element in these laws, and is now not just a matter for the professionals, but also for politicians and patients (Mikkelsen, Blystad og Stenstadvold 2005). The Norwegian Directorate of Health provides an overview of the most relevant laws and regulations:

- Municipal Health Care Act (Kommunehelsetjenesteloven)
- Statement of Nursing Homes and Institutions for Permanent Care
- Statement of Internal Audit of Health and Social Services
- Statement of Quality in Health Care Services (Kvalitetsforskriften)
- Statement of Individual Facilitation
- Health Personnel Act (Helsepersoneloven)

The Municipal Health Care Act states that the municipalities are responsible of providing several types of health care services for the citizens, among them nursing home services. This
means that the municipality can choose between producing the services and buying from private or non-profit organizations. Still the municipality is always responsible for that the service they provide meets the standards of present laws and regulations. The Statement of Quality requires that the municipalities have to implement quality specifications in the contracts with the producers. The Statement of Internal Audit imposes the municipalities to produce documented measures on how the services they provide shall meet the quality standards according to laws and regulations. In addition the municipality is responsible for continuous supervision and review of the nursing homes. Both statements constitute a need for a sufficient quality measurement system.

Besides from having their own measurement system, the municipalities have to report other quality measures for national statistics purposes in KOSTRA. Examples of such measures are the number of single patient rooms and staffing requirements. But these are not always reported on a nursing home level in a way that it can be fitted into this panel study.

2.2 Organization of the sector

The City of Oslo has implemented the parliamentary model with a City council and a City government. The City government runs the Department for Senior and Social affairs, the subordinate Agency for nursing homes (SYE) is responsible for providing nursing home services for the 15 different city districts, and thereby the inhabitants of Oslo. SYE runs all the public nursing homes in Oslo. SYE also buys beds from, and manage the contracts with, the outsourced nursing homes. By the end of 2009 there were 50 nursing homes in Oslo; 29 run by SYE, 13 run by non-profit organizations and 8 run by private companies. Examples of private companies are Attendo, Carema and Norlandia, while examples of nonprofit organizations are the Salvation Army and the diaconal foundation of Kirkens Bymisjon.

While SYE is responsible for providing nursing home services, the City consists of 15 different district administrations that are responsible for buying these services on behalf of their inhabitants. The district administration defines who needs, and thereby has the rights to nursing home services based on central guidelines. Finally when a person is granted nursing home services, he or she is given free choice of nursing home.

The City administration must pre order beds at the beginning of each year and pays a fixed price to SYE regardless whether it is public, private or non-profit. The intention of this system
is to secure inhabitants a free choice of nursing home and redistributing the economic risk of empty beds between SYE, the nursing home and the district administrations. Even though the price paid by the city district is fixed, the cost of each nursing home varies. SYE produces annual cost reports where the City of Oslo’s cost per bed for each nursing home is calculated. Capital costs are excluded and the numbers are adjusted for differences in patient mix so that comparisons are possible. Appendix 1 gives an overview over the cost variations among the 48 nursing homes included in this study.

As mentioned before, the city districts are not directly affected by these cost variations because the price paid per bed is fixed. SYE is a monopolist in this market since the city districts cannot buy beds directly from the nursing homes. The variations of costs are equalized among the districts, as the fixed price is calculated based on the district’s annual pre orders of beds. Figure 2 illustrates the different roles and tasks in the nursing home sector of Oslo.

Figure 2: The nursing home sector in Oslo

The establishment of SYE in 2007 caused a political controversy between the right and left oriented parties (Bystyresak 262/06 2006). The agency’s performance, positive or not, is often used to assess political credibility for each side. Cost control and the cost variation is, in this
perspective, an important source for political lines of reasoning. Political controversies also characterize the question of outsourcing and operating structure. As there is a fair consensus regarding buying beds from nonprofit nursing homes, there is a greater disagreement about whether public nursing homes should be outsourced to private profit maximizing organizations.

One interesting and notable condition for the nursing homes in Oslo is the difference in pension arrangements among the operating structures. The nonprofit organizations have run nursing homes for a longer period, compared to private, and traditionally offered their employees the same pension agreements as the public. Private companies were allowed to run nursing homes through tendering processes after a decision in the City council 1997. The nonprofit organizations had up until then and continued to offer their employees the same pension benefits as the public. The pension cost for public employees is 15.5 % of total pensionable wage in 2009. This constitutes a larger proportion for the public and nonprofit organizations compared to the private. For comparisons; the pension costs for an employee in a private company and member of NHO (the confederation of Norwegian enterprises) is 4% of pensionable wage (Department of Finance 2010). Unfortunately there is not available data on the pension costs among the operating structures or nursing homes.

2.3 The development of the operating structures

The three different operating structures; public, private and non-profit, have different origins. The public nursing homes counted only four in 1948, at that time most nursing homes was owned and run by church parishes or foundations. The number of public nursing homes grew and was regulated under the Hospital Act 1. January, 1970 (Department of Seniors and Social Affairs 2005). At that time the nursing homes treated chronically ill and long term patients. The parliament gave the municipalities responsibility for nursing homes in 1988, and the services was converted gradually to the nursing homes we see today. The nursing homes offer services to elderly patients which of different reasons need medical attention and practical assistance, but are not in need of specialized hospital care.

Many of the non-profit nursing homes are still owned and run by church parishes, ideal and religious organizations. In many cases the buildings and property are self-owned. One mentioned example is the diaconal foundation Kirkens Bymisjon which runs 5 of the non-
profit nursing homes (Facts and figures about Bymisjonen i Oslo 2010). The non-profit organizations have, since the establishment, sold services to the city based on individual agreements and contacts. Contracts dated back to the 70-ies demanded that the employees should have equal pension agreements as public employees. Note that this was the time before introduction of outsourcing. HSH, The Federation of Norwegian Commercial and Service Enterprises, argues that this has given the nonprofit nursing homes higher pension costs. The nonprofit organizations are therefore not able to hand in competitive offers in tendering processes, compare to private companies (HSH n.d.). Still, the foundation Kirkens Bymisjon won the tender process for the nursing home Paulus in 2003.

The private companies were allowed to run nursing homes by the city council when it opened up for outsourcing in 1997. The first nursing home to be outsourced was Hovseterhjemmet in 2000 to the company Pluss Omsorg og Rehabelitering AS, later known as Carema Omsorg AS (Department of Seniors and Social Affairs 2010). The City does not regulate the pension agreements for the employees as long as national standards are met. This means that the private companies can offer their employees a cheaper pension plan. When a public nursing home is outsourced, the employees changes both employer and pension agreement. But former employees get a two-year option to transfer to equivalent positions in public services (Department of Service and Organization Development in Oslo 2001).

8 nursing homes are outsourced in Oslo, 7 of these were originally public and one nursing home was outsourced as it was ready built. The City has established an independent company, Kommunal Konkurranse, which hands in “internal” tenders under the same conditions as the other competitors. Kommunal Konkurranse runs no nursing homes today.

It is a stated goal that quality is one important factor when tenders are evaluated (Bystyresak 782/97 1997).

### 2.4 The quality measurement system

Measuring quality can be challenging; it is often perceived differently and in many cases affected by external factors and the individual health status of the patient. What is perceived as a high quality for some can be perceived as a medium or low quality for others. A single quantifiable measure, as for example percentage of patients with registered bed sores in one
nursing home, gives little indication of the whole quality. Are 20% of patients registered with bed sore an indication of a high quality nursing home, or should it be less than 10%?

The system in Oslo is first and foremost a tool for supervising defined quality measures. As mentioned in the introduction of this study; a quality measure or indicator must be evaluated in context of other indicators and over time (Agency for Health and Welfare 2007). A negative development over time, and in comparison to the majority, may imply decreasing quality level and require further investigation and necessary actions.

The City of Oslo has by the choice of indicators defined the parts of quality that, in their opinion, is relevant to supervise. Results from user surveys and objective quality indicators give politicians and health leader’s information on the quality levels in nursing homes and enables monitoring results over time. An advantage of such a system is that benchmarking and comparisons between the nursing homes are made possible and better quality can be achieved through the exchange of experience and knowledge. The disadvantage is that a quality measurement system only measure what it is set to measure, aspects of quality that are not obtained in the system can be considered less important. It is also a risk that politicians and health leaders put efforts on achieving good results from the quality measurement system, and neglect other important responsibilities in the nursing homes. A one-sided focus on measured results may lead to down-prioritizing of other essential tasks.

The premises for the quality measurement system in Oslo were approved by the City council in 1999 and 2004. Earlier the quality measurement was mainly carried out in nursing homes run by private companies or non-profit organizations. Although user surveys had been completed in all the nursing homes, the Health and Social Committee demanded a more comprehensive plan for quality measurement regardless of operating structure. It was also necessary due to plans for increased outsourcing and the need for a system that secured that all laws and regulations regarding quality were met. In 2004 the City Government proposed the quality measurement system based on previous experiences with quality measurement and a model of quality developed by the University College in Sør-Trøndelag (Bystyresak 12/04 2004). The system consists of the three following elements:

**Objective quality indicators:** Selected indicators are measured to secure the medical standard of the services. The indicators selected are supposed to be strongly related to the quality of
care. The nursing homes reports on the indicators there times a year. Quality indicators have been selected based on previous research of staffing level effect on quality in USA. The City of Oslo have considered the differences between the nursing home sector in USA and Norway, and the selected quality indicators are: bed sore, urinary incontinence, contractures, weight loss and number of falls.

**Patient and relatives surveys:** These surveys have two different target groups; patients and relatives. The questionnaire is divided into 7 parts: results for the patients, well-being, user participation, respectful treatment, accessibility, information and overall impression. The aim of these surveys is to measure the satisfaction level of users and the relatives related to the received service. The surveys are performed on an annual basis.

**Internal audits:** the main perspective is to measure the nursing homes preconditions for meting quality standards. The nursing homes receive visits from audit teams that observe and inspect the nursing homes quality strategies, routines and processes. In the period this data covers, there was only performed one fully coordinated audit for all the nursing homes. This was performed in 2008. However, there are several reasons that have made me exclude these data; mainly these are not quantifiable and there are doubts about comparability.

The results from the quality measurement system are reported on an institutional level. This makes it possible for politicians, leaders, management, staff, patients or relatives to monitor the quality for each nursing home. But comparisons between one nursing home and another must be carried out with carefulness. The official statement is that the individual results must not be used to evaluate one nursing home alone. The individual score or result must be considered in context of other quality measures *and* over time. (Agency for Health and Welfare 2007). In addition respondent rates and patient mix varies across the nursing homes making the results sensitive to the opinions of just a few patients.
3 Literature review and hypothesis

In this section contain a short presentation of three American and one Norwegian study on costs, quality and operating structures in nursing homes. I will start with the international studies on the nursing home field. In my search for relevant research, it seems that the international, mainly American studies on the field are more extensive while equivalent Norwegian studies are more limited.

O’Neill et al. (2003) have conducted a study of the relationships between profit, quality and ownership status among nursing homes in California with data from 1998 and 1999. Previous studies suggest that private, for-profit nursing homes have lower quality because revenues increase at the expense of the quality of clinical care. The conceptual framework is that if improving the quality raises costs faster than revenues, profit decreases as quality improves, given that is exists a tradeoff between profit and quality. O’Neill et al. found that private nursing homes with profit above a certain threshold had lower quality. It is likely that there are stronger incentives to exploit the tradeoffs between profit and quality in the US compared to Norway. The nursing homes sell their services more directly to the patients in the American market, and out-of-pocket payments are more common.

Harrington et al. (2001) have studied the relationship between ownership and quality of care in all US nursing homes that are certified for payment from Medicare and Medicaid in year 1998. The quality measures used are 185 defined quality standards divided into 17 categories. These are again subjects to inspections conducted by state operators in the service of Medicare and Medicaid. They found that for-profit nursing homes provided worse care and less nursing care than nonprofit and public nursing homes. The authors conclude that the most obvious explanation of this relationship is that in quest for profits, the focus on clinical care was compromised. The result also led to the conclusion that more regulation and opportunity to sanction against nursing homes that violate quality regulations are needed.

Mukamel and Spector (1999) have studied the relationship between nursing home costs and risk-adjusted outcome measures of quality and tested the hypothesis that higher quality may also be associated with lower costs. The study included 535 private and nonprofit nursing homes in New York State during 1991. Quality measures were the objective indicators; mortality, worsening pressure ulcer and functional decline, adjusted for individual risk
according to these indicators. With costs as the dependent variable Mukamel et al found an unlinear relationship with quality. High quality regimes could be associated with both low and high costs, aka a U-shape relationship. The authors encourage more studies to identify care procedures and management strategies of low cost nursing homes with high quality results. Mukamel and Spector suggest that some nursing homes use innovative care protocols or management strategies that increase quality and reduce costs. Another interesting observation was that the private nursing homes had lower costs, the nonprofit had higher, suggesting that nonprofit nursing homes do not compete on price alone but also on quality.

To summarize the international studies I have assessed, there seems to be somewhat contradicting results on how a private operating structure affects quality results. Naturally, much depends on the type of quality measure and standards in use, but this also illustrate the complexity of measuring quality and explaining the variations. The studies by O’Neill et al. and Harrington et al. use results from quality inspections as variable and found the private nursing homes to have lower quality. While Mukamel and Spector use objective quality indicators and found a U-shape relationship between costs and quality, suggesting that high quality also can be associated with some low cost private nursing homes.

Moving on to the Norwegian study; Nesheim and Rokkan (2001) have studied the early experiences and consequences of introducing alternative operating structures in Oslo and Trondheim in 2001. This study is relevant because it outlines how different forms of operating structures relate to both costs and quality in a theoretical and empirical perspective. The study also forms a basis for my main hypothesis; measured quality and costs per bed are not affected by operating structure. Nesheim and Rokkan focus on the differences between public and private nursing homes and how these different organizational elements can affect costs and quality. The non-profit nursing homes are not subject of their study, while I have included them in my analysis as these have characteristics that might relate to costs and quality.

Nesheim and Rokkan's theoretical platform is organizational theory on how economic incentives appear in different organization forms, and how these can be implemented to achieve efficiency. In this perspective it is important to bear in mind that increased efficiency can not only reduce costs, but also be improve quality or quantity. Alternative operating structures like privately run nursing homes are relatively new elements to the nursing home
sector. Nesheim and Rokkan point out the political and ideological controversy related to outsourcing. The advantages of outsourcing are stronger economic incentives because the supplier bears the risk, is replaceable and presents lower transaction costs. The disadvantages outlined by Nesheim and Rokkan is that outsourcing presents new transaction costs related to search of suppliers, contract negotiations etc. in addition to less control over the suppliers behavior. The last is most relevant in my study; the outsourcing of nursing homes gives the City of Oslo less control over the private operator’s behavior. The risk is that higher share of profits are realized at the expense of quality.

The City of Oslo’s public nursing homes are organized in a hierarchical form, and the private nursing homes in a marked oriented form. The nonprofit nursing homes are somewhat in a special position since these historically have individual contracts and agreements with the City, and are to some degree protected from competition because their ideological purpose. In the later years there has also been special competitions created for the nonprofit organizations. Nesheim and Rokkan point out that by organizing nursing homes in different operating structures may improve the efficiency (cost and quality) among all the nursing homes. This is because new ideas are introduced and there is an increased pressure on efficiency.

The main challenge of introducing market ideas in the nursing home sector is to secure that services are delivered as agreed at the best efficiency level. The problem is that the buyer, in this case the City, and the supplier, in this case the private companies, partly have contradicting objectives. The nonprofit nursing homes on the other hand do not have the same economic incentives to reduce quality to raise revenues. But these organizations have a strong negotiating position when it comes to the price per bed due to their high standing among politicians and in the general opinion.

The nursing home cases used in Nesheim and Rokkan’s study was selected from Trondheim and 2 city districts in Oslo. The findings from Oslo are most relevant in my study and are in focus in this section. The relatively short existence of outsourced nursing homes in year 2001 makes data limited, so any findings must be interpreted as indications. But the tendencies found by Nesheim and Rokkan will form the basis for my hypothesis. My data spans from a later period which enables me to test the hypothesis. The empirical work was based on interviews with employees in city district administrations, which played at that time a
“double” role as buyer of private nursing home services and producers of the public nursing home services. This was the time before the establishment of the Agency of Nursing Homes.

Private suppliers were also interviewed. In the case of Røa city district, the nursing home Hovseterhjemmet was outsourced to the private company NOR in 2000. The preliminary evaluation was mainly positive when it came to costs and quality. The city district estimated to save costs up to 3% over the 5 year long contract period. When it came to quality the problem of understaffing was reduced and the city district felt a more positive attitude towards finding new solutions and flexible adaptations to improve quality.

In the case of the city district St. Hanshaugen-Ullevål the nursing home St. Hanshaugen Omsorgssenter was outsourced to the publicly owned company Kommunal Konkurranse KF in 2000. The city district administration expressed an estimated 10 % cost savings over the 5 year contract period. When it came to quality the informants’ preliminary experiences was the need for more defined and measurable quality standards. The introduction of competition put the city district in a role as contract overseer and it was challenging to monitor the quality without clear definitions. Informants at the supplier; Kommunal Konkurranse, felt that there was more focus on patient satisfaction and differentiation of patients needs.

In the case of Trondheim the informants had challenges with the quality standards as these were unclear, like in St. Hanshaugen. The experiences with the two private nursing home service suppliers was positive as there was an increased focus on quality, yet the cost increase was marginal. One informant stated that the private company Norlandia won the competition based on quality and management system, not mainly costs.

Let me summarize; the informants from the city districts/buyers of nursing home services estimated reduced costs in Oslo and invariable costs in Trondheim. Possible explanations of the invariable costs could be that potential cost cuts were already realized. It could also be that the contract for private nursing homes was specified to the extent that additional cost cuts were not possible. On the contrary in the case of Oslo; reduced costs could occur because the private supplier was motivated by increased profit and able to find new effective methods to reduce costs without compromising the contract (Nesheim og Rokkan 2001). In all three cases the results showed, due to the necessary operationalization and control of quality, that it was an increased focus on quality among all nursing homes, not just the ones outsourced.
3.1 Hypothesis

Applied in my study the indications found in by Nesheim and Rokkan (2001) suggest that private nursing homes in Oslo might have a lower cost. But there is not necessary a difference in quality among private and public nursing homes, implying that the private nursing homes are more quality efficient compared to public nursing homes. In other words; the private nursing homes achieve more quality with the resources at hand. My hypothesis is therefore:

*Measured quality and costs per bed are not affected by operating structure.*

If the hypothesis fails and there is a significant difference in costs and quality among the operating structures, I will be able to discuss possible differences in efficiency levels. In other words; that one certain operating structure are able to achieve high/low quality at a high/low cost, compared to the other structures.

I have included the non-profit nursing homes in this study. These are expected to have higher costs because of their strong negotiating position to the City of Oslo. Nevertheless, the nonprofit nursing homes are subject to the same quality requirements as public and private. It is interesting to analyze the quality performance of nonprofit nursing homes, since these do not calculate profit out of the nursing home price.

The studies I have presented in this chapter are not panel studies using random and fixed effects, but they highlight interesting aspects of the relationship between quality, cost and operating structures. Additionally they illustrate the complexity of the field. I will now move on to describing the data collection and then move on to the analysis.
4 Data collection

This chapter contains a presentation of how the data are collected. In some cases I have also recalculated some observations into comparable or aggregated values. All data are collected from previous reports, surveys and registrations produced by the Department for Senior and Social Affairs and the subordinate Agency for Nursing Homes (SYE). I have arranged the data as a retrospective panel consisting of annual registrations of cost, operating structure and quality results per nursing home in the period from 2007-2009. There are 50 nursing homes in Oslo, 48 are included in this study. Three registrations per nursing home, over three years, result in 144 observations. Each nursing home is given an id ranging from 1 to 48. The variable for operating structure, opstruc, is transformed into dummies; private, nonprofit and public. I have also constructed dummies for each year. Table 1 shows an example of how the data file is constructed and the variable names:

Table 1: Example from the panel dataset

<table>
<thead>
<tr>
<th>nursing home</th>
<th>id</th>
<th>year</th>
<th>cost09value</th>
<th>opstruc</th>
<th>patientq41</th>
<th>relativeq41</th>
<th>meanindexoqi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(cost per bed displayed in thousands)</td>
<td>(operating structure)</td>
<td>(mean patient survey score)</td>
<td>(mean relative survey score)</td>
<td>(mean index of objective quality indicators)</td>
</tr>
<tr>
<td>Abilsø</td>
<td>1</td>
<td>2007</td>
<td>610</td>
<td>Public</td>
<td>3.4</td>
<td>2.1</td>
<td>9</td>
</tr>
<tr>
<td>Abilsø</td>
<td>1</td>
<td>2008</td>
<td>635</td>
<td>Public</td>
<td>3.2</td>
<td>2.5</td>
<td>21</td>
</tr>
<tr>
<td>Abilsø</td>
<td>1</td>
<td>2009</td>
<td>659</td>
<td>Public</td>
<td>3.2</td>
<td>2.1</td>
<td>10</td>
</tr>
<tr>
<td>Ammerudhjemmet</td>
<td>2</td>
<td>2007</td>
<td>541</td>
<td>Nonprofit</td>
<td>3.1</td>
<td>3.0</td>
<td>6</td>
</tr>
<tr>
<td>Ammerudhjemmet</td>
<td>2</td>
<td>2008</td>
<td>578</td>
<td>Nonprofit</td>
<td>3.7</td>
<td>3.3</td>
<td>9</td>
</tr>
<tr>
<td>Ammerudhjemmet</td>
<td>2</td>
<td>2009</td>
<td>616</td>
<td>Nonprofit</td>
<td>2.1</td>
<td>2.9</td>
<td>14</td>
</tr>
<tr>
<td>Ammerudlunden</td>
<td>3</td>
<td>2007</td>
<td>620</td>
<td>Private</td>
<td>2.3</td>
<td>2.0</td>
<td>5</td>
</tr>
<tr>
<td>Ammerudlunden</td>
<td>3</td>
<td>2008</td>
<td>542</td>
<td>Private</td>
<td>2.5</td>
<td>3.9</td>
<td>3</td>
</tr>
<tr>
<td>Ammerudlunden</td>
<td>3</td>
<td>2009</td>
<td>564</td>
<td>Private</td>
<td>3.0</td>
<td>3.9</td>
<td>22</td>
</tr>
</tbody>
</table>

As a part of the City of Oslo’s transparency policy all reports and statistics on the City’s services are made available at the web pages (Byrådssak 1039/07 2007). Raw data are also available on request. I have arranged all collected data into a Stata-file and performed all the analysis in Stata statistics software program. The panel is identified as strongly balanced in Stata, meaning that it consist of equally number of observations per nursing home with few missing values. The Stata DO file can be found in appendix 2.
4.1 The characteristic of the panel data

The panel data give information on the same variables for each nursing home over a period of time. There is more variability within the panel data, across the nursing homes and over time. In comparison; a cross sectional data set can only give information about the relationship between quality, costs and operating structure in one single year. While a times series data set cannot reveal if the same relationship between these variables over years. Panel data allows examination of the relationship between the variables over time, giving results that cannot be obtained with cross sectional data or times series data alone.

The panel data deal with the heterogeneity of the nursing homes, meaning that there are numerous unmeasured variables that can explain variations in the quality in each nursing home over time. If these variables are correlated with the included variables, the omitted variable will bias this analysis. In a panel data study the problem of omitted variables can be moderated (Kennedy 2003).

The data in this study can be characterized as a short panel, with relatively many nursing homes over few years, in other words a large $n$ and low $t$. Figure 3 illustrates how a regression line can be drawn in a panel data set. As an example in this study, let the circle represent one nursing home’s 3 yearly observations on the same variable. Let for instance $Y$ be the quality and $X$ be costs per bed. In this illustration each nursing home has the same slope, but different intercept. Different intercepts can be a result of all the other unmeasured variables that influence quality. The fixed and random effects method, which I will use in this study, treats these intercepts differently. The fixed effects create a dummy variable for each intercept while the random effects estimate a mean intercept. I will present the fixed and random effect further in my analysis. By using these models I seek to remove the effects of the omitted variables that are materialized in the different intercepts and look for the net effects of operating structure.
4.2 The nursing homes

48 nursing homes are included in this study. Of a total 50 nursing homes in Oslo in 2009, 2 did not qualify. These are Eugene Hanssens home and Jødisk bo- og seniorsenter. Eugene Hanssens home is only for women and have only 13 beds, to protect the privacy of the small number of patients many of the quality measurements are not performed here. Jødisk bo- og seniorsenter is only for elderly Jews in Norway and consists mainly of apartments, the home has 6 beds. Jødisk bo- og seniorsenter is for the same reason exempted from parts of the quality measurements system. I have chosen to exclude these nursing homes in this study due to few results and available registrations.

The nursing homes Grandsalen, Adamstuen, Ensjøtunet and Casinetto were also excluded from the study because of conclusion during the period that resulted in uncertainties about the costs reports in addition to lack of quality measurement data.

4.3 Cost reports (cost09value)

The Agency for Nursing Homes produces annual reports on the yearly costs per bed for all nursing homes. The reports are scanned documents and the report from 2007 was downloaded from the Health and Welfare Agency. Cost reports from 2008 and 2009 were e-mailed on
request. The cost per bed for each nursing home was then typed into the main Stata-file. It is important to bear in mind that these reports present the costs, but can also be interpret as the price the City of Oslo pays per bed. The costs are based on accounting figures for the public nursing homes and the price paid per bed to the private and non-profit nursing homes. This means that there is a possible profit share in the costs for private nursing homes. Nevertheless; the costs represent what the City of Oslo has to pay per bed, regardless of operating structure.

The purpose of the cost reports is to be able to compare the costs between the nursing homes, capital costs are excluded while maintenance and operation costs are included. Differences in the patient mix are adjusted by different weighted categories as shown in table 2:

<table>
<thead>
<tr>
<th>Type of bed</th>
<th>Weight</th>
<th>Type of bed</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somatic</td>
<td>1</td>
<td>Rehabilitation</td>
<td>1.24</td>
</tr>
<tr>
<td>Senior</td>
<td>0.75</td>
<td>Daycare</td>
<td>0.15</td>
</tr>
<tr>
<td>Dementia</td>
<td>1.18</td>
<td>Short term</td>
<td>1.10</td>
</tr>
<tr>
<td>Behavior prob./psychological</td>
<td>1.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diseases</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The weighted cost per bed makes comparisons between the nursing homes within one year possible. As the costs from year to year increase due to general price and wage inflation I have recalculated the costs to 2009 level. Since labor cost is the major cost group in a nursing home I have used calculations from Statistics Norway that shows the quarterly increase of total labor costs for the health and social service sector. From 2007 to 2008 the total labor costs increased by a yearly mean of 6,725 % and from 2008 to 2009 the increase was 1,8 % (Statistics Norway 2010). I have recalculated all costs to 2009 value in the variable \textit{cost09value}. By making these calculations it is possible to study and compare the variation of costs controlled for wage inflation.

4.4 Operating structure (\textit{opstruc})

Type of operating structure is available at the nursing home information web pages and trough the cost reports (Agency for Nursing Homes 2010). In Stata I have coded the 3 operating structures as 3 dummies and by the variable \textit{opstruc} where the value 1 is public nursing homes, 2 is nonprofit and 3 is private. In the panel I have 29 public nursing homes, 11 nonprofit, 8 private. Table 3 shows how the different types of beds are distributed among the different operating structures.
Table 3: Yearly mean of bed type and percentage per operating structure

<table>
<thead>
<tr>
<th>Type of bed</th>
<th>Yearly mean from 2007 to 2009</th>
<th>% of total run by private</th>
<th>% of total run by nonprofit</th>
<th>% of total run by public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somatic</td>
<td>2980</td>
<td>20</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Short term</td>
<td>506</td>
<td>14</td>
<td>12</td>
<td>74</td>
</tr>
<tr>
<td>Senior</td>
<td>136</td>
<td>10</td>
<td>11</td>
<td>79</td>
</tr>
<tr>
<td>Dementia</td>
<td>929</td>
<td>17</td>
<td>16</td>
<td>67</td>
</tr>
<tr>
<td>Behavior prob./psychological diseases</td>
<td>136</td>
<td>5</td>
<td>3</td>
<td>93</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>69</td>
<td>16</td>
<td>10</td>
<td>74</td>
</tr>
<tr>
<td>Daycare</td>
<td>711</td>
<td>21</td>
<td>28</td>
<td>51</td>
</tr>
</tbody>
</table>

4.5 Relatives and patient surveys (*patientq41 and relativeq41*)

These surveys are performed annually in each nursing home. The patient surveys are performed by an independent survey company and conducted through individual interviews based on a questionnaire. The staff recruits patients that are able to be interviewed. The respondent rates varies across the nursing homes and are relatively low. This makes the results from one nursing home very sensitive to individual preferences and expectations. The surveys consist of 41 questions divided into 6 sections; the service results, environment, individual facilitation, respectful treatment, availability and information. The respondents are asked to rate from 1-4 to which extent they are satisfied with the different services they receive. Rating number 1 is “very unsatisfied/ unhappy” and the value 4 is “very satisfied/ happy”. In addition the respondents are able to answer “don’t know/not relevant”. The interviewers also ask the respondents to give an overall grade from 1 to 4. This question (number 41) capture the respondent’s general evaluation of the service, as many of the detailed questions might not be relevant for all the respondents. I have therefore chosen to use patients overall evaluation of the nursing home at a dependent variable in this study, that is; the yearly mean grade from question 41 in each nursing home. I have called this variable *patientq41*. 
The relative surveys are mailed to respondents who are related or guardians to patients in somatic wards. The respondents can either fill in the questionnaire by hand or via internet. The scale of grading is the same as for the patient survey where 1 is “very unsatisfied/unhappy” and 4 is “very satisfied/happy”. In addition the respondents are able to answer “don’t know/not relevant”. The questions are also divided into the same categories as the patient survey. Question 41 from the survey asks the respondents to give an overall grade from 1 to 4, the mean score from each nursing home is set as the dependent variable in this study and referred to as \textit{relativeq41}.

The patient and relative survey is only conducted among the patients in somatic wards, while the costs are calculated based on all the types of beds. This means that there is a possibility that operating structure show only a partly effect on patient and relative survey results. If a nonprofit nursing home has a higher quality in a day care ward, this should in theory have no effect on the surveys. To what extent this is relevant is not possible to reveal without a more close-up study of each nursing home’s quality plan. Still it is important to bear this in mind when interpreting the results from the analysis.

The Department of Health and Social Affairs (2009) publishes official reports every year based on the survey results. The latest reports from 2009 compare the results from previous year and only distinguishes between \textit{public and nonpublic} nursing homes. The official report from 2009 concludes that there are minimal differences in patient survey score between the public and nonprofit nursing homes. The official report concerning the relative survey concludes that nonpublic has a higher mean score compared to the public (Acency for Health and Welfare 2009). In this study I will split the nonpublic nursing homes into two categories; private and nonprofit to see if there is any differences among them related to the survey scores.

4.6 Objective quality indicators (\textit{meanindexoqi})

In the period 2007-2009 the objective quality indicators were registered in week 17, 34 and 49. The results show the percentage of patients with the following indicator in each nursing home at a specific time. The results are not adjusted for patient mix, but the indicators for bedsore and urinary incontinence are risk adjusted by categorizing the patient’s individual risk as high and low. The City of Oslo measures these indicators in each nursing home because
they are believed to give some indication about the quality of care. Each condition can to some degree be prevented or postponed. Even though one must consider each patient individual medical condition, the City of Oslo concludes that the registration of objective quality indicators is a valid measure of quality of care when the results are reported as share of patients per nursing home over time (Agency for Health and Welfare 2007).

The quality indicators are:

- 1a Bed sore (low risk patients)
- 1b Bed sore (high risk patients)
- 2a Urinary incontinence (low risk patients)
- 2b Urinary incontinence (high risk patients)
- New or worsened contractions
- Serious weight loss
- Number of falls last month
- Reduced mobility due to contractions

The data on these objective quality indicators consists of 8 indicators * 3 annual registrations * 3 years * 48 nursing homes = 3456 observations. The challenge with these data is to make them into quantifiable and comparable measures of quality which can be used as a dependent variable. As an example take the indicator for serious weight loss; is 5% with the registered indicator an indication of good quality? In my opinion the best way to make any conclusions based on quality level must be to consider one observation in context of other nursing homes. One nursing home might have a higher quality of care if it has 5% of patients with weight loss compared to another which has 30%.

A potential problem with the objective quality indicator data is missing values and uncertainty about measurement methods. The threshold for registration the indicators might vary among the nursing homes and are affected by subjective assessments of the nurse or care assistant. As all these objective quality indicators are supposed to be affected by the quality of care, I have chosen to aggregate the observations into one dependent variable: this is how the data on objective quality indicators was fitted into the panel data set:

1. I have 3 yearly observations; week 17, 34 and 49, which measure the percentage of total patients in a nursing home with the registered condition at the specific time.
2. I have calculated each nursing home mean of these 3 observations within each indicator category and year.

3. The yearly mean within each indicator is given a score from 1 to 100 where the nursing home with the lowest mean gets the score 1 and the highest mean gets the score 100.

4. I have calculated the nursing homes overall mean score and called the variable meanindexoqi

By this procedure a low meanindexoqi indicates a low mean share of patients with a registered indicator across all the categories, compared to the other nursing homes. Converting these data into a mean index also imply some loss of data in the sense that a nursing home can experience notable low and high percentage of patients within two categories. While this is moderated by calculating the mean index since all the indicators are weighted the same. I make the assumption that the indicators are equivalent measures of quality of care across all the nursing homes. Still it might be other elements, besides the quality of care, that have an effect on these indicators. If these are correlated, the effect might bias my analysis. A more thoroughly research on the effects on the objective indicators within each nursing home is necessary to address this possible bias. Such investigation exceeds the limited capacity in this study.
5 Data analysis

This chapter starts with an assessment of the descriptive statistics followed by a presentation of the regression model, the regression assumptions and data problems. I will then describe the regression methods, fixed and random effects before I comment on the analysis results. My hypothesis is:

*Measured quality and costs per bed are not affected by operating structure.*

My intention in this analysis is to isolate the effect operating structures have on costs and quality.

5.1 Descriptive statistics

Table 4 shows the total mean values for all the nursing homes broken down to year and operation structure. The outlined rows display the total mean value across the nursing homes. The table shows two interesting trends. First; the costs are adjusted for wage inflation and still shows an increase of costs per bed per year. Should an increase in quality also be expected? The table also shows that the private nursing homes, which are outsourced through competition, have a notable lower mean cost during the period, while non-profit nursing homes have the highest costs. Are these differences significant? Is the quality significantly lower in the private nursing homes? The means for the quality measurements are also showing some interesting trends, patient surveys seems to be stable, but there in an increase of mean score on relative survey. The mean index of objective quality indicators shows that private nursing homes have a lower score followed by nonprofit and public. The table shows also that the non-profit organizations have a higher mean score on the patient and relatives survey.

Looking closer at the means among the operating structures; the public and nonprofit nursing homes show an increase in mean costs every year, while the private nursing homes display a cost decrease between 2007 and 2008, and a relatively small yearly cost increase in 2009. The private nursing homes also show less cost per bed variation compared to public and nonprofit. This may be unsystematic, but can also be due to the fact that prices paid to the private nursing homes are based on a contractual agreement over a period of time.
<table>
<thead>
<tr>
<th>Table 4: Descriptive statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cost09value</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>public</td>
</tr>
<tr>
<td>nonprofit</td>
</tr>
<tr>
<td>private</td>
</tr>
<tr>
<td><strong>patientq41</strong></td>
</tr>
<tr>
<td>public</td>
</tr>
<tr>
<td>nonprofit</td>
</tr>
<tr>
<td>private</td>
</tr>
<tr>
<td><strong>relativeq41</strong></td>
</tr>
<tr>
<td>public</td>
</tr>
<tr>
<td>nonprofit</td>
</tr>
<tr>
<td>private</td>
</tr>
<tr>
<td><strong>meanindexoqi</strong></td>
</tr>
<tr>
<td>public</td>
</tr>
<tr>
<td>nonprofit</td>
</tr>
<tr>
<td>private</td>
</tr>
</tbody>
</table>
Figure 4 show box plots for the variables; costs, patient survey, relative survey and mean index of objective quality indicators. The main trends from table 4 are visible here: private nursing homes have the lowest mean cost during the period, but score second best on the patient survey. Private also have the lowest mean score on the relative survey and the lowest share of patients with registered indicators. On the other hand; non-profit nursing homes has the highest costs and scores highest on the patient and relative survey, and second best on the objective quality indicators. These trends are interesting; the alternative operating structures, private and nonprofit, may be associated with high quality scores, but has also the highest and lowest costs.

*Figure 4: Box plots for variables*

![Box plots for variables](image)

Figure 5 illustrates the trends in time based on the mean values from table 4, the private nursing homes actually experience a cost decrease from 2007 to 2008, while the public and nonprofit nursing homes have a relatively large cost increase from 2008-2009. For the patient survey score all the three groups of nursing homes experience a decline in score from 2007 to 2008, and a rise again in 2009. For relative survey and mean index of objective quality indicators, the trends in time appear more unsystematic, except that nonprofit nursing homes
have a notable stable score on relative survey throughout the period and a declining percentage of patients with registered indicators.

Figure 5: Timelines for variables

5.2 The fixed and random effects model

The nursing homes have their own individual characteristics that may have an effect on quality. These characteristic are unobservable and will be included in the model’s error term. The fixed effects model assumes that some of these individual characteristics are shared by several nursing homes and seeks to control for this. In the fixed effects model the time invariant variables are contained in a dummy intercept, therefore any changes in the
dependent variable must be due to other effects. In other words; the fixed effects method assume that the time invariant variables is exclusive to each nursing home and should therefore not be regressed with other variables (Torres-Reyna 2009). The model creates a dummy for each nursing home intercept which absorb the effects of individual characteristics. In this case, the operating structure is embodied in the intercepts since this does not change over time and is considered a unique feature for each nursing home. In this way the fixed effects model is constructed to study the within effects of change by keeping operating structure fixed. This is unfortunate since I want to study these effects on quality. Another disadvantage for the fixed effects model is that the dummy variable for each nursing home intercept results in a loss of degrees of freedom. This reduces the statistical power of the model (Wooldridge 2003, 463)

With the random effects model on the other hand, I assume that the variation across the nursing homes is random and uncorrelated with the independent variables. This model allows me to include the time invariant variable, in this case the operating structure. I assume that the unobserved effects, embodied in error term, are uncorrelated with the independent variables, so that operating structures can serve as an explanatory variable. One disadvantage of the model is that it is more vulnerable to omitted variable bias.

The main difference between the fixed and random effects method is that the unobserved effects are a part of the intercept in the fixed effects model and included in the error term in the random effects model. The choice between fixed and random effects method is also a question about which estimates you need, given that the model assumptions are met (Wooldridge 2003, 473). The fixed effect method estimates the intercepts by creating dummies and removing the effect, while random effects include the intercept and assume it to be random with zero conditional mean.

5.3 Fixed or random?

The fixed effects eliminate all unobserved effects on quality and costs, including time invariant variables. My problem is that by eliminating the time invariant operating structure, I am not able obtain the estimates from this variable. While the random effects method assumes that the unobserved effects on quality and costs are uncorrelated with each explanatory
variable at all times. Random effects model this model is the preferable in this study since it allows me to analyze the effects of operating structure.

So what makes sense in the case of the nursing homes in the City of Oslo? Is it reasonable to assume that the unobserved effects on the measured quality are uncorrelated with operating structure? The Hausman test can help determine if the nursing homes error is correlated with the included variables. In other words it tests if the unexplained variance for each nursing home is systematically related. The null hypothesis is that the difference in coefficients from the fixed and random effects method is not systematic, which means; use the random effects method. First I have to construct the two models in order to run the test.

5.4 The models

In the previous chapter I described the variables used in this study; quality, costs and operating structure. I will first comment on how these variables interact before I present the regression models.

I expect that the costs per bed and operating structure are to some extend correlated by looking at table 4 and figure 4 and 5; the private nursing homes have the lowest mean costs and the nonprofit have the highest. This may indicate that outsourcing can reduce costs, but does the operating structure have an effect on quality? I have stated earlier that this study is oriented in the City of Oslo’s perspective, meaning that costs are the price the City pays per bed. I assume that the operating structure is an exogenous variable in this relationship. Costs per bed and quality, on the other hand, can be interpreted as endogenous. By this I mean that a nursing home service is an assessment of a quality level and a cost level. It is not possible to isolate the effect costs has on quality and vice versa since this is probably a simultaneous process when a nursing home produce services. Costs per bed and quality must be interpreted as decision variables. The objective in a tendering process is not the operating structure itself, but to achieve an acceptable price at a desired quality level. In this perspective the existing private nursing homes have won a tendering process because of competitive prices and a convincing quality plan.

If costs or quality are set as independent variables, the result would be a endogeneity problem where the values are determined within the model. The endogeneity makes it difficult to keep other effects on the dependent variable constant, while analyzing the net effect of the
explanatory variable. The result is inconsistent coefficients. If I want to analyze the effects quality has on cost or the effects cost has on quality, another model is more sufficient. One suggestion is an instrumental value and a simultaneous equation model. I will only describe this method briefly as a full analysis with SEM is beyond the capacity of this study. This method involves finding an instrumental variable which is correlated with the endogenous variable. Wooldridge (2003:544) describes the SEM model with panel data as a two stage approach; 1: eliminating unobserved effects by fixed effects method 2: find the instrumental variable for the endogenous variable and analyze the relationship with a two-stage least square method (2SLS).

I have performed an OLS regression with a robust cluster in appendix 3, where quality is the only dependent variable and costs and operating structure are independent. The results are consistent with the fixed and random effects model.

I will return to the interactions between the variables costs and quality in my discussion. In the following analysis the costs and quality are dependent variables and operating structure is the independent variable. All other factors affecting the quality and costs are considered unobserved factors and assumed uncorrelated. I have also controlled for years (T) by constructing year dummies. I will analyze the relationship by using the previously described models; fixed and random effects. These two models are expressed in equations 1 and 2 by Wooldridge (2003:461 and 469). For the readers understanding I have formulated the models with the variables used in this study below each equation. Base year is 2007 and reference group is private:

(eq. 1) Fixed effects: \[ Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + u_{it} \]

- Quality = year08 + year09 + unobserved effects + error
- Costs = year08 + year09 + unobserved effects + error

(eq. 2) Random effects: \[ Y_{it} = \beta_0 + \beta_1 X_{it} + \cdots + \beta_k X_{itk} + \alpha_i + u_{it} \]

- Quality = intercept + public + nonprofit + year08 + year09 + unobserved effect + error
- Costs = intercept + public + nonprofit + year08 + year09 + unobserved effect + error

\[ Y_{it} \] = measured quality, where i is the nursing home and t is the time

\[ \alpha_i \] = unobserved effects
\[ \beta \] represents the coefficient
\[ X \] = independent variable, where \( i \) is the nursing home and \( t \) is the time
\[ u_{it} \] = is the error term where \( i \) is the nursing home and \( t \) is the time

The main difference between the fixed and random effects method is that the unobserved effects \( \alpha_i \) is part of the error term in the random effects method and a part of a dummy intercept in the fixed effects method. The preferred model is the random effects and I will display p-values from Hausman tests which can verify the choice of model. My main interest is the coefficient, weather it is positive or negative and whether they have a significant effect on the quality measure. To make any conclusions about the significance of the coefficients the following assumptions must be met; independence of errors, linear relationship, normally distributed errors and homoscedasticity

In the next sections I will display and comment the coefficient and p-values from the Hausman test.

**5.5 Costs as dependent variable**

Table 5 shows the coefficients from the fixed and random effects model. The reference group is private and the base year is 2007. In the fixed effects model the time invariant variables; public and nonprofit is omitted, but time variant variables like year is included. The increase of mean costs from table 4 is visible in the fixed regression. The constant 598.8 (in thousands) represent the mean costs per bed in 2007 among the operating structures. The mean costs increase 27 000 NOK by the year 2009 here represented by the significant coefficient (1 % level) of the variable year09. The fixed effects regression can in this case be interpret as a comparison of yearly means test (Wooldridge 2003, 223).

The random effects model is also displayed in table 5. Public and nonprofit is now included and has significantly higher costs compared to private at the 1% significance level. Regressions with replaced reference group (not displayed) gave no significant difference between the cost per bed in public and nonprofit nursing homes.

As mentioned the random effect model is preferable and I test the coefficients of the two models against each other. The null hypothesis is that the difference in coefficients is not systematic, in other words the unobserved effects in fixed effects are not correlated with the
independent variable. An insignificant p-value suggests that the random effects model is ok to use. In this case the Hausman test has a p-value of 0.9896.

Table 5: Cost as dependent variable

<table>
<thead>
<tr>
<th>Dependent variable: cost09value</th>
<th>(fixed)</th>
<th>(random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>public</td>
<td>(omitted)</td>
<td>43.436296</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(14)***</td>
</tr>
<tr>
<td>non-profit</td>
<td>(omitted)</td>
<td>55.08212</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(16)***</td>
</tr>
<tr>
<td>year08</td>
<td>1.9613286</td>
<td>1.9613286</td>
</tr>
<tr>
<td></td>
<td>(4.8)</td>
<td>(4.8)</td>
</tr>
<tr>
<td>year09</td>
<td>27.046975</td>
<td>26.994365</td>
</tr>
<tr>
<td></td>
<td>(4.8)***</td>
<td>(4.8)***</td>
</tr>
<tr>
<td>Constant</td>
<td>598.82302</td>
<td>560.17174</td>
</tr>
<tr>
<td></td>
<td>(3.4)***</td>
<td>(13)***</td>
</tr>
<tr>
<td>N</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Hausman (p-value)</td>
<td>0.9896</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level. Standard error in parentheses.

I conclude from the results in table 5 and the random effects estimation that:

1) there is a significant increase of costs in 2009 compared to 2007 at the 1 % level holding operating structure fixed.
2) private nursing homes has significantly lower costs per bed compared to public and nonprofit at the 1 % level, holding years fixed.

5.6 Patient survey score as dependent variable

In this section I will present the results from fixed and random effects model when patient survey score is the dependent variable. The independent variables are operating structures which are time invariant. I have therefore included year dummies in order to model the fixed effects, and to control for the change over time in both models. Reference group is private and base year is 2007. For space reasons I have not displayed regression with replacing the reference group, as this gives no new or significant information about the effects on patient survey.
The fixed effects coefficient can be interpreted in the fixed regression as the effect of year on patient survey score, when year change by one unit. The patient survey score is significantly lower in 2008 compared to 2007 at the 1% level.

Table 6: Patientq41 as dependent variable

<table>
<thead>
<tr>
<th>Variables</th>
<th></th>
<th>(fixed)</th>
<th>(random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>public</td>
<td></td>
<td>(omitted)</td>
<td>-.08337957</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.072)</td>
</tr>
<tr>
<td>nonprofit</td>
<td></td>
<td>(omitted)</td>
<td>.02096387</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.083)</td>
</tr>
<tr>
<td>year08</td>
<td></td>
<td>-.13914652</td>
<td>-.138989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.049)***</td>
<td>(.049)***</td>
</tr>
<tr>
<td>year09</td>
<td></td>
<td>-.08612434</td>
<td>-.0724918</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.049)*</td>
<td>(.049)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>3.4248029</td>
<td>3.4626239</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.034)***</td>
<td>(.069)***</td>
</tr>
</tbody>
</table>

N 133 133
Hausman p-value 0.1010

*Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level. Std. error in parentheses. Reference group is private and base year is 07

The operating structure coefficients obtained by random effects can be interpreted as the average effect on patient survey score, controlled for time effects across the nursing homes. The random effects model also suggests that survey score is significantly lower in 2008. Holding years fixed the random estimation gives no significant difference in patient survey score among the operating structures.

I have performed a Hausman test, which tests the coefficients from the two models and the correlation between included variables and unobserved effects. The null hypothesis is that both fixed effects and random effects are consistent estimators, but fixed effect is inefficient. The Hausman test provide a p-value of 0.1010 which suggests that the random effects model is consistent. I therefore conclude from the results in table 6 and the random effects estimation that:

1) there is a significant decrease in patient survey score in year 2008 compared to 2007 at the 1 % level holding operating structure fixed.
2) there is no significant difference in patient survey score among the private, nonprofit or public nursing homes.
5.7 Relatives survey score as dependent variable

In this section I will present the results from fixed and random effects model when relatives survey score serves as the dependent variable. Again; the reference group is private and the base year is 2007.

Table 7: Relativeq41 as dependent variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>(fixed)</th>
<th>(random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>public</td>
<td>(omitted)</td>
<td>.06284028</td>
</tr>
<tr>
<td>nonprofit</td>
<td>(omitted)</td>
<td>.41664394</td>
</tr>
<tr>
<td>year08</td>
<td>.04792738</td>
<td>.04766844</td>
</tr>
<tr>
<td>year09</td>
<td>.07324653</td>
<td>.07298759</td>
</tr>
<tr>
<td>constant</td>
<td>3.2370845</td>
<td>3.1015313</td>
</tr>
<tr>
<td>N</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>hausman p-value</td>
<td>0.9962</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 10% level **Significant at the 5% level ***Significant at the 1% level. Std. error in parentheses. Reference group is private and base year is 07

The fixed effects model displayed in table 7 indicate an increasing mean relative survey score over time; there coefficients are positive and significantly higher in 2009 at the 10% level compared to 2007. As mentioned before the fixed effects model assume that unobserved effects on quality is correlated with the included variables, in this case years. The alternative and in this case the preferable model is random effects. The Hausman test provide a p-value of 0.9962 which suggests that I use the random effects model.

The random effects regression in table 7 shows that the nonprofit nursing homes have a significantly higher relative survey score compared to private. Regression with replaced reference group (not displayed) also indicate that nonprofit have a significantly higher score compared to public. Both coefficients have a 1% significance level. The random effects model also indicates that the mean survey score is higher in 2009 compared to 2007 at the 10% significance level. I therefore conclude from the results in table 7 and the random effects estimation that:
1) there is a significant increase in patient survey score in year 2009 compared to 2007 at the 10 % level holding operating structure fixed.

2) nonprofit nursing homes have a significant higher relative survey score compared to public and private at the 1 % level.

5.8 Objective quality indicators as dependent variable

In this section I will present the results from fixed and random effects model when objective quality indicators is the dependent variable. Regressions with replaced reference group gave no new or significant information about the relationship. I have therefore not included these coefficients and standard errors in the table due to space reasons. Note that, opposing to the patient and relative survey score, higher values of meanindexoqi indicates lower quality, since the measured unit here is percentage of patients with a registered indicator. The indicators specify conditions/events that are likely to occur due to low quality of care. Table 8 shows the results from the fixed and random effects estimations.

Table 8 displays the Hausman p-value, which equals 1, and suggests the random effects model. I therefore conclude from the results in table 8 and the random effects estimation that:

1) there is no significant difference in mean index among the operating structures or across years.

**Table 8: Meanindexoqi as dependent variable**

<table>
<thead>
<tr>
<th>Variables</th>
<th>(fixed)</th>
<th>(random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>public</td>
<td>(omitted)</td>
<td>2.7440476</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>nonprofit</td>
<td>(omitted)</td>
<td>2.1704545</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.3)</td>
</tr>
<tr>
<td>year08</td>
<td>-2.787234</td>
<td>-2.787234</td>
</tr>
<tr>
<td></td>
<td>(1.8)</td>
<td>(1.8)</td>
</tr>
<tr>
<td>year09</td>
<td>-.12765957</td>
<td>-.12765957</td>
</tr>
<tr>
<td></td>
<td>(1.8)</td>
<td>(1.8)</td>
</tr>
<tr>
<td>constant</td>
<td>44.489362</td>
<td>42.346631</td>
</tr>
<tr>
<td></td>
<td>(1.3)***</td>
<td>(2)***</td>
</tr>
</tbody>
</table>

N 141 141

*Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level. Std. error in parentheses. Reference group is private and base year is 07.
5.9 Other data problems and model assumptions

In the following sections I will comment on the model assumptions and possible data problems:

**Independence**

The assumption of independence concerns the errors; the errors corresponding to the observations of quality should not be correlated once the explanatory variables are taken into account. I have performed the Hausman test in the previous regressions and presented the p-values in table 5-8. This tests the coefficients obtained from fixed and random effects model and if they are correlated with the included variables. None of the tests were significant at the 5 % level which allowed me to use the random effects model.

It is possible that an error component associated with a nursing home one year may be correlated with the following year, also called serial correlation. Presence of serial correlation will not bias the coefficients but reduce the efficiency of the regression model. I have applied a new Wooldridge test (Drukker 2003) which is designed to detect serial correlation in linear panel data models. The null hypothesis is no serial correlation, which could not be rejected for any of the dependent variables patient and relatives survey score. The p-values were above 0.05 (Prob > F) But the test gave significant p-values at the 5 % level when costs and mean index of objective quality indicators, indicating autocorrelation.

**Unusual observations and outliers:**

The quality observations from each nursing home may be sensitive to a few patients’ health condition and preferences. The data set might therefore contain irregular observations that can influence the regression line in order to fit the extreme observations. A simple check for influent and irregular observations can be done with simple scatter plots shown in figure 6. There are some observations which may show somewhat unusual combination of quality score and costs level. The observations are identified in each plot as Villa Enerhaugen 2008 (public) in the first plot, Romsås 2007 (public) in the second and Abilso 2009 (public) and Nordberghjemmet 2009 (public) in the last plot. I have performed a random and fixed effects regression with and without these potential outliers and found no notable change in coefficients or test statistics.
Regression assumptions; linearity

The models I use assume a linear relationship between quality, costs and operating structure. This may be biased in the patient and relatives survey. The surveys measure the perceived quality over from year to year on a scale from 1 to 4. A disadvantage is that as the nursing home improves the quality, new patient has not experienced “the before and after” the improvement. They rate the nursing home according to their expectations of quality. A patient that has stayed at the nursing home for some time, and experienced the improvement, will possibly rate the nursing home higher than his or her initial expectations. This makes the user and relative surveys inadequate to measure the development of quality improvements in each nursing home over long time periods. The mean index of objective quality indicators is also dependent on the medical condition of the patients. It is possible that the mean health condition of all patients admitted to nursing homes change from year to year. This would make the variable meanindexoqi insufficient to capture the development over time.

Regression assumptions; heteroscedacity:

I have also run a test for heteroscedacity, this is only available for fixed effects models (Baum 2001). Heteroscedacity, inconsistent variance, can appear over time and across the nursing homes and may bias the test statistics. A modified test for groupwise heteroscedacity in fixed effects model, preformed in Stata, indicates presence of heteroscedacity for all the dependent variables. The null hypothesis is constant variance, and all three p-values are 0.000.

The presence of heteroscedacity suggests that I use the robust regression, in order to correct for non-constant variance (Wooldridge 2003, 258). The robust regression will not change the coefficients, but normally increase the standard error term which again can increase the test statistic. The statistical software Stata does not allow the Hausman test to be performed with the robust option. I have therefore compared the values in table 5-8 with values from a robust
estimation. These comparisons are not displayed in the tables as there was no difference in the significant significance levels. The estimated coefficients displayed in the tables are therefore not robust in order to perform a Hausman test.
6 Discussion

In this section I will discuss the results from the analysis and how these relate to the main hypothesis;

*Measured quality and costs per bed are not affected by operating structure.*

As mentioned; the costs and quality are endogenous variables in this relationship. Costs per bed depend on many things, but one of them is the quality level. On the same time quality depends on many things; among them are costs. Cost level and quality level emerge simultaneously when a nursing home produce a service. It is not possible to isolate the effects one has on the other. I have chosen to set cost per bed as dependent variable along with the quality measurement results; patient and relative survey and mean index of objective quality indicators. The exogenous variable operating structure is the only independent variable, controlled for time effects by year dummies. By doing this I am able to study the differences in cost level among the operating structures and the effects operating structure has on quality. The relationship between costs, quality and operating structure can then be discussed in a 2x2 matrix as displayed in the following sections.

It is likely that costs per bed varies among the operating structures, I got significant results indicating lower cost per bed for the private nursing homes in table 5. These results lead way for Nesheim and Rokkans reasoning about efficiency and that increased efficiency is not only reduced costs but can also take form of improved quality or quantity. Is it possible to get more quality, for less or at least the same cost? I will not conclude to this question in my discussion, but the findings can contribute to new hypothesis about the cost efficiency among operating structures and the corresponding quality level.

6.1 The effects on patient survey score

I have found no apparent relationship between operating structures and patient survey score with the available data and methods in this study. Table 6 showed a significantly lower patient survey score for all the nursing homes in 2008 and 2009 compared to 2007. Table 5 showed that the public and nonprofit nursing homes have higher costs compared to private, at the 1% significance level. The results from table 5 and 6 are illustrated in a 2x2 matrix in figure 7.
Note that this matrix only compare the operating structures in high/low categories, the regression coefficients and its significance level give the precise picture of the relationship.

**Figure 7: 2x2 matrix of patient survey score and cost per bed**

<table>
<thead>
<tr>
<th>High quality</th>
<th>Public</th>
<th>Nonprofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low quality</td>
<td>Private</td>
<td></td>
</tr>
<tr>
<td>Low cost per bed</td>
<td>High cost per bed</td>
<td></td>
</tr>
</tbody>
</table>

I have placed public and nonprofit nursing homes in the high cost category based on the significant higher costs compared to private in table 5. There is no significant difference between public and nonprofit when it comes to costs. The random effects model in table 6 gave no significant difference in patient survey score, meaning that none of them has a better score compared to the others. So regardless of operating structure; the mean score on patient survey is 3.35 (table 4) where 3 is satisfied and 4 is very satisfied. Hence I have placed private, nonprofit and public nursing homes in the high quality category.

In a situation where the City of Oslo has to choose between operating structures a private structure might be a rational choice in a short term economical perspective. I have not found indications of lower patient survey score in private nursing homes, only lower cost per bed. But as mentioned in the introduction; there are many political controversies related to outsourcing nursing homes to private companies. Nevertheless my results indicate that private nursing homes might be more cost efficient in the sense that they achieve the same quality level at lower costs.

So back to my hypothesis; it seems that operating structure have an effect on costs per bed. I have also found indications that private might achieve the same quality score with less costs. Public and nonprofit nursing homes show the same score even though they cost more. This suggests that there might be something within the private operating structure that makes them more efficient.
6.2 The effects on relatives survey score

The random effects method in table 7 showed that the nonprofit nursing homes score significantly higher compared to the public and private, holding time effects fixed. The 2x2 matrix below compares the significant relationships from table 5 and 7. Note that there is no significant difference in relative survey score between private and public, only a difference in costs. Likewise there is no significant difference in costs between nonprofit and public, only a significant difference in relative survey scores.

*Figure 8: 2x2 matrix of relative survey score and cost per bed*

My results indicate that even tough public and nonprofit has the same cost level, there might be some characteristics within the nonprofit nursing homes which yield a higher relative survey score and cost. It is also likely that given the same quality level there is something within private nursing homes that result in lower costs and score compared to public.

6.3 The effects on mean index of objective quality indicators.

With the methods and data used in this study I have not found a significant relationship between the mean index of objective quality indicators and operating structure. The mean index score among the operating structures is 43.52. It is hard to say if this index score expresses high or low quality across the city’s nursing homes. There is no stated definition of what level of patients with a registered indicator is high or low quality. My results suggest that the variations in quality levels across all nursing homes are random. Hence, there is no significant difference between the operating structures. Throughout my studies of the nursing
homes sector I have found no literature, stated arguments or research concluding that the overall quality of care in the City’s nursing homes are of low quality. I assume that Oslo practices the laws and regulations that concern the sector, for this reason I place the nursing homes in the high quality category. I want to emphasize that I have not found any significant proofs that this is true, but placing the operating structures in the same quality level category does not affect my hypothesis or conclusion.

*Figure 9: 2x2 matrix of objective quality indicators and cost per bed*

| High quality | Nonprofit
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Public</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low cost per bed</td>
</tr>
</tbody>
</table>

Private would be an economic preferable choice if the City of Oslo were to choose between the 3 operating structures in figure 9. There might be characteristics within the private nursing homes that maintain the same quality level as public and nonprofit, but at a lower cost.

### 6.4 Quality and costs

The private nursing homes have a less expensive pension agreement with their employees. The public and nonprofit have equivalent agreements which result in the same pension cost level. The pension cost are included in the calculations of cost per bed, but the cost reports do not specify the share of pension costs as a comparable measure. This means that there is a possibility that the cost gap between private and the other 2 operating structure only involve the share of pension cost. If this is the case there is in a sense no difference in cost level among the operating structures. In other words; all the nursing homes produce approximately the same quality level at the same costs per bed. The only significant difference is the relative survey score, where the nonprofit nursing homes have higher mean score.

An alternative situation is that the cost gap between the operating structures involves more than just pension costs. If this is the case; the private nursing homes might still have an ability
to maintain the same measured quality level at a lower cost. The exception is where the nonprofit has a higher relative survey score.

One might suggest that a favorable pension agreement would attract applicants to vacant possessions and thereby give the public and nonprofit nursing homes access to skillful and experienced staff. A more skillful and experienced staff might have an effect on the quality measures. The results from my analysis are not consistent with this reasoning. If favorable pension agreements supposed to have an effect on quality, the public should also have significantly higher quality than private.

Another important aspect about the cost variable is that an unobserved share of profit is probably included in the costs per bed in private nursing homes. It is likely that the profit margin varies across the private nursing homes and from year to year. Data on share of profit is not available and I can only assume that the private companies calculate a share of profit in the price paid by the city of Oslo aka costs per bed. This means that the cost variable do not represent the economic resources used to produce the private nursing home service. Since public and nonprofit nursing homes do not take any profit, I can assume that the costs per bed better reflect the production costs compared to private. This may imply that private homes are able to produce services at lower use of economic resources compared to public and nonprofit.

In my opinion it is necessary to study the share of pension costs and profit margins more thoroughly. Right oriented politicians would probably outsource a public nursing home to a private company in a situation where the city of Oslo wants to save costs. The City would most likely pay a lower price regardless of pension agreement and profit margins. But outsourcing is a political area of conflict. Left oriented politicians argue that it is unethical to outsource services at the expense of the pensions to the professionals who are already low paid. Other arguments consider the principles of letting private companies benefit on public budgets. More knowledge about how the share of pension costs differ among the operating structure and profit margins would allow more well-founded conclusions about the relationship between costs, quality and operating structures. With the available data in this study, it is not confident that private can achieve more quality for less costs. If pension cost is taken out of the equation; it is a possibility that the cost level is the same among the operating
structures. Then again if profit margins are also taken out of the equation; it is possible that private nursing homes are able to maintain the same quality level for less.

I will now move on to the measured quality variables in this study. It is possible that there are significant variations of quality measures that are not included. An example of this can be nurse-patient ratio. The quality measurement system in Oslo consists of 3 parts, only 2 are included here. The third part is, as mentioned, the quality review visit. It is possible that there would be a significant difference among the operating structures based on the outcome of these visits. I have already referred to the findings in the studies by O’Neil et. al. and Harrington et. al; they found that private, for-profit nursing homes had lower quality. The quality measures in these studies where based on quality reviews. I have not included the quality reviews since 2008 is the only year this was performed, in addition to methodical problems which make comparisons unreliable. The City of Oslo plans to perform these yearly and based on a common procedure. Such data would be highly relevant in future studies of the quality variations among the operating structures.

I have found only one significant difference among the operating structures; nonprofit nursing homes have higher relative survey score compared to private and public. This indicates that there is something within the nonprofit nursing homes that result in a higher score. The relative survey measures the overall satisfaction. Still, the relatives do not stay at the nursing home or have personal experiences with the quality of care compared to the patients. What makes the relatives to be more satisfied with the nonprofit nursing homes? Are there care procedures, food or facilities that are common for the nonprofit nursing homes? The nonprofit nursing homes do not differ from public when it comes to costs, so is it possible that the “not for profit” vision impose relatives to give the nursing home higher score? The patients in nonprofit nursing homes do not express the same high satisfaction, compared to private or public. The questions illustrate the complexity of measuring quality and explaining the possible reasons. I believe my data is too limited to discuss the reasons for why the relatives of patients in a nonprofit nursing home are more satisfied. I believe more research on the field is necessary.
7 Conclusions and Recommendations

In my study I have focused on the question: Do operating structures have an effect on costs per bed and the measured quality? I have discussed this question from the City of Oslo’s perspective. My main hypothesis have been: Measured quality and costs per bed are not affected by operating structure. I have assessed a panel data set from available quality and cost reports in Oslo, and used a fixed and random effects method in the analysis.

With the available data and methods, I have found that private nursing homes have a significantly lower cost per bed compared to public and nonprofit. I also found that nonprofit nursing homes have a significantly higher score on the relative survey. I can make these conclusions on a 1% significance level. These results suggest that I reject my main hypothesis and conclude that measured quality and costs per bed are affected by operating structure. In my discussion I have pointed out 3 conditions that might make such conclusion inconsistent. I therefore believe further research is necessary to make more well-founded conclusions in the case of Oslo’s nursing homes.

1. Given that the share of pension costs is taken out of the cost variable; it is possible that there is no significant difference in costs per bed among the operating structures.
2. Given that the share of profit is taken out of the cost variable; there is a possibility that private are able to maintain the same quality level for less costs compared to public and nonprofit.
3. The only significant difference in quality level is relative survey score. Relatives in nonprofit nursing homes are more satisfied, but the patients are not. There is a possibility that the nonprofit policy give the nursing home a good reputation and high satisfaction among relatives. But the quality of care is not necessary better since the patients do not rate the nursing home any different compared to public and private. Nonprofit nursing homes do not show higher quality when it comes to the objective quality indicators.

Still, in the City of Oslo’s perspective, it is possible that private nursing homes may impose reduced costs. I have not found any indications that private have lower quality compared to Oslo’s own, public nursing homes. This might be a symptom of well defined quality
specifications in the contracts with private companies. The right oriented politicians are in lead in Oslo and have stated that they will continue with the outsourcing policy. It will be interesting to follow the future development in the nursing home sector and to see the long term effects of operating structures on costs and quality.
References


Appendix 1 Costs per bed variations
Appendix 2 Stata DO-commands

use "C:\Users\Jeanette\Documents\My Dropbox\main stata.dta",clear
xtset id year

*Table: Descriptives
by opstruc, sort : summarize cost09value patientq41 relativeq41 meanindexoqi
by year, sort : summarize cost09value patientq41 relativeq41 meanindexoqi
mean cost09value relativeq41 patientq41 meanindexoqi, over(opstruc)
by year opstruc, sort : summarize cost09value patientq41 relativeq41 meanindexoqi
summarize cost09value relativeq41 patientq41 meanindexoqi

*Figure: Box plots
graph box cost09value, over(opstruc)
graph box patientq41, over(opstruc)
graph box relativeq41, over(opstruc)
graph box meanindexoqi, over(opstruc)

*Figure: Unusual observations
scatter patientq41 cost09value, mlabel(opstruc)
scatter relativeq41 cost09value, mlabel(opstruc)
scatter meanrankoqi cost09value, mlabel(opstruc)

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extremes relativeq41 cost09value
extremes meanindexoqi cost09value

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xtreg patientq41 public nonprofit if ob !=128 , fe
xtreg patientq41 public nonprofit, re
xtreg patientq41 public nonprofit, fe

xtreg relativeq41 public nonprofit if ob != 85, re
xtreg relativeq41 public nonprofit if ob != 85, fe
xtreg relativeq41 public nonprofit, re
xtreg relativeq41 public nonprofit, fe

xtreg meanindexoqi public nonprofit if ob != 3, re
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xtreg meanindexoqi public nonprofit, fe

*Test for heteroskedacity:
xtreg cost09value public nonprofit year08 year09, fe
xttest3
xtreg relativeq41 public nonprofit year08 year09, fe
xttest3
xtreg patientq41 private nonprofit cost09value, fe
xttest3
xtreg meanrankoqi public nonprofit cost09value, fe
xttest3

*Test for serial correlation:
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xtserial relativeq41 public nonprofit year08 year09, output
xtserial meanrankoqi public nonprofit year08 year09, output

*Table: Costs as dependent variable
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xtreg cost09value public nonprofit year08 year09, re
estimates store re
hausman fe
est table fe re, se(%9.2g) stats(N r2_a)
est table fe re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)

*Replaced reference group:
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estimates store fe
quietly xtreg cost09value private nonprofit year08 year09, re
estimates store re
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est table fe re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)

*Comparison with robust option:
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quietly xtreg cost09value public nonprofit year08 year09, fe
estimates store robustfe
quietly xtreg cost09value public nonprofit year08 year09, robust re
estimates store robustre
quietly xtreg cost09value public nonprofit year08 year09, re
estimates store robustre
est table robustfe fe robustre re, se(%9.2g) stats(N r2_a)
est table robustfe fe robustre re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)

*Table: patientq41 as dependent variable (fixed and random effects model)
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quietly xtreg patientq41 public nonprofit year08 year09, re
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est table fe re, se(%9.2g) stats(N)
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*Replaced reference group:
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quietly xtreg patientq41 private nonprofit year08 year09, fe
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est table fe re, star(.01 .05 .10) b(%9.2g) stats(N)

*Comparison with robust option:
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quietly xtreg patientq41 public nonprofit year08 year09, robust re
est store robustre
quietly xtreg patientq41 public nonprofit year08 year09, re
est store re
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est table robustfe fe robustre re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)

*Table: relativeq41 as dependent variable (fixed and random effects model)
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est table fe re, star(.01 .05 .10) b(%9.2g) stats(N)

*Replaced reference group:
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quietly xtreg relativeq41 private nonprofit year08 year09, fe
est store fe
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*Comparison with robust option:
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quietly xtreg relativeq41 public nonprofit year08 year09, fe
est store fe
quietly xtreg relativeq41 public nonprofit year08 year09, robust re
est store robustre
quietly xtreg relativeq41 public nonprofit year08 year09, re
est store re
est table robustfe fe robustre re, se(%9.2g) stats(N r2_a)
est table robustfe fe robustre re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)

*Table: meanindexoqi as dependent variable (fixed and random effects model)
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est table fe re, star(.01 .05 .10) b(%9.2g) stats(N)

*Replaced reference group:
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est store re
quietly xtreg meanindexoqi private nonprofit year08 year09, fe
est store fe
est table fe re, se(%9.2g) stats(N)
est table fe re, star(.01 .05 .10) b(%9.2g) stats(N)

*Comparison with robust option:
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quietly xtreg meanindexoqi public nonprofit year08 year09, fe
est store fe
quietly xtreg meanindexoqi public nonprofit year08 year09, robust re
est store robustre
quietly xtreg meanindexoqi public nonprofit year08 year09, re
est store re
est table robustfe fe robustre re, se(%9.2g) stats(N r2_a)
est table robustfe fe robustre re, star(.01 .05 .10) b(%9.2g) stats(N r2_a)
Appendix 3 OLS-regressions with robust cluster.

Patient surveys dependent variable:

In appendix table 1 I have regressed costs and operating structures on patientq41. I have not included the coefficients from the separate regression in the tables as these add no new information. None of the coefficients came out significant at the 5 % level other than the year dummies; which can be interpreted as the mean score on patient survey in 2008 is significantly lower than in 2007 at a 1 % significance level. Although not significant; the effects of costs on patient survey score is positive as the coefficient is 0.0064. The nonprofit has the highest mean score, followed by private, the public nursing homes has the lowest score, but there is no significant difference in means on patient survey among the operating structures. Appendix table 1 indicates a significant relationship between patientq41 and costs at the 10 % significance level. A cost increase of 1000 NOK will result in a 0.00088 increase on the patient survey score, given all other factors unchanged. An interesting result here is that even though being a nonprofit nursing home gives the highest mean score on patient survey during the period, being a private nursing homes present the highest score given the same level of costs. However this difference is not significant, but according to (3) and (5) being private nursing homes yields a higher score than being public at a 10% significance level. Controlling for differences in time by the year dummies does not change the estimates, but regression (4) and (6) shows that the patient survey score was significantly lower in 2008 and 2009 compared to 2007, holding all other factors fixed. This OLS model assume that the slopes for the different operating structures is the same, or in other words that the relationship between costs and quality is the same among the private, nonprofit and public nursing homes. I have performed a simple F-test for I have tested a null hypothesis that the slopes are the same and obtained a p-value of 0.9111 (Prob>F) (Wooldridge 2003, 234). I therefore assume that the slope is the same for all the operating structures.
Appendix table 1: Patientq41 coefficients from OLS regression with robust cluster (id)

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Note: standard error in parentheses. *Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level .Note: reference group is year07

Relative survey as dependent variable:
Appendix table 2 gives the coefficients and standard error for the independent variables when costs, operating structures and years are included variables. The coefficients for costs show a significant positive effect on the relative survey at a 5% and 1% level. A cost increase of 1000 NOK would according to (12) and (14) result in a .00175 increase in score, holding all other factors fixed. The nonprofit nursing homes have a significant higher score compared to public and private nursing homes, given the same cost level and controlling for year dummies. This OLS model assume that the slopes for the different operating structures is the same, or in other words that the relationship between costs and quality is the same among the private, nonprofit and public nursing homes. I have performed a simple F-test for I have tested a null hypothesis that the slopes are the same and obtained a p-value of 0.6858 (Prob>F) (Wooldridge 2003, 234) I therefore assume that the slope is the same for all the operating structures.
### Appendix table 2: Relativeq41 coefficients from OLS regression with robust cluster (id)

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Note: standard error in parentheses. *Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level. Note: reference group is year07

### Mean rank of objective quality indicators as dependent variable:

In this section the mean index of objective quality (meanindexoqi) indicators is set as the dependent variable. A high mean index indicates that the nursing home has a high percentage of total patients within the indicator groups. A low mean index can therefore be interpret as an indication of higher quality. This means for example that if high quality is related to high costs, the coefficients for the independent variable cost09value should be negative.

This OLS model assume that the slopes for the different operating structures is the same, or in other words that the relationship between costs and quality is the same among the private, nonprofit and public nursing homes. I have performed a simple F-test for I have tested a null hypothesis that the slopes are the same and obtained a p-value of 0.0292 (Prob>F) (Wooldridge 2003, 234) This indicates that the slopes are different.
Appendix table 3: Mean indexoqi coefficients from OLS regression with robust cluster (id)

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Note: standard error in parentheses. *Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level. Note: reference group is year07