Explaining differences between hospitals

A multidisciplinary market model to overcome the under- and oversocialized aspects of traditional models

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January 2008

Master thesis
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Title: Explaining differences between hospitals
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Summary

We have conducted longitudinal quantitative research to explain the differences between profit and non-profit hospitals of the state of Florida. We focus on hospitals from the state of Florida, because it has a free market environment and consists of a wide range of different hospital types. A free market environment is relevant for this research, since observations in a free market environment are least contaminated with external influences (like government interference). Different economic reasons of existence between profit and non-profit hospitals, conversion of non-profit to profit hospitals, and changes in traditional maximization goals are reasons why we explain ownership type differences.

Previous research showed contradicting results, where 60% concluded higher performance of non-profit hospitals and 40% concluded higher performance of profit hospitals (Kosner 2008). Theoretical different views can result in different conclusions about hospitals. We identify three views: economic, cultural, and sociological. Each of these three views are criticized for having a serious theoretical shortcoming in their market assumptions. To overcome these shortcomings, Zeltner (1992) suggests the use of a multidisciplinary model: the Multiple Market Model (MWM).

The goal of this research is to demonstrate the added value of the multiple market model (MWM) while identifying, describing and explaining the differences between hospitals in the health care market (of Florida), because of the contradicting results found in previous health care research we have formulated the research question:

Why are non-profit hospitals more efficient than profit hospitals, while economic theory predicts profit hospitals to be more efficient?

The scientific relevance of this research is to make a convincing overlapping model for explaining the differences in organizational forms, which is currently lacking.

The practical relevance of better knowledge about organizational forms will help health care policy makers to understand the implication of their policy. This is important, since some ownership types are stimulated by tax advantages, based on assumed differences in ownership where a particular ownership type should perform better.

A final relevant contribution of this research originates from the fact that in some countries there is a tendency to stimulate market functions in their health care market. The insights from this research may be used to visualize the consequences of different organizational forms for hospitals.
Summary

For every approach of the WMM we formulate two hypotheses. The data used to test the hypotheses is primarily collected from the inpatient dataset of the Agency for Health Care Administration (AHCA) in the years 2000 to 2014.

We test, using statistical software SPSS, efficiency differences between ownership types for the economic approach, range of service for the cultural approach, and financing behavior between alliances for the sociological approach. Logistic regression is performed to analyze the predictive value of explanatory variables or the dependent variables. We included only non-teaching short term acute care hospitals in our research. Average total research population is 165 (s.d. 2) hospitals for every year.

Based on the results we can conclude that Florida’s short term acute care hospitals show:

- Convergence of the efficiency scores
- Convergence of the range of service in broad ranges hospitals
- Convergence within the close social context, the alliance

We suspect three cultural changes to be a reason for the convergence of efficiency scores, the conversion movement, the halted tax benefits for non profit hospitals, and managed care. With the disappearance of external forces that ensured difference between profit and non profit hospitals, maximization goals could become more equal. Traditional cultural differences between profit and non profit hospitals are reflected in their different maximization goals. Profit hospitals maximize output to satisfy the financial need of the shareholders. Non profit hospitals maximize input to satisfy community health care need.

Focused hospitals are more efficient than broad ranged hospitals. Because the number of broad ranged hospitals increased are the relative efficiency scores converging.

We did not find a definitive reason for the convergence of ranges of service, but based on the sociological approach we suspect hospitals within an alliance to mimic the range of service of their market environment and mimic the range of service within their alliance. This is based on the large percentage of alliances in the state of Florida (71%) and the fact that all hospitals participating in an alliance have a broad range of service.

To answer the research question, efficiency scores between profit and non profit hospitals were similar in the year 2004. Non profit hospitals are more likely to be focused and the more focused a hospital is, the more efficient it gets. Therefore, the mean efficiencies of non profit hospitals are more likely to be higher while hospitals of equal range and equal hospital type are equally efficient, independent of ownership type.

This research implicates that hospitals in a free market environment become broad ranged hospitals who participate in an alliance. If a health care policy aims on the diversity and specialization of hospitals then a free market environment is not the appropriate choice.
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Preface

This research concludes my master course Health Sciences on the University of Twente (the Netherlands). I have enjoyed the master course and was particular interested in the consequences of health care systems on health care in general. This research was an opportunity to look at the complexity of health care differences (in the form of markets) on a multi-disciplinary level. Also my interest in market function within health care markets was a stimulus in this research.

This master thesis could not be written without the help of others. I would like to thank my supervisors for their time and for their remarks. I would like to thank prof. van Aswem for his sincere interest and concrete advice. I would like to thank Tekco for every coffee break we had and our very helpful discussions. I felt great support from both supervisors especially, through their help in making working facilities possible. Thank you both.

My friends and family supported my research by giving great comments and asking sharp questions. I would like to thank Timon and Johan for everything during lunch breaks, coffee breaks, sympathy breaks, and other breaks. But, most of all, I would like to thank Anne Jan and Marc for their time invested in this thesis and in me.

Joris Smid.
January 2006
1 Introduction

1.1 Motive

Over the past decades, health care organizations have been subjected to intensive research as well as major changes in their organizational structure. Considerable increases in health care costs led to the questioning of the organization of health care in general. This reassessment of health care systems resulted in new insights about health care markets and health care organizations. Theoretical implications were formulated about, for example, which type of ownership type would be suitable for a hospital in a certain market environment.

During the assessments of organizations in health care markets, many different organizational forms were found. From an economic perspective, profit hospitals were expected to be more efficient than non-profit hospitals (Clark 1980). However, only 30% of the health care research could support this hypothesis (Kosenau 2003). The nonconformity between theoretical expectation and observation makes us wonder why organizational forms in the health care market are different from each other.

1.2 Problem identification

Organizational forms can be studied from different points of view, based on their own specific fundamental assumptions. We identify three views: economic, cultural, and sociological. Each of these three views is criticized for having a serious theoretical shortcoming in their market assumptions. These shortcomings have become known as the under-, and oversocialized aspects of human behavior in economic action. To overcome these shortcomings, Zeith (1988) suggests the use of a multidisciplinary model: the Multiple Market Model (MMM). In this research, we will use this MMM to explore differences between the organizational forms of hospitals.

1.2.1 Significance

The behavior of hospitals to influence performance has been a subject of many health care studies, with various topics and with different results. This research will focus on differences between profit and non-profit ownership type. There are three main reasons why we compare ownership types of hospitals.

First, the economic reason of existence in terms of financial needs differs between ownership types (Keller and Horwitz 2000). This means that from an economic perspective profit and non-profit hospitals are different by nature. Earlier research shows small performance differences between non-profit and profit hospitals (Sloan and Vracu 1983). However, when hospital ownership types are compared by their efficiency scores, 60% of the health care research indicates non-profit hospitals to be more efficient versus only 10% for profit hospitals (Kosenau 2003).
Second, hospitals have experienced a major conversion of non-profit organizations towards profit organizations (see section 3.1.2 (Gray 1997)). This conversion was based on economic reasons that affect the performance of hospitals. This means that the difference between ownership types is big enough to make hospital want to convert.

Third, traditional goals seem to emerge in some cases, where non-profit hospitals are questioning efficiency and profit organizations are exploiting non-profitable treatments to answer social needs. Some research suggests non-profit hospitals to maximize profits and not only maximize social surplus value, while maximizing social surplus is considered the traditional purpose of non-profit hospitals (Bennett and Masson 2012). This suggests cultural differences between ownership types that exist but in some cases vanish.

When we compare hospitals by their market environment, we find that some hospitals copy behavior from other hospitals in their direct competition, whereas others do not (Duggan 2002).

We compare hospital ownership types, because economic theory predicts ownership type differences, because hospital ownership types were under influence of cultural changes, and because hospitals in a competitive environment influence each others behavior.

These studies illustrate that the social context of market environment of hospitals has effect on their economic behavior. This means that previous research suggests some effect of the social context or market environment on the economic behavior of hospitals. These studies, however, may be based on fundamentally different market assumptions, which lead to different results about the differences between these hospitals. Therefore, we will combine multiple approaches in this research. This allows us to give a more comprehensive exploration of the differences between organizational forms.

The scientific relevance of this research is to make a convincing overlapping model for explaining the differences in organizational forms.

The practical relevance of better knowledge about organizational forms will help health care policy makers to understand the implication of their policy. This is important since some ownership types are stimulated by tax advantages, based on assumed differences in ownership where a particular ownership type should perform better.

A final relevant contribution of this research originates from the fact that in some countries there is a tendency to stimulate market functions in their health care market. The insights from this research may be used to visualize the consequences of different organizational forms for hospitals.
1.3 Research question

We have reasons that economic performance differs between ownership types and that a MMM should reveal a more comprehensive picture of why these differences occur. This research will look at the differences in efficiency between ownership types, in order to assess the economic performance of hospitals (see section 2.1). With these results, we will examine why differences between types of ownership occur. Summarizing, our main research question will be:

Why are non-profit hospitals more efficient than profit hospitals, while economic theory predicts profit hospitals to be more efficient?

We will start with an economic approach, followed by a cultural approach and concluded by a sociological approach, to explore the three views that should give a more comprehensive answer to the research question. By exploiting these three approaches of the MMM, we will demonstrate the added value of the MMM.

1.4 Research goal

The goal of this research is to demonstrate the added value of the multiple market model (MMM) while identifying, describing and explaining the differences between hospitals in the health care market [of Florida].

Our MMM exists of three different market approaches: economical, cultural, and sociological. This research will focus on the hospitals in Florida USA, for reasons that will later be explained in chapter 3. We categorize hospitals into two ownership types: profit and non-profit.

1.5 Outline

The second chapter of this thesis explains the different approaches through a literature study. We will discuss the economical, the cultural, and the sociological approach. For every approach, we will formulate two hypotheses. Chapter two is concluded with a detailed explanation of the MMM.

In the third chapter, we will introduce the framework of this research. We will chronologically look at three different movements: the multiple hospital system (1950-1980), the conversion movement (1980-1990’s), and the third malpractice crisis (2000’s).

Chapter four is dedicated to the measurement and sources of data.

In the fifth chapter, the results and analysis for each individual hypothesis is presented. We will give a summary of the results of the first four hypotheses, which focus on calculating the predictive value of efficiency and range of service for ownership types. The second part of the results focuses on the mimicking behavior of alliances. At the end of chapter five, a conclusion about the results is presented.

Chapter six describes the overall conclusion of this thesis, based on the research question presented above. We will conclude this chapter with a discussion of the limitations of this research and give advice for future research.
2 Literature study

In this chapter, we will explore the research question stated in the introduction and explain the three different points of view for looking at this research question. For each approach, we will explain the differences between the types of ownership and formulate a concluding hypothesis.

This chapter also gives a detailed description of the multiple market model (MMM), which aims at giving a more realistic market view through the incorporation of different market approaches. The multiple market model represents an alternative to the neoclassical paradigm of markets and is therefore an useful model with a more realistic view of market behavior (Zeiler 1988).

2.1 Economical approach

When organizational forms are studied from an economical point of view, they are usually compared by efficiency. High health care costs combined with little health care improvement have led to question the efficiency of the health care system as a whole (Porcher and Olesniski Heiberg 2004; Schieber and Poullier 1999). Reasons for the high health care costs are related to the increased need for health services. These health services account for 16% of the total health care expenditures of the US, where inefficient use is a reason for the yearly increase of the health care costs (Bates, Mulherjee, and Sante 2006).

Efficiency differences between non-profit and profit hospitals are the result of their different financial needs and organizational goals. Microeconomic theory suggests that profit-driven hospitals will minimize costs by maximizing efficiency. The shareholders’ claim on profit hospitals is an incentive for managers to focus on efficiency and to question hospital processes (Donald, Gardner, and Jaehnig 1994). This means that profit hospitals should be more efficient than non-profit hospitals.

Managerial theories, on the other hand, suggest that non-profit hospitals managers do not have the motivation to be efficient. Non-profit hospitals lack the pressure of shareholders, which is supposed to be the reason for non-profit managers to focus on quantity or quality care (Newhouse 1970). This means that non-profit hospitals, with the constraint of a zero profit policy, maximize the quantity of their services rather than the efficiency (Detolle and Masson 2002).

Combining these two theories, we can formulate the following hypothesis from an economical viewpoint about the differences in efficiency between hospitals:

Hypothesis 1: Profit hospitals are (relatively) more efficient than non-profit hospitals.

Although efficiency is the logical choice for explaining differences in ownership from an economical point of view, its definition and measurement cause difficulties (Hollingsworth, Bannor, and Maniadakis 1999). The reason for this is threefold. First, real output is hard to define. Do only completely recovered patients count...
as real output? Is created knowledge or are residents output? Second, there is a high probability of biased cost reporting by hospitals. Third, techniques for measuring efficiency are subject to high sensitivity. Even if these problems can be overcome, measured efficiency results are still only valid for the unit of analysis. This makes it challenging to draw a conclusion about the health care system as a whole based on efficiency.

The difficulties with efficiency and health care are reflected in the contradicting results of several efficiency studies. Striking are the results of earlier health care research, where only 10% resulted in accepting hypothesis 1. From a classic economic argument, however, differences between efficiency and ownership are expected, in favor of profit hospitals. As argued before, financial needs (Cutler and Newhouse 2000) and managerial incentives are the reasons for the distinction between ownership types. An explanation for differences in efficiency can be that the measured efficiency results are influenced by hospital characteristic and environmental variables.

The size of the individual hospitals also affects efficiency. Large hospitals can have the benefit of economies of scale (Khan and Luce 1992), which can lead to efficiency gain. On the other hand, large hospitals can also have the burden of excess manpower, which causes inefficiency (Wang et al. 1999). One of the problems with the former results is that the research was conducted in metropolitan as well as urban areas. Therefore, the location could have had an effect on efficiency. Efficiency research of the health care system of the U.S. did find differences that were contributed to the concentration of hospitals in metropolitan statistical areas (MSA) (Bates, Mulherin, and Sorenson 2008; Baker et al. 2000).

Efficiency studies where competition was measured by a Herfindahl Hirschman index (HHI) showed a positive relation between efficiency and competition (Rash 2001). This suggests that microeconomic theory about the efficiency of profit hospitals holds under perfect market conditions. We assume perfect market conditions more likely in a competitive market environment. Therefore we formulate the following hypothesis:

**Hypothesis 2:** in a competitive environment, profit hospitals are (relatively) more efficient than non-profit hospitals.

We have argued that differences between ownership types are partly due to different maximization goals. Non-profit hospitals are more focused on maximizing community health care. But hospitals converted, as we will discuss in more detail in section 3.1.2, are traditional goals of hospital types have changed. For example, non-profit hospitals do not only maximize social surplus, but also maximize profit (Deere and Mason 2002). This means that the traditional view of non-profit hospitals providing health care is no longer valid and that the organizational culture could possess the reason why some research contradicts the hypothesis that profit hospitals are more efficient. In the next section we will take a closer look at the cultural differences between non-profit and profit hospitals.
2.2 **Cultural approach**

Organizational forms studied from a cultural approach can be compared through their range of service. We argue that the cultural differences between non-profit and profit hospitals originate from their social purpose. To demonstrate the effect of culture, one must demonstrate that an individual or group with a specific culture shows different behavior than a group with different cultural elements (DiMaggio 1994). Mutual cultural elements in both profit and non-profit organizations include, among others:

- the sanctity of the healthcare professional. To emphasize the professionalism of the healthcare professional.
- the irrelevance of life, the perception to get better when asking for help at the healthcare organization.
- the rewards of excellence, giving by several quality authorities to emphasize the reputation of organizations.
- to act in the best interest of the patients. The patients do not only get better with the best help, but the organization will try all they can.

What distinguishes non-profit from profit organizations is their social purpose. Historically, non-profit hospitals existed to fulfill a social purpose to provide healthcare for the community, i.e., to answer the right to healthcare for all. In return, tax privileges and other privileges are available for hospitals (Newhouse 1970). Profit organizations traditionally have a different purpose: they have to answer to shareholders who finance their organizations, as was explained in section 2.1.

The consequence of different social purpose between profit and non-profit hospitals results in different ways for maximizing their utilities. Non-profit hospitals would prefer higher volumes by offering a broad range of services in order to answer the demand for healthcare in the community, i.e., outcome maximization. Profit organizations would prefer services that respond to the need of their shareholders by eliminating services that do not meet profitability, i.e., profit maximization. This means non-profit hospitals will maximize their total utilities or treatments, while profit hospitals will maximize their total total profits or utilities or treatments. In other words, because of the different goals between ownership types, the range of service will be different. (Zawadzky, Melnick, and Simonson 1996). From a cultural point of view, we can now formulate the following hypothesis about the range of service differences between hospitals:

**Hypothesis 2:** Profit hospitals have a (relatively) smaller range of service than non-profit hospitals.

Culture has additional effects on hospital structure that are not related to economical motives. These effects are related to the definition of culture. Culture consists of four types of symbolic: norms, values, beliefs, and expressive symbols (Fetzer 1979). Norms and values influence behavior by regulating the boundaries to act within (regulative culture). Beliefs influence behavior by defining the individual needs or drives of the actor (constitutive culture). In a sense, culture can set rules to pursue one's own interest or by general accepted standards (DiMaggio 1994). This means culture defines individual preferences and community accepted restrictions on behavior.
Meyer and Rowan (1977) argue that through institutionalized myths and formal organizational structure, organizations gain legitimacy and stability when being isomorphic with socially accepted myths. In other words, if a hospital can comply with a myth it gains a reason for existence. These myths are institutionalized products, techniques, services, and programs.

Myths are a form of regulative culture, i.e., community accepted restrictions on behavior. For example, a myth can be principles of contract or, more specific, professional rules of practice. These regulative elements affect how the community perceives organizations and how organizations want to be seen.

Health care professionals use pressure groups, courses, and certification to emphasize their professionalism. It underlines trust and legitimacy of own judgment. Under stress of competition, hospitals can emphasize their heritage as provider of health care for the community. It underlines the reason of their existence in the community while their economic reason of existence might be under debate. Consequently, formal organizational structures are, for a part, formed independently of rational economical choices (Oliver 1991; Deeghuize 1996).

However, under stress of the market environment profit hospitals feel the need to specialize, in order to gain competitive advantages like economies of scale and standardization advantages (Stinchcombe 1990). Another consequence of competition is that profit hospitals skin their patient mix and specialize (Ghezart 1985). This means that hospitals are partly driven by economic rationality, especially profit hospitals. Profit hospitals are less likely to use social purpose as an argument to explain their existence in the community. Part of the myth of a profit hospital is to make profit for their shareholders. This means that competition affects how a hospital will use their culture in their advantage. Therefore, competition affects range of service. This means that hospitals have to balance the legitimacy advantages of myths with the stresses of the market environment and economic rationality. Based on this discussion, we can formulate the following hypothesis:

**Hypothesis 4:** Profit hospitals in a competitive environment have a (relatively) smaller range of service than profit hospitals not under competition.

We have argued that the culture of an individual hospital is affected by the different social purpose and that competition affects the range of service of profit hospitals. However, the market environment is not the only environment that influences a hospital. The close social context of an alliance creates a group of hospitals that can exceed the (direct) market environment, and forms a constitutive culture that is equal for all members of the alliance. In the next section we will argue that hospitals that are part of an alliance will behave similarly in terms of efficiency and range of service.
2.3 Sociological approach

Organisational forms studied from a sociological approach can be studied through their relational link with others, in this case alliances. An (strategic) alliance is a “voluntary arrangement between organizations involving exchange, sharing, or co-development of products, technologies, or services” (Gulati 1998). The reason why we look at alliances is based on the embeddedness of economic action in social context (Granovetter 1985). This embeddedness theory suggests that economic action can be placed within the relations between individuals or between organizations. In a sense, the relation between actors influences economical choices. However, social relations will also create a common constitutive culture.

Granovetter (1985) emphasizes that relations between firms are more important than personal relations when looking at economic actions of organizations. Examining alliances can lead to a more comprehensive view of the strategic behavior of firms (Gulati, Nohria, and Zajac 2000). This means that an alliance is a social context formed by social relations between organizations that directly influence the economic behavior and culture within the social context.

In the previous two sections we have argued that, in theory, profit and non-profit hospitals have different economical outcome and different cultural purpose. We have chosen efficiency and range of service to represent the differences in ownership type. Since the alliance embeds economic behavior and cultural purpose, hospitals within an alliance should be equal in economical and cultural terms.

This means that we argue that hospitals mimic behavior from other hospitals. We are interested in to what extent alliances mimic the behavior of their social context and their market environment.

Mimicking behavior is a strategic choice that occurs when information about a market is scarce or available and uncertainty is high. As a result, rational decision making is hard. Indeed, the uncertainty in the health care market is high and information about expenses or demand imperfect, thus mimicking behavior can be expected. As a result, hospitals look in their environment to find better practices or results and try to copy them. This mimicking behavior of hospitals runs through their network ties (Gulaski and Wasserman 1988). This means we expect that mimicking behavior occurs within the market environment of alliances.

We explain three bases of mimicking behavior: frequency based, trail based, and outcome based imitation (Hauschild and Minn 1997). Although the identification of the different imitations is not part of this research, the differences between the three bases of mimicking behavior give useful examples about how alliances could be mimicking.

Outcome imitation assumes organizations mimic behavior of other organizations whose economic return is perceived to be the best. With the economical approach, we have explained economic return through efficiency scores. Since efficiency information can be seen as competitive sensitive information, it is more likely that this kind of information is more reliable for partners and shared with more ease within an alliance. Therefore, an alliance could allocate efficient processes within their social context. An example would be the sharing of profitable treatments from profit organizations to non-profit organizations, as was reported by Iglesias (1983).
Trait imitation assumes organizations mimicking characteristics of competitors within their environment. These traits can be size, status or technical processes. An example of trait imitation is copying expansion plans from competitors, although this could also be an example of outcome mimicking when high outcome is expected.

Frequency imitation assumes organizations mimicking behavior that is practiced by a large amount of other organizations. Frequent behavior gains legitimacy until it reaches a taken-for-granted status. This means organizations imitate these for granted behaviors just because they are frequently practiced (Aligheid 1535). This last kind of mimicking behavior resembles institutionalized myths that give organizations legitimacy.

We have argued that because of the characteristics of the health care market, hospitals tend to mimic behavior. We have suggested this mimicking behavior to be more present within an alliance, since the network ties between partners are stronger. From a sociological point of view we can formulate the following hypothesis about alliances:

**Hypothesis 5:** Hospitals within an alliance are relatively more affected by mimicking behavior, making the efficiency scores and range of service more alike.

We argue that resource sharing and trait skimming are of more importance in a high competition environment, because they are essential for survival. This suggests that the market environment is affected by alliances. We argue that efficiency and range of service of an alliance is affected by the dominant partner or the dominant alliances in the market environment. Because competition within and outside alliances increases just by the presence of an alliance, causing hospitals to react (Ireland, Hitt, and Venkatraman 2002).

**Hypothesis 6:** In a competitive environment, alliances are relatively more affected by mimicking behavior, making the efficiency scores and range of service more alike.

We have argued that alliances mimic efficiency scores and range of service within their alliance and in a competitive environment. In the next section we will explain why the three approaches of the MMM gives a more comprehensive view of market behavior of hospitals.

### 2.4 Conceptual model, synthesis between the approaches

The concept of the MMM is to form a middle course for the three approaches as described in sections 2.1 to 2.3. Interaction between the approaches allows for multi-dimensional solutions without being restricted by undermining basic market assumptions, which are called the under-idealized and over-idealized aspects of economic behavior. In this section, we will explain those two undermining market assumptions and explain the added value of the MMM.
2.4.1 Undersocialized aspect of economic behavior

Adam Smith (1776) argued in the "Wealth of Nations" that perfect information and perfect competition is the basis for a free market environment. In this market environment, an invisible hand will lead the market to a stable optimum. The idea of the invisible hand forms the basis for classical economic theory, where economic action is a result of atomized human behavior (Granovetter 1985). This implies that social relations are not an important part of economic action. This is called the undersocialized conception of human action and is more appropriate to the economic approach.

The reality of the health care system is different, caused by uncertainty and imperfect information (Arrow 1963). Under this uncertainty, organizations find a way to make their organization successful. For example, by maintaining relations between suppliers of medical products and hospitals to create a bond of trust that decreases uncertainty about the delivery of materials. This has a direct effect on the reputation of both parties and the economic outcome of the hospital (Sutton 1997). The discussed economic efficiency comparison between ownership types (section 2.1), leaves relations and cultural differences underestimated.

2.4.2 Oversocialized aspect of economic behavior

The fundamental basis of the cultural and sociological approaches lies in the oversocialized conception of man (Wrong 1962). This conception implies human behavior to be responsive to regulative culture. Systems, norms, and values are created just to be consulted with the general accepted opinions of the community, even without questioning these opinions (Granovetter 1983). This is in contrast to real life. Individualism is part of human behavior and rational based economical choices are made by individuals and therefore by organizations. This means that disobedience to regulative culture does happen.

Granovetter (1985) suggests that disobedience can be explained through the social context of the action. Acting on social exception rules without acceptance is called the oversocialized aspect of economic behavior, because social expected values are the rules of which all behavior is subordinate.
2.4.3 Synthesis between the three approaches

Both over- and undersocialized conceptions view human behavior as subordinate to the opinion of the community or to the invisible hand of the market. In reality, social context allows for disobedience of general accepted rules. This means that hospitals will not always show the expected patterns based on theories that have undermining market assumptions.

In reality, there is interaction between economic and non-economic factors, but this interaction is hard to show (Zeiler 1988). An example would be the mimicking behavior of hospitals based on the success of a hospital. This economic behavior can be observed in the market environment by all other hospitals providing interaction between all hospitals. This suggests every "special category of social relation" (Zeiler 1988) to interact with economic behavior as a result. Fortunately, the three approaches all have clear variables that can be measured, making every approach a power tool for exploring efficiency differences between hospital ownership types. When we are able to explain unexpected results from one of the approaches by using the results from the other two, we will have shown the added value of the MNIM (see Figure 1).

![Multiple Market Model Diagram](image-url)
3 Introduction to the background of this research

We perform our research with hospital data from the state of Florida, U.S. We have chosen for the state of Florida since it has a free healthcare market environment. Observations in a free market environment are least contaminated with external influences (like governmental interference), which means that the influence of the invisible hand can be observed in the Florida market environment. Florida is also an interesting location for this research, since there are many different hospital types there, therefore making comparison between hospital types possible.

In this section we give an overview of three periods in the history of healthcare in Florida, the multiple hospitals system, the conversion movement, and the third malpractice crisis. But first we show some demographic characteristics in Table 1 and introduce some main demographic characteristics.

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</tbody>
</table>

Table 1: Characteristics of Florida; Sources: (Data Center for Health Statistics 2006); (Office of Planning, Evaluation & Data Analysis 2007); (U.S. Census Bureau 2007)

Florida, one of the southern states, had a population of 16 million in the year 2000 and around 18 million in the year 2004. Of these residents 16.8% are aged above 65 years. The ageing population causes extra stress on the health care system.

In total, around 2,000,000 resident of the state Florida underwent a medical procedure in the year 2004. Personal health care spending was $75.9 billion in Florida in the year 2001. The Organisation for Economic Co-operation and Development (OECD) has calculated that the United States has the most expensive health care system with health care spending accounting for 17.3% of the gross domestic product (GDP) and the highest spending per capita of $5,100 in 2004 (OECD 2006). The GDP of Florida is with $550 billion almost as high as the Netherlands, although the Netherlands spend 8.3% of their GDP on health care in 2009.
One of the problematic chronic diseases in Florida is obesity. Obesity has reached epidemic proportions in the U.S., where an estimate of 20% of the population is obese. Economic costs are estimated around $300 billion and 40 million workdays lost annually. Besides the health risk involved with obesity, patients suffer from emotional burden due to prejudice or discrimination on the job market (Weilman and Freedberg 2012). The stress of both obesity and the aging population can be seen in the overcrowding of emergency rooms (ER). These ERs have limited and safety net functions that undergo capacity problems due to excess health care demand, especially in urban areas.

The World Health Organization (WHO) argues that the U.S. can be split into three separate parts: the rich, the average, and the poor. Only the rich top 10% receive top health care and the poor top 10% receive health care comparable to the health care of sub-Saharan Africa (The Economist 2000).

In comparison to other U.S. states, the state of Florida is placed 41st on health system performance (Commonwealth Fund 2007) and the U.S. is placed 32nd in comparison to the rest of the world, just above Slovenia, in the WHO world’s health system ranking. Nevertheless, the state of Florida is a rising “New South” state with high GDP and personal incomes surpassing most other U.S. states.

3.1.1 The multiple hospital systems (1965-1980)

During 1965-1980 two dramatic structural and behavioral changes occurred (Sloan and Vissel 1983).

The first major change had an effect on proprietary hospitals and corporate multiple hospital systems. The small proprietary hospitals owned by a handful of doctors decreased in number. A proposed reason for this decrease is the increase in innovations in medicine and technology, which increased the minimum efficient size of a hospital making small hospitals no longer profitable. Multiple hospital systems (both investor owned, and not for profit) emerged as a result of financial efficiency (Jags 1983), especially in Florida which could this effect be seen resulting in 9.2% multiple hospitals systems with more than three hospitals (Centers 1982).

The second major change had an effect on traditional business ethics. Changes in the environment, such as medical innovations, created demand for new financial needs and expertise. The hospital industry moved towards competition thinking (Sloan and Vissel 1983).

In a time of growing market function and efficiency thinking concerns about uncompensated care were answered by government regulation. Two regulations were issued. Medicare was decided by the U.S. government in 1965 to provide health care in the elderly (above 65). Medicaid was decided by the Florida state (in cooperation with the U.S. government) in 1970 to provide health care to indigent people.
3.1.2 The conversion movement (1980-1990s)

During the period 1980-1990 Florida was one of the four states with the largest number of public hospital conversions towards profit organizations (Needleman, Chiller, and Lamphere 1997). Most hospital conversions occurred among government hospitals. Most of these conversions were described as a result of the unwillingness of the community to provide tax support. Before the 1980-1990 period non-profit hospitals were given tax advantages over profit hospitals, a large part of these tax advantages disappeared. This meant that some non-profit hospitals were no longer economic feasible. A given reason for the high conversion percentage in Florida was the lack of a process to monitor community benefits or to oversee efficiency changes within the health care sector. As a result, researchers questioned the remaining safety net for the indigent.

Consequence of the non-interest of the state of Florida in the conversion surge was that uncompensated care in previous public hospitals decreased (Needleman, Lamphere, and Chiller 1999). Although it is not clear if the safety net for the poor was shrewdly, it did have an effect on the capacity to serve the community needs for uncompensated care. The capacity of the safety net was affected since the traditional purpose of public hospitals was to provide community health care needs. With the conversion of public hospitals towards profit hospitals capacity to provide public health care was lost.

The rising health care costs, the reluctance to provide tax benefits for public hospitals, the conversion of these hospitals to profit hospitals, and the charge business ethics towards competition thinking gave the impression that providing for the poor was not part of any mission statement. As J. Goldsmith, enthusiast of free markets, stated at the 1985 Cornell University Medical College conference, "I don't see the marketplace doing anything for the poor" (Lluch 1985).

Halfway the 1990s managed care affected the U.S. health care market by its growing number of enrollees. Managed care exists in many forms, but is in general a payment system based on the number of enrollees instead of the number and quality of treatments. This has transformed the hospitals into cost centers (Shortell, Gillies, and Devers 1995).

Former legislation restricted managed care but when this legislation changed into encouraging preferred provider organizations (PPO) growth of enrollees escalated. This escalation changed the HMO market (a form of managed care). Permitting participation of HMO in Medicare under the Balanced Budget Act of 1997 has made the growth of health plans complete, although requirements that limit its growth have not totally disappeared (Glied 2000).

A second reason for the popularity of managed care is the way it responded to the health care market characteristics as reported by Arrow (1963). Managed care divides health consumers according to risk by making some packages more appealing for certain patient groups. This reduces the traditional problem of information asymmetry. Managed care can restrict, by contract, costly technologies, or stimulate supply-side cost sharing. As a result, health care providers have fewer incentives to create more ranges of service. This reduces the problem of moral hazard.
Managed care has focused competition between healthcare providers based on the maximum added value, in other words cost reducing. This might reduce the problem of formal, and informal barriers to competition (Glied 2000).

The transformation of hospitals toward cost centers—caused by managed care—caused the debate about the quality and accessibility of healthcare. The consequence of managed care is that hospitals narrowed their range of service to services with lower expenses. The high costs services were placed outside the hospital in specialized facilities, which were presumed to be more cost effective. The empty beds within hospitals were not replaced, or removed, which increased the excess inpatient bed capacity up to 50% in some hospitals.

A positive situation occurred from 1993 to 2000 when the percentage of NHE of the GDP remained stable. This stability was in line with the changing nature of Medicare Health Maintenance Organization (HMO) benefit package, the decline in premium, and extra benefits since 1994 (Hamphreus et al. 1997).

3.1.3 The third malpractice crisis (2000’s)

During the period after the year 2000 the stable percentages of National Health Expenditure (NHE) spend on Gross Domestic Product (GDP) ended. The rise of the stable expenses is in line with the third malpractice crisis and insurance market instability, especially this third crisis is important, since it affects the period of this research.

The resulting market instability is related to an increase of malpractice insurance premiums, which caused temporary shutdown of facilities, early retirement of physicians, and reluctance to perform high-risk procedures (Halle 2004). Florida state is one of the 20 states in full-blown crisis, exceeding base rate premiums with 10% (Drano, Grob, and Shikawa 2000). The malpractice crisis has no negative impact on the range of services in rural areas (Brack et al. 2004).

3.1.4 Summary of the background of this research

The state of Florida has had many different problems facing the healthcare system. Costs were the reason to question the organization of healthcare institutions and are still a subject of concern. The malpractice crisis is seen as a direct problem to the capacity of the healthcare system.
Measurement and source of data

In this chapter we will explain how we have measured the dependent and independent variables and how we have collected the necessary data. We will start by presenting the data sources. We will then explain how we have measured the independent variables of which some are used in more than one approach within the MMM. Finally, we will discuss how we have measured the dependent variables. We will draw a conclusion about the measurement of efficiency used in the economical and sociological approach.

Full time equivalent (FTE) is excluded from the measurement of human resources, because of their high correlation with the number of beds within a hospital and because of data constraints on human resource collection. This leaves two input and two output variables for the efficiency measurement.

4.1 Source of data

The data used to test the hypotheses was primarily collected from the inpatient dataset of the Agency for Health Care Administration (AHCA) (see disclaimer in the appendix), the American Hospital Directory (AHD) website (2004) and the AHCA (2004) public Florida health compare website. The U.S. Census Bureau website and the Department of Justice website were also used to collect data.

We assume the collected data to be valid, as hospitals are compelled by law to provide data to the AHCA and to the Florida health compare database. The AHD website claims to use only reliable sources.

Table 2 gives an overview of the used variables, their names, and their sources.
### Table 2: Variables and Sources of Data

<table>
<thead>
<tr>
<th>Variable names</th>
<th>Sources</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Profit: Governmental Hospital, City, County, State or Other</td>
<td>- Agency for Health Care Administration [Agency for health care administration (A-HCA) 2007]</td>
<td>Recent, 2007</td>
</tr>
<tr>
<td>Voluntary Nonprofit: Church or Other</td>
<td>- Individual websites of Hospitals, and ASC</td>
<td>Recent, 2007</td>
</tr>
<tr>
<td>Size: Number of beds</td>
<td>- A-HCA</td>
<td>2000-2004</td>
</tr>
<tr>
<td>Competition: HHI</td>
<td>Department of Justice [Justice 2001, Cover Story (Rhodes 1993)]</td>
<td>2000-2004</td>
</tr>
<tr>
<td>Output: Y1: Number of patients, Y2: Length of Stay (LOS)</td>
<td>- A-HCA</td>
<td>Recent, 2007</td>
</tr>
<tr>
<td>- Florida Department of Health [Florida Department of Health 2007]</td>
<td>Recent, 2007</td>
<td></td>
</tr>
<tr>
<td>Service Mix: Range of services (11 ICD-9-CM Chapters)</td>
<td>- A-HCA</td>
<td>2000-2004</td>
</tr>
</tbody>
</table>

### 4.2 Measurement of Independent Variables

In this section, we will explain the measurement of the independent variables.

#### 4.2.1 Ownership type

Ownership types were collected from the A-HCA Florida health compare site and from the AHD website. A hospital has one ownership label that does not change over the years, because only recent (or until inactive state) information could be collected. We presume ownership types did not change significantly in the period 2000 to 2004. This assumption is reasonable, since most ownership conversions have stopped after the year 2000, which is before the studied period of this research [Robson 2004].

#### 4.2.2 Alliances

Alliances were collected by visiting the individual websites of health providers and organizations. We assume hospital websites to give information about their type of alliance and who are the participants. If not all since is mentioned, no alliance is presumed. Most recent alliance data was collected. This means we will compare the explanatory variables and dependent variables for the year 2004.

We identify five combinations or types of alliances:
4.2.3 Metropolitan statistical area

Metropolitan statistical areas (MSA) were collected from the U.S. census bureau and are defined by the Office of Management and Budget (OMB). The CSA definitions of 2004 were used as a reference, which are based on the 2000 MSA standard. The MSA concept has been successful as a statistical representation of the social and economic images between urban cores and outlying integrated areas (Federal Register 2000).

For statistical reasons, use of a logistic regression, MSA is a single dichotomous. Cut-off points are areas with more than 200 hospitals, where large MSAs are labeled 1. The MSA that are labeled as large are: Miami-Fort Lauderdale-Pompano Beach, Sarasota-Bradenton-Venice, and Tampa-St. Petersburg-Clearwater.

4.2.4 Competition

We use the Herfindahl-Hirschman index (HHI) to measure the level of concentration in a market as a measurement for competition. The HHI has been used in most hospital market studies as a proxy of concentration and competition (Delmar-Mattaromadas and Fulghum 1998). The HHI is defined by squaring the market share of each firm and then summing the squares, as presented in the following.

\[
HHI = \sum_{i=1}^{n} S_i^2
\]

Where \( S_i \) represents the market share of firm \( i \) in MSA \( j \) with a total of \( n \) firms in the market.

We have measured market share as a percentage of share of total hospital beds of the organization within their MSA, or state wide data. Discharges can also be used as a measurement of market share, but because of the heterogeneous treatments causing variable bias, beds were chosen (Gresenz, Rogowski and Eisenstein 2004).

This HHI gives weight to large firms with a high contribution to the outcome in terms of production units, in this case the total number of patients. Economic argument in this weight is that with large firms controlling large portion of the outcome, competition in the market will be weak (Shanettes 1993). The HHI reaches a maximum of 10,000 (One firm with 100% of outcome makes 100² - 10,000), and a theoretical minimum of zero. For example, 100 firms with equal market share will have a HHI = 100. This means a lower HHI represents higher competition. The U.S. Department of Justice and the Federal Trade Commission uses the HHI to detect unlawful mergers, and states:

- HHI equal to or between 1,000, and 1,800 to be moderately concentrated (for our study no competition).
- HHI above 1,800 point highly concentrated (in our study competition).
• HHI below 1.000 points not concentrated (in our study no competition).

We have dichotomized competition, because we will use a logistic regression to measure the predictive effect of competition on efficiency.

4.2.5 Size

The total size of a hospital was measured by the total number beds of the organization. Previous research reports the efficient number of beds for hospitals is between 200-300 (Wang et al. 1999). We have divided organizations in three categories: less than 200 beds, equal to or between 200 and 300 beds, and more than 300 beds. To perform logistic regression, we have dichotomized the three categories into: equal to or less than 300 beds, and more than 300 beds.

4.3 Measurement of dependent variables

In this section we will examine the measurement of the dependent variables. Brackets behind the header of the subsections indicate the approach for which the variable is used.

4.3.1 Efficiency (Economical and Sociological approach)

Efficiency is defined as relative technical efficiency. Technical efficiency is producing the maximum amount of output with a minimal amount of input. An organization is technically efficient when it operates on its production frontier (Hollingsworth, Dawson, and Maniacakis 1999). The second type of efficiency is allocative efficiency. An organization is regarded allocation efficient when it minimizes costs with a certain price of input, revenue or output. Technical and allocative efficiency combined are called overall efficiency. Technical efficiency is a robust way to compare grouped hospital efficiencies (Hollingsworth and Street 2006).

4.3.2 Data Envelopment Analysis

We use data envelopment analysis (DEA) to measure technical efficiency, since this is a robust way to measure general hospital group efficiencies (Holland and Aker 2001; Oscar and Luke 1992; Hollingsworth and Street 2006).

DEA uses decision making units (DMU) that can have multiple inputs and multiple outputs. In our research, those DMU's are represented by the hospitals. DEA measures relative production frontiers using weighted inputs and outputs. The weight of the resources is defined by the DEA model (Wasserman 2003).

\[
\begin{align*}
\max \ h_0(u,v) &= \sum u_j y_{jx} / \sum v_j x_{jx} \\
\text{subject to} & \quad \sum u_j y_{jx} / \sum v_j x_{jx} \leq 1 \text{ for } j=1,...,n, \\
& \quad u_j, v_j \geq 0 \text{ for all } j \text{ and } r.
\end{align*}
\]

Figure 3: DEA model by Cooper, Seiford, and Zhu (2004)

DEA software calculates the maximum of a DMU as the sum of weighted output y, divided by the sum of weighted input x, (see Figure 3). This calculation is performed under the following restrictions: efficiency can not be larger than 1, and the weight of a resource is presumed larger than 0 (Cooper, Seiford, and Zhu).
2004). For further reading we suggest Coelli (1998) for an introduction on DEA, and Wassenberg (2001) for a thorough explanation of DEA and DEA software.

After choosing the DMUs, we have to define input and output variables. Since we exclude teaching hospitals, we can define output variables as the length of stay of all patients (an undesirable output) and the total amount of patients treated of every DMU. Input variables represent the hospital resources: workforce and materials (beds).

Data on human resources could not be collected in the years 2000-2004, so we have calculated the correlation between actual resources (see Figure 4). Because human resources show a high correlation (large than 0.5) with material resources, we can exclude human resources from the technical efficiency analysis. This makes the individual technical efficiency less accurate, but this has no major effect on this research, since we are interested in comparing grouped hospitals. We are interested in the relative difference between groups ownership types instead of claiming efficiency of an individual hospital over other hospitals. Besides, we use two other approaches: cultural and sociological, to make our statement about the differences between ownership types more accurate.

Summarizing the chosen input and output variables, we state:

Input:
- X1: General/surgical beds
- X2: Special care beds

Output:
- Y1: Number of patients
- Y2: Length of Stay (LOS)

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>General/ surgical beds</th>
<th>Special/ long term beds</th>
<th>FTE Staffing</th>
<th>FTE Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>General/ surgical beds</td>
<td>1</td>
<td>.409(**)</td>
<td>.314(**)</td>
<td>.548(**)</td>
</tr>
<tr>
<td>Special/ long term beds</td>
<td>.409(**)</td>
<td>1</td>
<td>.652(*)</td>
<td>.634(*)</td>
</tr>
<tr>
<td>FTE Staffing</td>
<td>.557(**)</td>
<td>.652(*)</td>
<td>1</td>
<td>.812(*)</td>
</tr>
<tr>
<td>FTE Others</td>
<td>.548(**)</td>
<td>.652(*)</td>
<td>.812(*)</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 4: Summary of correlation between input variables. ** Correlation is significant at the 0.01 level (2-tailed).

DEAfrontier™ software was used to calculate DEA in Excel. This application’s main advantages are the calculation of slack, environment variables and undesirable models (we will discuss these terms further on). A disadvantage of the software version we have used, is the maximum of 200 DMUs. For further reading on this program, we suggest Zhu (2003).

An assumption of the DEA method is that decreasing input and increasing output will lead to more efficiency. In this research, LOS does no necessary result in a positive efficiency when it increases. This is called an undesirable variable. Therefore, we have used an undesirable DEA model where we can indicate such undesirable variables and still calculate the cost frontier.
The DEA software lets us choose between output or input models. The distinction between both models is defined by what the organization intends to maximize. The output model is chosen because we argue that the hospitals' goal is to help as much patients as possible. This means we suspect hospitals to maximize their output with a given input.

Secondly, the DEA software lets us choose between constant or variable return to scale (VRS). The distinction between both options relies on the question whether organizations of different size can be explained without biased effects. VRS is chosen because we argue that hospitals can be best compared with hospitals of the same size in terms of input and output variables.

Therefore, we have chosen an output envelopment model with a variable return of scale (VRS).

Before explaining the calculation and use of efficiency scores in this research, we have to discuss the disadvantage of the chosen DEA model. The DEA analysis, in general, is sensitive to outliers, because of the extreme way it uses the frontier method. There are easy and efficient methods for compensating for outliers, but with these methods super-efficiency must be calculated (Banker and Chang 2006). We did not find a way to calculate super efficiencies with the chosen undestable output VRS DEA model. Therefore, outliers are not compensated for.

After choosing the DEA model, efficiency scores can be calculated. For every year, one single average efficiency score for the total hospital sample was calculated. The efficiencies were calculated by DEA frontier software, which is an add-in of Microsoft Excel.

Environmental disturbance on efficiency differences can be calculated with a two-stage method (Coelli, Rao, and Battese 1998). The first stage is calculating efficiency score; the second stage uses a logit regression model to predict the effect on the explanatory variables.

The first step involves the calculated efficiency score (EE). These efficiency scores are dichotomized: technically efficient are those hospitals with efficiency score of one. All other hospitals are regarded inefficient (Cooper, Seiford, and Zhu 2004; Ogun and Ogun 2002). Thus, the first step gives a score of 1 to technically efficient hospitals, while all other hospitals are given a score of 0. The second step uses logistic regression to predict the effect of the explanatory variables on efficiency (Ogun 1998).

A disadvantage of this method is that it gives contaminated results when variables are highly correlated, which is partly the case. Another disadvantage is that it partly ignores slack. Advantages, on the other hand, include its simplicity and the wide variety of research for which it can be used.

As mentioned before, the ability of the DEA software to calculate slack is a big advantage. Slack is the amount of resources that should be decreased or increased in order to perform on the optimum cost frontier.
We have chosen a DEA model that fits the data, is able to calculate technical efficiencies and can report which resources should be allocated to become technically efficient.

4.3.3 Range of service (Economical and Sociological approach)

The dependent variable range of services is defined through the 15 chapters of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9CM). The ICD-9-CM consists of one of a classification system for surgical, diagnostic, and therapeutic procedures.

We measured these chapters by measuring the maximum number of different groups in a hospital over a year. This means a hospital that uses two chapters, one of which is used only once a year will be given a range of service of 2.

Depending on the number of ICD-9-CM chapters, the range of service a hospital offers will be higher. Because the range of services is normally distributed, we group this variable into three categories. These categories are based on a histogram of all hospitals for a year. We noticed a peak on both ends of the total number of chapters used. Therefore, we classified the chapters into:

- Small ranged hospitals have less than 6 chapters
- Moderate ranged hospitals have between 6 and 15 chapters
- Large ranged hospitals have 16 or 17 different chapters

Besides being grouped into three categories, the range of services is also dichotomized to be used in logistic regression. We have grouped small against large, with a cut-off point at 5 different chapters, with large labeled 1. And we have grouped large against small, with a cut-off point at 15 different chapters, with large labeled 1. With these two groups we can compare the effect of the mediator group on very small range and very large range hospitals, as well as the effect on both ends of range of service.

4.4 Statistical approach

We will use the statistical software SPSS to support our results and conclusions. Exceptional methods will be described separately for each approach.

We will use data envelopment analysis (DEA) software to calculate the dependent variable: efficiency. Efficiency scores are calculated for the total population for every year of this research period. This means we have five efficiency score calculations.

We will use ANOVA to compare the range of services of a hospital. Section 2.2 discusses why we have chosen the range of service to be the dependent variable.

After describing the results of the first four hypotheses, a post-hoc logistic regression will be performed to evaluate the predictive power of the explanatory variables.

As mentioned before, we will use individual hospital websites to collect alliance information. The alliance information gathered is recent information, but will be compared with efficiency information and range of service information of the year 2004.

In the chapter conclusion and discussion, the added value of our approach will be described.
4.5 Research population

The research population is based on inpatient and organizational information of all hospitals of the state of Florida that were active for one, a few, or all years during the period 2000-2004. Excluded are:

- Teaching hospitals. Teaching hospitals were excluded from the efficiency study, since their resources are also used for education and therefore cannot be compared with non-teaching organizations.
- Freestanding ambulatory surgical centers (ASC). ASC hospitals were excluded since too little information could be collected.

This means that four types of hospitals are part of this research population: Critical access hospitals, long term hospitals, psychiatric hospitals and short term acute care hospitals. Because of the two exceptions mentioned above, rehabilitation hospitals are excluded from this research population. Hospital based ASC's are only included if they shared the same AHCA ID number. This results in a research population of, on average, 161 (exc. 2) hospitals.
5 Results and analysis

In this chapter we will present the results and analysis of the hypotheses formulated in chapter 2. First, we will give a description of the research data. We will specify the different hospital types, show the MSAs in a competitive environment, give a description of the alliances and specify the variables that are used to measure the efficiency score. In the introduction to the data, we will show that efficiency scores differences are significant between hospital types and unrelated to casemix differences. Therefore, we focus our analysis to short term acute care hospitals.

Subsequently, we will analyze the hypotheses one by one. After the first two hypotheses, we give a small conclusion and calculate the predictive value. We conclude this chapter with a summary of the results and analysis.

5.1 Introduction to the data

The total number of profit and non profit hospitals show little variation over the years. The difference in the total amount of hospitals has a maximum 3 hospitals within a year.

We analyze efficiency differences between hospital types and case mix variables, since the nature of the illness influences the length of stay and the efficiency score. Long term hospitals will not have the same amount of patient discharges as short term hospitals, because long term patients obviously have a longer stay at the hospital than short term patients. Therefore, efficiency scores will be different.

The results of comparing efficiency with hospital types show large efficiency differences that are only related to the different types. To further support this statement, we have tested correlation between two casemix variables and efficiency.

We have used percentages of patient's labeled emergency and patient length of stay (LOS) longer than 2 days as the two case mix variables. We performed regression for the four hospital types for the years 2000 and 2004. LOS longer than two days had a small effect on efficiency for critical access hospitals with a confidence interval of 0.02 to 0.04 for both years. A scatter plot analysis of critical access hospitals proved this difference to be 0.03 efficiency points.

All other hospital types showed no linear relation between the case mix variables and efficiency. This is surprising, as one would expect hospitals with a high percentage of emergency patients to be less efficient, as emergencies are harder to plan. Analyzing scatter plots of all combinations showed more variance in efficiency for hospitals with around 60% of LOS longer than 2 days (see appendix for scatter plot in figure 3). Since the differences between efficiencies are not related to casemix differences and since efficiencies are very different between hospitals types, we have chosen the hospital type with the largest number hospitals to analyze the hypothesis: short term acute care hospitals.
5.1.1 Description of the population and MSA with competition

Table 4 shows the description of the location and number of hospitals located in a market environment under competition for the year 2004. Short term acute care hospitals are counted and shown between brackets. The hypotheses based on a competitive environment are tested with information from the four specified MSAs.

Table 4: Division of competition, 2004

<table>
<thead>
<tr>
<th>Competition in the year 2004</th>
<th>Hospital Count</th>
<th>Concentration number (HHI) Mean (s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(count for Short term acute care hospitals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No competition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSA's not specified</td>
<td>40 (36)</td>
<td>467 (2822)</td>
</tr>
<tr>
<td>Miami-Ft. Lauderdale-Pompano Beach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sarasota-Bradenton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tampa-St. Petersburg-Clearwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total in competitive environment</td>
<td>51 (36)</td>
<td>354 (199)</td>
</tr>
</tbody>
</table>

5.1.2 Description of the population and alliances

Table 5 shows the description of the hospital alliances. Most hospitals (71%) form an alliance with other hospitals. Because of the large percentage of alliances, independent hospitals have a small effect on the mean efficiency. This means that the behavioral differences between ownership types can be contributed to the large percentage of alliances within the state of Florida.

Of the short term acute care hospitals, 72% (47) have formed an alliance and 28% (38) have not. Five (5) alliances combine more than one hospital type (28%) and 17 (72%) are all short term acute care hospital alliances.
All alliances have short term acute care hospitals, some combine short term acute care hospitals with other hospitals types, and all but one alliance have outpatient facilities.

<table>
<thead>
<tr>
<th>Type of Alliance (short term acute care)</th>
<th>Number of Alliances</th>
<th>Total hospitals with n Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Alliance</td>
<td>0</td>
<td>38 (28%)</td>
</tr>
<tr>
<td>Alliances</td>
<td>9</td>
<td>44 (33%)</td>
</tr>
<tr>
<td>Profit dominance and sole profit alliance</td>
<td>3</td>
<td>1 (11%)</td>
</tr>
<tr>
<td>Non-profit dominance and mixed alliance</td>
<td>14</td>
<td>31 (23%)</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>135 (100%)</td>
</tr>
</tbody>
</table>

Table 5: Descriptive statistics alliances of short term acute care hospitals, 2004

5.1.3 Description of the population and efficiency variables

Table 6 shows the descriptive statistics of the input and output variables used for the data envelopment analysis (DEA) measurement. The input and output variables show large variations, which can be contributed to the different sizes of the hospitals. During the period 2001-2003, some hospitals had an extreme patient uptake that can be seen in the enormous differences between total numbers of patients. Length of stay (LOS) is measured in days and treatments that take less than one day are measured as 1 day. Consequently, hospitals with a high percentage of admissions of less than one day are awarded with a higher output variable, resulting in a potential higher efficiency score.

<table>
<thead>
<tr>
<th>Average per hospital Years</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof Input variable:</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>General/surgical beds</td>
<td>181</td>
<td>180</td>
<td>181</td>
<td>182</td>
<td>179</td>
</tr>
<tr>
<td>Special/long term beds</td>
<td>32</td>
<td>32</td>
<td>33</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Output variable:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients</td>
<td>11422</td>
<td>12482</td>
<td>13086</td>
<td>12419</td>
<td>11676</td>
</tr>
<tr>
<td>Total LOS</td>
<td>43205</td>
<td>41829</td>
<td>44150</td>
<td>43174</td>
<td>43203</td>
</tr>
<tr>
<td># patients/total LOS</td>
<td>0.238</td>
<td>0.208</td>
<td>0.206</td>
<td>0.268</td>
<td>0.277</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Prof. Input variable:</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>General/surgical beds</td>
<td>180</td>
<td>181</td>
<td>180</td>
<td>177</td>
<td>177</td>
</tr>
<tr>
<td>Special/long term beds</td>
<td>41</td>
<td>41</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Output variable:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients</td>
<td>14919</td>
<td>17313</td>
<td>13313</td>
<td>16959</td>
<td>19676</td>
</tr>
<tr>
<td>Total LOS</td>
<td>44920</td>
<td>52213</td>
<td>54064</td>
<td>53310</td>
<td>53140</td>
</tr>
<tr>
<td># patients/total LOS</td>
<td>0.382</td>
<td>0.326</td>
<td>0.326</td>
<td>0.313</td>
<td>0.305</td>
</tr>
</tbody>
</table>

Table 6: Descriptive statistics input and output variables
5.2 Result and analysis of the hypotheses

In the previous section, we have given a description of the data and made a decision about the focus of our research. We will now use this data to test the hypotheses formulated in chapter 2. Because the differences between hospital types are only related to the different hospital types and short term acute care hospitals are by far the most present hospital type in our research data, we will focus on these hospitals specifically.

We will analyze the hypotheses one by one. We will give a short conclusion after the first four hypotheses, because the first four hypotheses focus on ownership differences and the last two focuses on all cases.

5.2.1 Analyzing hypotheses one and two

The first two hypotheses were formed from the perspective of economic theory. Based on economic theory we have formulated the following hypothesis in section 2.1:

Hypothesis 1: Profit hospitals are (relatively) more efficient than non-profit hospitals.

Based on economic theories, profit hospitals should be more efficient. Table 7 shows the results of the efficiency analyses for the ownership types. Because efficiency scores did not show normal distribution, we used the Wilcoxon rank test to test this hypothesis (Ozcan, Wagner, and Mau 1998). Because we use the Wilcoxon rank test, we analyze the null hypothesis if the distribution of efficiency scores between profit and non profit hospitals is equal.

The Wilcoxon results show that the distribution between profit and non profit hospitals for the years 2001 and 2004 are equal (p > 0.08). The insignificant difference for the year 2001 can be attributed to the large deviation of efficiency scores (see appendix figure 7 for histogram). This means that the differences in efficiency means between profit and non profit hospitals is not significant, making profit hospital as efficient as non profit hospitals.

For the years 2000, 2002, and 2003 distribution of the efficiency scores for the ownership types are not significantly different (p < 0.05). This points out that the difference in efficiency mean between profit and non profit hospitals is significant, where profit hospitals are less efficient than non profit hospitals.

These results reject hypothesis 1, but confirm most health care research about efficiency. We have shown that non profit hospitals are more or equally efficient compared to profit hospitals during the period 2000-2004; this suggests that profit maximization of profit hospitals is not measured by their efficiency. Another possibility is that shareholders are content with the profit they receive and does not need a higher efficiency score. This result also suggests that the maximization goal of non profit hospitals leads to a higher efficiency (e.g. productivity).
<table>
<thead>
<tr>
<th>Years</th>
<th>2010</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>(s.d.)</td>
<td>Mean</td>
<td>(s.d.)</td>
<td>Mean</td>
</tr>
<tr>
<td>Efficiency</td>
<td>.933</td>
<td>(.052)</td>
<td>.948</td>
<td>(.031)</td>
<td>.946</td>
</tr>
<tr>
<td>Profit</td>
<td>.936</td>
<td>(.041)</td>
<td>.948</td>
<td>(.038)</td>
<td>.960</td>
</tr>
</tbody>
</table>

Wilcoxon test of difference of efficiency

<table>
<thead>
<tr>
<th></th>
<th>Z-test</th>
<th>Sign</th>
<th>Difference in means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.192</td>
<td>.13</td>
<td>.012</td>
</tr>
<tr>
<td>Profit</td>
<td>-.192</td>
<td>.23</td>
<td>.030</td>
</tr>
<tr>
<td>Non Profit</td>
<td>.064</td>
<td>.017</td>
<td>.085</td>
</tr>
</tbody>
</table>

Table 7: Efficiency differences between ownership types

As we have argued in section 2.1, we suspect the economic theory about the efficiency of profit hospitals to be confirmed when the market environment resembles a free market. Based on this assumption we have formulated hypothesis two:

**Hypothesis 2**: In a competitive environment, profit hospitals are (relatively) more efficient than non-profit hospitals.

Based on the results shown in Table 8, we can reject hypothesis 2. The results show that under competition, distribution of the efficiency scores of ownership types differs for the year 2000. For 2001 to 2004, the distribution of the efficiency scores is not significantly different with a confidence level of p < .005. We have shown that profit hospitals under competition are not more efficient than non-profit hospitals. This implies that, even under competition non-profit hospitals have equal or higher efficiency scores.

<table>
<thead>
<tr>
<th>Years</th>
<th>2010</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>(s.d.)</td>
<td>Mean</td>
<td>(s.d.)</td>
<td>Mean</td>
</tr>
<tr>
<td>Efficiency</td>
<td>.909</td>
<td>(.051)</td>
<td>.931</td>
<td>(.040)</td>
<td>.941</td>
</tr>
<tr>
<td>Profit</td>
<td>.944</td>
<td>(.043)</td>
<td>.941</td>
<td>(.038)</td>
<td>.947</td>
</tr>
</tbody>
</table>

ANOVA test of difference in efficiency

<table>
<thead>
<tr>
<th></th>
<th>Z-test</th>
<th>Sign</th>
<th>Difference in means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.133</td>
<td>.073</td>
<td>.035</td>
</tr>
<tr>
<td>Profit</td>
<td>-.133</td>
<td>.300</td>
<td>.046</td>
</tr>
<tr>
<td>Non Profit</td>
<td>.037</td>
<td>.028</td>
<td>.009</td>
</tr>
</tbody>
</table>

Table 8: Efficiency differences between ownership types in a competitive environment: defined by MSAs: Miami-Fort Lauderdale-Florida, Beach; Sarasota-Bradenton-Venice; Tampa-St. Petersburg-Clearwater
5.2.2 Analyzing hypothesis three and four

We were unable to show efficiency differences between ownership types to be in favor of profit hospitals, nor could the analysis give a reason why profit hospitals would be less efficient than non-profit hospitals. With hypothesis three and four, we test our suspicion that cultural differences between non-profit and profit hospitals reveal reasons for ownership type differences. The third hypothesis we test is:

**Hypothesis 3:** Profit hospitals have a (relatively) smaller range of service than non-profit hospitals.

Table 9 shows the descriptive statistics of the range of service for short term acute hospitals and ownership type. Striking are the percentage small range non-profit hospitals in relation to profit hospitals. Non-profit hospitals tend to have a smaller range of service than profit hospitals based on a rejection limit of 5%, except in the year 2003. Based on the column percentage difference with a rejection limit of 5% for every year range of service “16 & 17 chapters” on ownership types did not show any significant differences. This means that on average, profit hospitals had the same percentage of high ranged short term acute care hospitals for every year.

The results show that profit hospitals in the years 2000, 2003, and 2004 had more hospitals with a range of service of “16-25 chapters”. In addition, the result show that in the years 2001 and 2003 profit have equal focused (6 chapters) short term acute care hospitals, but in the years 2000, 2002, and 2004 the focus of profit hospitals is lower than those of non-profit hospitals.

Overall, hypothesis 3 is rejected; profit hospitals do not have a smaller range of service than non-profit hospitals. This result suggests profit short term acute care hospitals to be not focusing on services.

It is interesting to note that all hospitals that do focus on a service do not have an outpatient facility. This suggests no skimming of services to more specialized hospitals, although skimming of certain high costs treatments cannot be ruled out since we have only analyzed ICD-9-CM chapters and not the individual treatments of every chapter.

Other interesting observation, when looking at Table 9, is the high percentage broad ranged hospitals. Although, we can not give a definitive reason for this high percentage we suspect two main causes. First, shift of hospitals with 15 ICD-9-CM chapters to 16 chapters. Second, mimicking behavior of hospitals in the same market environment. With the sociological approach we can investigate if mimicking behavior or alliances affect the range of service and thereby give reason for the high percentage of broad ranged hospitals in 2004.

---

1 Rejection limit and cross tab comparison were based on a textbook of Aarts (2007)
**Table 9: Descriptive statistics range of service of short term acute hospitals**

<table>
<thead>
<tr>
<th>Count Column %</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>P</td>
<td>NP</td>
<td>P</td>
<td>NP</td>
<td>P</td>
</tr>
<tr>
<td>&lt;6</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6-15</td>
<td>27.4%</td>
<td>11.1%</td>
<td>4.1%</td>
<td>8.1%</td>
<td>2.8%</td>
</tr>
<tr>
<td>16 &amp; 17</td>
<td>69.5%</td>
<td>68.3%</td>
<td>72.6%</td>
<td>71.0%</td>
<td>65.3%</td>
</tr>
</tbody>
</table>

We suspect profit hospitals to be more affected by economic rationality than non-profit hospitals are affected by social purpose when under pressure of competition (see section 2.2). Based on this assumption we have formulated hypothesis four:

**Hypothesis 4: In a competitive environment, profit hospitals have a (relatively) smaller range of service than non-profit hospitals and under competition.**

Table 10 shows the relation between competition and range of services. In 2004, all short term acute care hospitals have relatively the same high range of service. For the years 2000, 2002, and 2003, profit hospitals have a higher percentage of middle range hospitals. However, this higher percentage of middle range profit hospitals is due to the large number of hospitals that offer 15 different ICD-9-CM chapters. This means we do not accept hypothesis 4. The results suggest that, under competition, both profit and non-profit hospitals offer the same range of services.

**Table 10: Competition and range of service**

<table>
<thead>
<tr>
<th>Count Column %</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>P</td>
<td>NP</td>
<td>P</td>
<td>NP</td>
<td>P</td>
</tr>
<tr>
<td>&lt;6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6-15</td>
<td>25.6%</td>
<td>15.6%</td>
<td>23.1%</td>
<td>25.0%</td>
<td>33.3%</td>
</tr>
<tr>
<td>16 &amp; 17</td>
<td>71.8%</td>
<td>81.3%</td>
<td>71.8%</td>
<td>71.9%</td>
<td>66.7%</td>
</tr>
</tbody>
</table>
5.2.3 Predictive value variables and convergence of efficiency scores and ranges

The previous results show non-profit hospitals to be more efficient. Within an environment under competition, non-profit hospitals are also more efficient, but hospitals not located in a competitive environment do not show significant efficient differences.

We have calculated output slacks to estimate the reason for inefficiencies, see Table 15 in the appendix. By calculating output slack we can identify how much output is not produced given the expected output in relation to the DMUs on the efficient frontier (Wan et al. 2002). In other words, how much the output can be increased given the input.

Consistent with the low occupancy rates found in previous research, hospitals must reduce the number of beds to become more efficient or increase the total number of patient treated. There are two problems with this advice:

First, state regulation restricts hospitals to change their number of beds without considering community health care needs. The Certificate of Need (CON) program ensures that new or expanding services fit in the health care need of a particular community. Therefore, changing the number of hospital beds will take some time and can be considered a long-term decision.

Secondly, safety levels are not taken into account in this research. With uncertain demand, a hospital will have some spare beds in case of unforeseen extra patients. This means reducing the number of beds depends on the chosen safety level, which makes some proposed bed changes redundant.

The presented slacks show that hospitals must consider if they can reduce their total number of beds and balance such an effort against the expected efficiency gain.

The previous results show non-profit hospitals to have a smaller range of services than profit hospitals. Within a competitive environment, both non-profit and profit hospitals offer a broad range of services. The small difference for “G-15” ICD-9-CM chapters can be attributed to the large number of profit hospitals that offer 15 different services (in terms of ICD-9-CM chapters). The difference in range of services could be the reason for the differences in efficiency scores between profit and non-profit hospitals.

We have compared efficiency scores with ranges of services to see if the results show a reason for ownership type differences. Table 11 shows the mean efficiency scores and the standard deviation for 2000 and 2004. Of interest, are the small differences between ownership types and range of service (see column differences). The results suggest a high correlation between efficiency scores and ranges of service. This means the more focused a hospital the higher the mean efficiency scores. Unfortunately, this does not explain ownership type differences, because differences in efficiency scores between ownership types are very small for a given range of services.
Results and analysis

Most interesting is that efficiency scores and ranges of services converge between profit and non-profit hospitals. Differences in mean become smaller over time and standard deviations in 2004 are smaller than in 2000.

<table>
<thead>
<tr>
<th>Efficiency scores by range of service (Means, (s.d.))</th>
<th>2000</th>
<th>2004</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>Non profit</td>
<td>Profit</td>
<td>Non profit</td>
</tr>
<tr>
<td>&lt;5 Chapters</td>
<td>.9750</td>
<td>.9903</td>
<td>.0153</td>
</tr>
<tr>
<td>(1)</td>
<td>(1.0080)</td>
<td>(1.0096)</td>
<td>(1.0014)</td>
</tr>
<tr>
<td>6-15 Chapters</td>
<td>.9742</td>
<td>.9847</td>
<td>.0105</td>
</tr>
<tr>
<td>(0.0209)</td>
<td>(0.0096)</td>
<td>(0.0041)</td>
<td>(0.0014)</td>
</tr>
<tr>
<td>16 &amp; 1/2 Chapters</td>
<td>.9524</td>
<td>.9406</td>
<td>.0118</td>
</tr>
<tr>
<td>(0.024)</td>
<td>(0.034)</td>
<td>(0.030)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Total means</td>
<td>.933</td>
<td>.956</td>
<td>.026</td>
</tr>
<tr>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Table 11: Efficiency scores by range of service

We use logistic regression to analyze the predictive power of ownership type, competition, and range of service on efficiency. Table 12 shows the result of the logistic regression based on dichotomized efficiency scores, where technically efficient hospitals (with an efficient score of one) were labeled one. The results show that the efficiency frontier is dominated by non-profit hospitals. The results confirm that hospital efficiency scores converge, although the predictive value for ownership types on efficiency scores in the year 2004 is still significant (p < 0.05) the odds ratio is very low. In the year 2000, a non-profit hospital had 1.5 times more chance to be technically efficient, whereas in the year 2004 a non-profit hospital had only 1.2 times more chance to be more efficient than a profit hospital. This result confirms convergence of efficiency scores between hospitals for technically efficient hospitals. However, it does not give a reason for this convergence.

<table>
<thead>
<tr>
<th>Efficiency as dependent</th>
<th>2000</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuffel efficiency score of 1.0</td>
<td>B</td>
<td>S.E.</td>
</tr>
<tr>
<td>Ownership</td>
<td>2.604</td>
<td>1.666</td>
</tr>
<tr>
<td>Range</td>
<td>-1.136</td>
<td>1.500</td>
</tr>
<tr>
<td>Competition</td>
<td>.221</td>
<td>.689</td>
</tr>
<tr>
<td>Constant</td>
<td>4.172</td>
<td>1.282</td>
</tr>
<tr>
<td>B</td>
<td>S.E.</td>
<td>Wald</td>
</tr>
<tr>
<td>Ownership</td>
<td>-1.432</td>
<td>.687</td>
</tr>
<tr>
<td>Range</td>
<td>-2.564</td>
<td>1.562</td>
</tr>
<tr>
<td>Competition</td>
<td>-2.557</td>
<td>.635</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.851</td>
<td>1.021</td>
</tr>
</tbody>
</table>

Table 12: Predictors of efficiency; logistic regression for the years 2000-2004, threshold of 1

5.2.4 Suspected reason for convergence of efficiency scores

With the introduction of managed care programs, some research suggests hospitals to focus on efficiencies instead of efficiency. This means a convergence of efficiency scores could be a symptom of equal maximization goals between ownership types. Especially with the end of discriminating tax benefits for non-profit hospitals, hospital goals could be more inline since an external reason for differences vanished.
Convergence of efficiencies could be a sign of mimicking behavior, where the success of non-profit hospitals is adopted by profit hospitals or where resources are skimmed to alter efficiency scores in benefit for profitability. Analysis of hypotheses five and six should confirm these assumptions.

5.2.5 Analyzing hypotheses five and six

We have showed converging of efficiency scores between ownership types and demonstrated focused hospitals to be more efficient, regardless of their ownership type. But we did not find reasons why hospital efficiency scores are converging. In this section, we will analyze our suspicion that the convergence of efficiencies is related to the mimicking behavior of hospitals within an alliance. The fifth hypothesis we test is:

Hypothesis 5: Hospitals within an alliance are (relatively) more affected by mimicking behavior, making the efficiency scores and range of services more alike.

We test this hypothesis by comparing standard deviations of the individual alliances with the standard deviation of hospitals within an alliance. We present the results by grouping alliances by their dominant ownership type. For every group of alliance type we calculate the average standard deviation of the participating alliances. For calculation, see figure 5 in the appendix. This average standard deviation shows the similarity between hospitals within an alliance.

We identify four dominant alliance types: profit dominant, non-profit dominant, and mixed alliances with either profit dominance or no dominance. There are no mixed alliances with non-profit dominance. By grouping the alliances by dominant ownership types, we underline the influence of ownership types on alliances and give insight in ownership differences, which is the main research goal.

Table 13 shows that the average standard deviation for alliances is very low, less than 0.002 efficiency points. This suggests hospitals within an alliance to have relatively the same efficiency scores. Table 13 shows the mean efficiencies of short-term acute care alliances. Sole profit and sole non-profit alliances have different efficiency scores, where non-profit dominant alliances are most efficient. Mixed alliances do not have significant different efficiency scores. This suggests that efficiency differences can be attributed to the differences in dominant alliance types or differences between alliances.

When a profit hospital is part of a sole profit dominant alliance, efficiency scores are lower than when the same hospital acts alone or is mixed with non-profit organizations. Of interest is that, in one case, profit hospitals gain efficiency when part of an alliance mixed with non-profit hospitals. This suggests skimming of access bed capacity between non-profit and profit partners, making the profit partner more efficient. Unfortunately, one case is not enough to validate this observation.

* Alliance name: “Lae Memorial Health System”
Remotely, none of the alliances is focused. Unprofitable treatment skinning can not be confirmed with this result. What can be confirmed, is that most alliances share the same range of services. This suggests alliances to adapt to their partners. Based on the previously explained results, hypothesis 5 can be accepted: within an alliance hospitals show relative equal efficiency scores and equal range of services.

<table>
<thead>
<tr>
<th>Alliances (short term acute care)</th>
<th>Efficiency (mean ± s.d.)</th>
<th>Range of services in chapters</th>
<th>≤6</th>
<th>6-15</th>
<th>16 &amp; 17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean ± s.d.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit dominated and sole profit alliance</td>
<td>.9991 (0.0064)</td>
<td>.9891 (0.1060)</td>
<td>1</td>
<td>2</td>
<td>42</td>
</tr>
<tr>
<td>Profit dominated and mixed alliance</td>
<td>.9970 (0.0034)</td>
<td>.9942 (0.0028)</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>No dominance and mixed alliance</td>
<td>.9908 (0.0081)</td>
<td>.9933 (0.0049)</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Non-profit dominated and sole non-profit alliance</td>
<td>.9933 (0.0060)</td>
<td>.9891 (0.1064)</td>
<td>0</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Total Alliance</td>
<td>.9908 (0.0064)</td>
<td>.9894 (0.0062)</td>
<td>.9886 (0.0063)</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>No Alliance</td>
<td>.9909 (0.0178)</td>
<td>.9957 (0.0047)</td>
<td>.9886 (0.0211)</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 13: Mean efficiencies and range of service for short term acute care hospitals.

* = Outlier; ** = one extreme excluded with efficiency score of 0.923

We suspect hospitals to demonstrate more mimicking behavior when hospitals are in a competitive environment, since uncertainty results in mimicking behavior. Based on this assumption, we have formulated hypothesis six:

Hypothesis 6: In a competitive environment, alliances are relatively more affected by mimicking behavior, making the efficiency scores and range of service more alike.

To test this hypothesis, we have to prove that the average standard deviation of alliances under competition is lower and that ranges of service are more alike. We have already shown that all alliance have the same range of service, which is biased.

The results in Table 14 do not reveal a reason for any mimicking behavior in a competitive environment. The average standard deviations of alliances in a competitive environment are not smaller than the alliances not in a competitive environment. We can reject the hypothesis; in a competitive environment alliances are not more alike than not in a competitive environment.
### Table 14: Alliances in a competitive environment defined by MSAs: Miami-Fort Lauderdale-Pompano Beach; Sarasota-Bradenton-Venice; Tampa-St. Petersburg-Clearwater

<table>
<thead>
<tr>
<th>Alliances</th>
<th>no competition</th>
<th>competition</th>
<th>Alliances under mixed competition</th>
<th>no competition</th>
<th>competition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Profit Mean</td>
<td>Non profit</td>
<td>Profit Mean</td>
<td>Non profit</td>
<td>Profit</td>
</tr>
<tr>
<td>Profit dominance, sole profit alliance</td>
<td>0.991 (0.002)</td>
<td>·</td>
<td>0.888 (0.009)</td>
<td>·</td>
<td>0.988 (0.006)</td>
</tr>
<tr>
<td>Profit dominance, mixed alliance</td>
<td>0.994 (0.007)</td>
<td>1.000</td>
<td>0.994 (0.003)</td>
<td>0.996 (0.004)</td>
<td></td>
</tr>
<tr>
<td>No dominance, mixed alliance</td>
<td>0.997 (0.000)</td>
<td>0.993</td>
<td>0.994 (0.007)</td>
<td>0.986 (0.004)</td>
<td>0.980 (0.000)</td>
</tr>
<tr>
<td>Non profit dominate</td>
<td>0.997 (0.000)</td>
<td>0.993</td>
<td>0.995 (0.004)</td>
<td>0.988 (0.005)</td>
<td></td>
</tr>
</tbody>
</table>

We further test the hypothesis that dominant alliances in a market environment influence other hospitals within the same market environment. We compared mean efficiencies of the dominant alliance with the rest of the hospitals in the MSA. Mimicking behavior from the dominant alliance within a MSA does not occur. Although every alliance has a broad range of service, when an alliance is dominant their competitors in the same market environment do not have the same efficiency scores.

The analysis of hypotheses five and six suggests that alliances mimic processes or treatments within the social context of their alliance, resulting in almost equal efficiency scores. The equal range of services for all alliances suggests that hospitals within an alliance mimic traits of their competitors, showing in the same range of service between alliances. Differences in efficiency score can be contributed to differences between alliances.
5.2.6 Summary of the results and analysis

The results of this section show that during the year 2004, different combinations of alliances are the reason for efficiency differences between ownership types.

The mean differences between profit and non-profit hospitals can be ascribed to the number of focused hospitals within an ownership type. The more focused a hospital, the more efficient. With a higher number of non-profit focused hospitals mean efficiencies of non-profit hospitals appear to be higher.

Within an alliance, efficiency scores are almost the same, which can be seen by the low standard deviation of efficiency scores. Range of services is broad for hospitals participating in an alliance, which indicates that alliances mimic competitor characteristics and characteristics visual for the patients. Because all alliances have the same broad range of service and have an outpatient facility without being noticeably focused, we conclude that mimicking behavior of hospitals within their close social context occurs. This is confirmed by the lack of effect of a dominant alliance within a market environment on the efficiency scores of other hospitals within the same market environment.

In general, converging of efficiency and range of services can be ascribed to alliances being uniform.
6 Conclusion and discussion

In this chapter we will give answers to the research question and explore the added value of the MMV. We will formulate conclusions based on the analysis of the hypotheses. We will conclude this chapter by discussing the limitations of this research and give advice for future research.

6.1 Differences between profit and non profit hospitals

In section 1.3 we formulated the research question.

Why are non profit hospitals more efficient than profit hospitals, while economic theory predicts profit hospitals to be more efficient?

6.1.1 Convergence of efficiency scores

We have explored efficiency differences between ownership types by looking at efficiency differences of short term acute care hospitals.

The results rejected the first two hypotheses and supported the fact that non profit hospitals are more efficient than profit hospitals. However, based on the Wilcoxon rank test in the year 2001 and 2004, efficiency differences were not significant. For the year 2001, this can be explained by the large deviation of efficiency scores. For the year 2004, means and standard deviation between profit and non profit hospitals were almost identical. So, profit and non profit hospitals were almost identical.

Competition did not have a positive effect on the efficiency for profit hospitals. Under competition, non profit hospitals are more efficient than profit hospitals.

Interestingly, hospital efficiency scores converge during the research period. This can be seen by the difference in means and by the standard deviation in Table 7. Why this convergence occurs could not be explained by looking at efficiency differences.

We suspect three cultural changes to be a reason for the convergence of efficiency scores. The conversion movement, the bullied tax benefits for non profit hospitals, and managed care. The disappearance of external forces that ensure differences between profit and non profit hospitals, allowed for their goals to become more equal. Traditionally, cultural differences between profit and non profit hospitals are reflected in the different maximization goals. Profit hospitals maximize output to satisfy the financial needs of the shareholders. Non profit hospitals maximize inputs to satisfy community health care needs.

6.1.2 Convergence of ranges of service

We have looked at the cultural differences between profit and non profit hospitals by looking at their ranges of service. We suspected the range of service between profit and non profit hospitals to be different and non profit hospitals to be more focused. The third and fourth hypotheses were rejected. We did not
find support for the idea that cultural differences contribute to efficiency differences between ownership types.

Interestingly, both profit and non profit hospitals offered a broad range of treatments. Ranges of services converged during the research period. In the year 2000, 9 hospitals offered less than 6 different treatments and 33 hospitals between 6 and 15 treatments. In the year 2004, only 4 hospitals were focused and only 7 offered between 6-15 treatments. At the end of the research period most hospitals offered more than 15 different treatments for health problems.

Non profit short term acute care hospitals, without an outpatient facility are the only hospitals that are focused. This suggests that the skinning of an unwanted specialty to outpatient facilities does not occur. However, it is possible that skinning of unwanted treatments is applied in those hospitals, since we compared chapters of related treatments instead of individual treatments. Therefore it can not be sure if treatment skinning does not occur.

In general, given the range of services, both profit and non profit hospitals perform all treatments at all different market environments. If the community need for health care was served in the year 2000, then the community need for health care was still served in the year 2004, since the total LOS and total number of patients did not decrease (see Table 1 in the appendix). This suggests that the social purpose of providing community need is not restricted by non profit hospitals and that the traditional maximization goal of non profit hospitals is no longer exclusive for non profit hospitals. Profit hospitals do not fill in the most profitable market niches, but all profit hospitals treat all possible health problems. This could suggest that maximization goals have converted or changed.

We have performed a post hoc logistic regression to analyze if ownership type or competition predicts efficiency differences. The results did show that the technical efficiency frontier was dominated by non profit hospitals, the decline in odd ratio for the year 2004 supported the conversion of efficiency norms.

We did find focused hospitals to be more efficient than broad ranged hospitals, although this difference was unrelated to type of ownership, as can be seen by the small column differences in Table 11. Efficiency is affected by the range of service, but this does not explain ownership type differences.

Slack calculation revealed that hospitals must decrease their total number of beds in order to become technical efficient, which is consistent with low occupancy rates for Hawaii. This advice relies on the chosen bed safety level, which we did not include in our research. Besides, changing the number of beds is strictly regulated.

We suspect hospitals to maximize earnings due to the increased influence of managed care programs (since the mid 1990’s). The convergence of hospital goals could be the reason for the converging efficiency
scores and range of service. However, this does not explain why hospitals are converging. We suspect that hospitals mimic behavior and this mimetic behavior results in convergence of efficiency scores and range of service.

### 6.1.3 Convergence within close social context

We have explored mimicking behavior by looking at the range of service and efficiency differences between alliances.

Almost every short term acute care hospital is part of an alliance, 72% to be precise. Only short term acute care hospitals have alliances with other hospital types (28%). Because of the large percentage of alliances, mean differences can be ascribed to differences between the alliances.

Standard deviation of efficiency scores within an alliance is very small (less than 0.004). This suggests that hospitals participating in the same alliance mimic processes that influence their efficiency, making their efficiency scores more alike.

Interestingly, none of the alliances includes a focused hospital, which suggests alliances imitate characteristics of their competitors. Hospitals within the same market do not share the same efficiency scores, but hospitals within an alliance do share the same efficiency scores. All alliances share the same range of treatments. This is confirmed by the lack of effect of a dominant alliance within a market environment.

We could not find indications that hospitals maximize concurrence, as previous approaches suggested.

In general, converging of efficiency and range of service can be ascribed to alliances being uniform in their close social context while mimicking characteristics of their competitors that can be observed by their patient population. This mimicking behavior is independent of ownership type.

To answer the research question, efficiency scores between profit and non-profit hospitals were not different in the year 2004. Non-profit hospitals are more likely to be focused and the more focused a hospital is, the more efficient it gets. Therefore, the mean efficiencies of non-profit hospitals are more likely to be higher while hospitals of equal range and equal type are equally efficient, independent of ownership type.

This research implicates that, due to free market forces and regulations, the advantages hospitals are becoming more uniform and part of an alliance. If a health care policy aims on the diversity and specialization of hospitals then a free market environment is not the appropriate choice.

### 6.2 Discussion and limitations

This research provides insight in the implications of market forces on hospitals, especially, since we could compare data of several years. This research is not limited to the state of Florida and not limited to health
Conclusion and discussion

care systems with managed care. We have argued that the absence of discriminating external barriers (i.e., with the same market incentive [managed care] leads to uniformity within alliances and between alliances. We suspect that health care systems with no external barriers between hospital types and with a single market incentive (for example the incentive to reduce waiting lists) with a free market to behave as the hospitals in the research.

We have proven the added value of the MMM by offering additional explanations from the three combined approaches. We have combined cultural and economic reasons to explain the efficiency differences between ownership types. The question "Why convergence?" raised after the results of the first two approaches could be answered by the third approach that focused on the formal network between hospitals. A limitation of the MMM is that the political or legal perspective was not highlighted. We can only speculate that one of the effects of managed care is reflected in the uniformity of hospitals goals. A more thorough study of the political background or legal environment could visualize the restrictions on the free market.

A limitation of this research is that it is generalized by the research population bias. We have excluded hospital types other than short term acute care hospitals, we have excluded teaching hospitals, and ambulant surgical centers. This means that future research must confirm that hospitals show convergence of efficiency and range of service within a free market.

The use of the DEA method does not come without limitations. DEA is sensitive to outliers and efficiency scores are dependent on their variables. We did not take costs and human resources into account. This means that the efficiency scores are a relative indication of the material efficiency or productivity. This means the efficiency scores cannot be used to compare individual hospitals or to make statements about profitability. However, as with any technical efficiency score, the scores are useful in comparing different hospital groups (Frank and Dyer 2001).

The calculated efficiency scores are relative efficient scores, which means that technical efficient hospitals are not necessarily very efficient, as long as they are more efficient than those hospitals that are not on the efficiency frontier. We were unable to compare efficiency scores between different years, because we have calculated efficiency scores for every year separately. This means that the high efficiency score only indicates a convergence of efficiency scores; it does not imply that efficiency in the year 2004 was higher. In fact, efficiency in 2004 is probably lower than previous years since fewer hospitals were included.

Future research might focus on general accepted efficiency measurement variables, because we have encountered different efficiency measurements in each new journal article, although the DEA method is highly preferred. Teaching hospitals can be included when residents HE is considered an output (Wang et al. 1999). Quality of care can also be included in the DEA analysis by incorporating mortality rates.
Further research should focus on the implications of uniformity of hospitals in the quality of health care. Also, further research in the cost and quality of health care is needed, since managed care fueled cost competition without (suspected) regard for quality (Miller 1996).

The next logical step for the NMM is to build a model with generally accepted measurements for all approaches of the Multilevel model. With a fourth approach, a political or legal approach, the NMM should be even more capable of giving explanations for economic behavior.
Appendix

Disclaimer AHCA

DISCLAIMER

The Agency for Health Care Administration collects this data pursuant to Section 408.061, Florida Statutes, for the purpose of carrying out Agency duties. This information is not intended for any other use, including advertisement, endorsement, or promotional activities. This disclaimer must accompany any publication of, or reference to, this data in advertisements or publications.

Scatter plot of ownership types and LOS longer than 2 days for 2000 and 2004.

Figure 5: Scatter plot of ownership types and LOS longer than 2 days for 2000 and 2004.
**Slack calculation and ownership differences**

<table>
<thead>
<tr>
<th>Slacks</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Mean</td>
<td>Profit</td>
<td>Profit</td>
<td>Profit</td>
<td>Profit</td>
<td>Profit</td>
</tr>
</tbody>
</table>

**Genuine surgical needs**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits</td>
<td>68.43</td>
<td>89.10</td>
<td>101.1</td>
<td>101.5</td>
<td>70.34</td>
</tr>
<tr>
<td>Mean</td>
<td>91.96</td>
<td>57.41</td>
<td>72.49</td>
<td>37.40</td>
<td></td>
</tr>
</tbody>
</table>

**Special / non-surgical needs**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits</td>
<td>19.03</td>
<td>18.92</td>
<td>13.70</td>
<td>11.59</td>
<td>13.25</td>
</tr>
<tr>
<td>Mean</td>
<td>22.30</td>
<td>19.89</td>
<td>6.19</td>
<td>10.93</td>
<td></td>
</tr>
</tbody>
</table>

**Number of patients**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits</td>
<td>1.20</td>
<td>0.70</td>
<td>0.40</td>
<td>0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>Mean</td>
<td>2.75</td>
<td>36.26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15: Output slack of short term acute care hospitals, no columns show significant differences (α=0.05%)

**Average Standard Deviation calculation**

\[
\frac{\sum_{i=1}^{n} X_{ij} \times h_{i}}{Y_{j}}
\]

- \(X_{ij}\) = s.d. alliance i part of alliance type j
- \(h_{i}\) = number of hospitals participating inalliance i
- \(Y_{j}\) = total hospitals grouped by analliance type
- \(i\) = name of analliance, \(i = 1, \ldots, 26\)
- \(j\) = the four specified alliances

Figure 6: Average s.d. alliances
## Total patient discharge and total LOS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of patients</td>
<td>1002675</td>
<td>1082798</td>
<td>1054218</td>
<td>1250017</td>
<td>1081485</td>
</tr>
<tr>
<td>Ratio</td>
<td>1.09</td>
<td>1.19</td>
<td>1.18</td>
<td>1.19</td>
<td>1.12</td>
</tr>
<tr>
<td>Total LOS</td>
<td>320142</td>
<td>3266233</td>
<td>3344521</td>
<td>3813410</td>
<td>3448260</td>
</tr>
</tbody>
</table>
Figure 7: Total LOS and Patient discharge for short-term acute care
Figure 8: Histogram of Ownership type differences with competition and for 2000 and 2004.
8 References


