The Effects of Hospital Competition on the Quality of Health Care in OECD hospital markets
– *An Empirical Study*

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Abstract

In an increasing number of Organizations for Economic Co-operation and Development (OECD) countries, the quality of hospital care has been subject to various forms of health policies. Despite much research on the determinants of health care quality, there is no consensus on the underlying factors of health care quality. This thesis contributes to the previous works by analyzing the relationship between hospital competition and quality of care by using data in the areas of health care outcome and utilization measures, which rarely have been examined together. This thesis also uses a comprehensive measure of hospital competition in connection with the analysis of country level data for OECD countries. The results give robust support for the hypothesis that hospital competition leads to improved outcome of hospital care measured in mortality and length of hospital stay. Results suggest that as the competition intensifies, hospitals are likely to be able to reduce health care mortality. These findings are also confirmed for public and mixed models of a health care system. The evidence that greater competition leads to lower length of hospital stay is partly supported by the data. On the one hand controlling for the heterogeneity in the health care systems with country-specific dummy variables leads to lower length of hospital stay. On the other hand controlling countries in the mixed model of a health care system there is evidence in favor of positive association between length of hospital stay and hospital competition but negative association for countries included in the public health care system.

Keywords: hospital competition, health care quality, OECD, hospital capacity, average length of stay

Table of Contents

List of Tables

1. Introduction

This chapter begins with a review of the background information on the effect of competition on health care quality in hospitals. First, the chapter will review the background on the theory and evidence on the issue and in relation to measures of health care quality and hospital competition. Second, the chapter will describe the role of hospital competition in relation to the current reforms in countries within Organization for Economic Co-Operation and Development. Third, the chapter also discusses the difficulty of finding appropriate measures for hospital competition that would be applicable for public and private hospital markets. It then presents the aim of the research and limitation of the data collection model and the two research questions this thesis endeavors to explore.

1.1 Background

As the influence of hospital competition on the quality of care has been an important issue in the area of health care research for several decades (Chen & Cheng, 2010; Ginsburg, 2005; Propper, Burgess & Green, 2004; Giuffrida, Gravelle & Roland, 1999; Kessler & Geppert, 2005), the actual magnitude of the gains from hospital competition is still very much an open debate. To be precise, much of the focus of this debate is being aimed at the potential qualitative effects from hospital competition owed to improved productivity and performance of hospital providers (Bowers, Swan & Koehler, 1994; Cowing, Davino-Ramaya, Ramaya & Szmerekovsky, 2009). Another effect of hospital competition is, however, often overseen; the increase of hospital competition is likely to follow for different hospital markets in the public and private sectors such that the effects are likely to reflect differences in stages of development towards hospital competition that could be comparable in for-profit, not-for-profit, private and public hospital markets. This idea has led researchers to question whether the promotion of hospital competition is based on empirical evidence that is consistent with positive relation of hospital performance with the quality of health care (FTC, 2004; Giuffrida, Gravelle & Roland, 1999).

It is important to establish definitions of hospital competition and quality of care and to describe background for the promotion of hospital competition in the framework of health care policy development. First, what is meant by hospital competition is the high level of performance of hospital providers in the provision of health care whereas the health care quality is the desired health outcome for treated patients. Second, the relationship between health care quality and hospital competition is expected to exist, due to the possible spillover effects on the hospital quality when hospital performance improves. Third, the advantage from hospital competition comes from reduced demographic transitions that are likely to come into force in the form of future rising health care expenditures. This means the promotion of hospital

competition there is a desire to impede the rise in health care expenditure that would affect preferable outcome for health care quality. Finally, the reformations of public hospitals have been the dominant structural trend under the current health policies directed towards downsizing and consolidation of hospital services in the public sector. This policy to the public sector is prevalent for the developed countries within the Organization for Economic Co-operation and Development (OECD) which have had framework for inter-state cooperation motivated primarily by the increase in country's health care expenditures caused by demographic transitions (OECD, 2012; Blanchette & Tolley, 1997). This framework is associated with primarily public-private partnerships that represent new way to deliver health care services targeting possible future health outcomes in the OECD (Espigares & Torres, 2009; Curristine, Lonti & Joumard, 2007). Moreover, as there has been a widespread demographic transition in the OECD it becomes even more desirable to pursue development cooperation in the area of health care policy as the outcome of hospital quality tends to undermine governments' efforts to improve the quality of care when countries are allocating greater share of their GDP in the finding of health care (OECD, 2011; Xu, Saksena & Holly, 2011).

This study draws in the theory of "*economic model of a hospital*," first introduced by Newhouse in the 1970. This theory signified an improved understanding of the significance of hospital performance and its possible effect on the quality of care by arguing that hospitals aim to maximize both quality and quantity constraints of their services subject to financial incentives and constraints (Newhouse, 1970; Morris, Devlin, Nancy, Parkin & David, 2003). This conceptual framework offers reasonable structure of analysis to approach hospital performance and quality of care within the context of managerial decisions that tend to balance various services provided in hospitals (Morris, Devlin, Nancy & Parkin, 2003). Even so, it seems to be relevant to use the theory in the health policy environment that requires hospitals in different hospital markets to promote the development of competitive solutions allocated by managerial decisions with focus on future quality improvements (OECD, 2013; OECD, 2012). The hospitals are then able to improve health care quality when they improve operational capacity and thereby insure better utilization of hospital services and lower excess capacity (Devers, Brewster & Casalino, 2003; Morris et al., 2003).

As far as the research has shown to date there does not seem to be any international studies in the field of Health Service Research (HSR). Most studies have used regional data but there appears to be very little if none at the international level. At the same there seems to be a link between hospital competition and quality of care due to the intensification in the health care reforms process aimed towards improved hospital performance (Curristine et al., 2007). Therefore, the international study aims to contribute to the current state of knowledge regarding the future impact of health care policies by filling the gap of research at the regional level as there is little agreement of the benefits of increased competition in the health care quality. Moreover, evidence outlines that an empirical analysis needs to be developed further by combining new approaches and possible measures towards hospital quality (Arah, Klaziga, Delnoij, Ten Asbroek & Custers, 2003; Chow-Chua & Goh, 2002). This means that the assessment of quality of care and

hospital competition requires incorporating performance related measures in the approach to hospital competition that might be relevant in different health care systems (Arah et al., 2003). The performance related measures are not completely determined by the previous research since the methods used vary greatly. Moreover, the use of health system-related indicators themselves is complicated since this often entails developing an operational definition of quality with the view to allow the establishment of health care monitoring practices (Arah et al., 2003). This preposition seems to be in line with the *economic model of a hospital* that suggests that hospitals appear to be aiming to maximize both the quantity and quality domains of their services. In relation to this, the thesis intends contribute to the research at the regional level by arguing that hospital performance needs to be approached within the framework of hospital management decisions with regard to hospitals' operational capacity, outcome of hospital treatment and financial incentives of different health care systems. In order to control for health care system differences this study will follow the example of Bjegović and Donev (2004), who developed a model for separating countries according to their health care system characteristics, that is, the public and mixed models.

In the previous papers, most results are obtained by using quantitative methods of analysis and health system related factors to determine the interaction between, most commonly, health insurance coverage and quality of care in the context of hospital competition. While, the health-system related factors are relevant to the outcomes of health care quality, for instance, the type of insurance, they have an effect on how the health care service is organized. Empirical studies do not seem to capture the context of the methods used. For example, the empirical evidence has indicated that while the increased hospital competition may help to reduce costs the relationship between hospital competition and health care quality is complicated by the prevailing differences in the health care insurance coverage, price regulation and for-profit status (Bijlsma, Koning, Shestalova & Aouragh, 2010; Volpp, Ketchman & Town, 2003; Epstein & Williams, 2005; Excarce, Jain & Rogowski, 2006). Studies in the United States, for instance, have used regional data in private hospital settings and have pointed out that Health Maintenance Organization (HMO) influences the way hospital competition effects the quality by distinguishing an HMO and Managed Care plans as one of the key factors that influence hospital's competition effect on the quality of care (Gowrisankaran & Town, 2003; Escarce, Jain & Rogowski, 2006; Mukamel, Zwangziger & Tomaszewski, 2001). In regards to hospital market, these studies seemingly state, nothing about how the quality of care is impacted from hospital competition in the public hospital sector where the extent of hospital competition is limited. Moreover, there appears to be a lack of consensus on the part of the evidence and papers on the English National Health Service (NHS). Propper, Burgess and Green (2004) disclose negative relations between health care quality and hospital competition when assessing patient's travel times in hospitals catchment areas as measure of hospital competition. Similarly, Liu and Pheleps (2008) established negative relation in the case of managed care plans when assessing non-price competition whereas Gowrisankaran and Town (2003) and Mukamel, Zwangziger and Tomaszewski (2001) found positive relation for HMO insured patients and Escarce, Jain and Rogowski (2006) for less HMO insurance. In addition to the little agreement in the empirical studies creates an impediment to establishment of country level measurement approaches

that will aid in the assessment of recent health care development in the public sector.

In this thesis I argue that an increase in hospital competition provides a prerequisite for positive effects on health care quality regardless of the setting of hospital market as competitiveness triggered by policies to improve performance seems to increase the overall pressure to improve hospital services. There are several arguments to this point. First, many countries in the OECD have already identified priorities in relation to best practice used by implementing market-related policies which means firstly the reinforcement of competitiveness between health providers and insurers and secondly the information and choice available for patients in different hospitals (OECD, 2012; Propper & Dixon, 2011). Second, governments within OECD countries by having followed development with respect to English NHS reforms in hospital markets became increasingly involved in sustaining innovative ways to improve public sector efficiency by partnering with the private sector. This comes from the increased effort to diminish the excess capacity in the public hospitals (Bloom, Propper, Seiler & Reen, 2010; Curristine, Lonti & Joumard, 2007; Taylor & Blair, 2002). The underlying reason for this is that according to current state of knowledge the public-private partnerships play an important role in improving the viability of public hospitals and thus the quality of hospital services (Taylor & Blair, 2002). It has triggered the development of hospital competition with both overlapping tendencies among different hospital markets and with focus on the development within a hospital. In light of these health care policy reforms, it seems reasonable to question to what extent hospital competition actually affect the quality of care in the policy environment that demands innovative ways to improve quality and that also tends to overlap with differences in the health-system related factors across countries.

The mechanism of health care policies in different hospital markets are affected in the following ways. A number of OECD countries have faced the challenge of accomplishing both higher quality and greater efficiency in the health care use among different sectors of hospital market (Jiang, Friedman & Begun, 2006). To improve the competitive climate between different hospitals the market-based reforms are designed to create financial incentives for health care providers to improve hospital performance among both the public and private hospital types (Cooper, Gibbons & Jones, 2012; Gaynor & Town, 2011). First, the idea is to increase competitive pressure in public hospitals and simultaneously enhance competitive efforts further in the privately owned specialty hospitals (Cooper, Gibbons & Jones, 2012; Gaynor & Town, 2011). Particularly, the policies aimed at sustaining the scope of competition for patients through the expansion of opportunities for patient choice and lower waiting times (Ettelt, 2007). Second, the expansion of competition among the large public hospitals should be pursued for the purpose of creating greater efficiency in the use of the health care services. Finally, measures are aimed at sustaining the competitive environment between privately-owned specialty hospitals. That is to say, health care reforms are aimed at both private and public sectors of hospital market in the number of OECD countries.

Due to recent health care developments there seems to be a problem with finding the appropriate measure

for hospital competition in the public sector. Empirical studies that have used regional data were predominantly focused on the hospital market structure that is distinguished by the private hospital arrangement. In these studies the problem seems to have been the reluctance to develop new operational measure for hospital competition that is distinctly different from Herfindahl-Hirchman Index (HHI) that is used as hospital market shares (Chen & Cheng, 2010; Gaynor, 2007). There are several arguments for the relevance of the measures that are used in the private hospitals. First, the argument is that, due to the extended role of private hospital sector, governments are justified in their attempt to increase private participation in public hospitals which is expected to result in better public sector performance (Taylor & Blair, 2002). As such, the public-private arrangements are intended to bring about more private sector efficiency into public hospitals (Curristine, Lonti & Joumard, 2007; Taylor & Blair, 2002). Second, the great share of research seems to be concentrated on markets with more developed private hospital arrangements. That means that measuring hospital competition often occurs in areas with legally enforced hospital competition while the impact of the reforms has been targeting primarily the hospital quality in the public sector. As a result, empirical research seems to be complicated by the prevailing difficulty to establish complete comprehension of the effect of current health care policies in different hospital markets.

1.2 Aim and Purpose

The idea of health care policy reforms is to generate quality improvements in health care by the use of competitive strategies in public and private sectors in an increasing number of OECD countries. The spread of health care policy measures promotes the development in the hospital market and is considered important for many countries struggling to improve the efficiency of health care services. With the introduction of free choice of health care providers, health care policy reforms are able to target the greater use of competitive strategies among the publicly owned hospitals in order to accomplish continuous improvement in health care quality (Brekke, 2011). As Brekke (2011) and Tailor and Blair (2002) point out these reforms are aimed to increase the scope of competition in general and in public hospitals in particular. One approach is to reward efficiency in the performance of hospitals. In relation to this, hospitals in the U.K are paid a tariff for each treated patient, which is known as compensation granted to hospitals if hospitals manage to increase their patient base. This result-oriented approach has also been developed in the early reform period as a response to increase cost-effectiveness in the public sector (Curristane, Lonti & Jourmard, 2007). Similar measures have been instigated in Norway, Denmark, Italy, Netherlands and several other countries (Brekke, 2011). The use of the performance-based measures in health care suggest that hospitals in number of OECD countries have come under increasing pressure to improve the quality of their health care services by use of similar strategies.

The purpose of this thesis is to contribute to the understanding of the existing empirical literature by clarifying whether or not greater competition among hospitals contribute to ways to improve services in the policy environment that requires greater quality of care (Tailor & Blair, 2002; Cooper, Gibbons & Jones, 2012). To conduct the empirical analysis of hospital competition the study adopts a measure that is different from the measure of HHIs for hospital market shares that were overwhelmingly used in the regional research (Propper, Burgess & Green, 2004; Mukamel, Zwanziger & Tomaszewski, 2001; Chen & Cheng, 2010; Keeler, Melnick & Zwanziger, 1999; Krishnan, 2001; Town, Wholey, Feldman & Burns, 2007; Gaynor, 2007; Noether, 1988). That is, the study adopts the density measure on the total number of hospitals in the population for OECD countries available at the country level. The study motivates the use of density measures is that they are insensitive to a certain variation in the hospital market appropriate in the assessment of heterogeneous OECD hospital market development (Gresenz, Rogowski & Escarce, 2004; Morris, Devlin & Parkin, 2003). In addition to that, the use of density measures is also motivated by that greater quantity of hospital providers has a tendency to increase pressures for hospitals to improve its services and attract patients' demand (Ecevit, Ciftci & Ag, 2010). To control for the unobserved country heterogeneity in the hospital market development the study uses also country dummy variables. In relation to the outcome of health care quality hospital mortality is chosen because it measures undesirable health outcome for patients related to hospital internal failures. Considering the use of health care services the length of hospital stay is an appropriate measure because it allows accounting for source that contributes to lower excess capacity influencing health care quality in the process of health service improvements (Morris

et al., 2003; Devers, Brewster & Casalino, 2003). The two indicators are then related in this study since them both measure cases for the disease known as acute myocardial infarction (AMI) as the leading cause of death (McLafferty, 2003).

1.2 Limitations

There are two specific limitations in this thesis. First is, because there were missing time periods the researcher needed to estimate values and it would have been preferable to have the data available for this rather than using the estimated values. Second is, that the data has less years and it would have been preferable to have longer time periods whereas the data used is on average between 2002-2009.

1.4 Research questions

The thesis aims to examine the following questions:

1. To what extent is health care quality influenced by hospital competition among health care providers in the OECD countries?
2. In what way does hospital competition affect the quality of services, given the differences in the reimbursement levels and health care systems in different countries?

1.5 Summary

This chapter has underlined the importance of hospital competition in the health care reform process that targets improvements in the quality of care. It has argued that hospital competition plays an important role for improving the quality of hospital care but their effect is far from being determined completely by the previous empirical studies. The underlying difficulty lies in establishing appropriate measurement approaches. Furthermore, the overwhelming evidence is concentrated on measuring competition in private hospital arrangements while the impact on hospital services target the quality in the public sector. Later, the chapter points out that in some OECD countries hospitals have used similar health care policies to improve the performance of their hospital care, such as patient-choice and compensation for increasing patient base in hospitals in different hospital types. Therefore, the study intends to clarify its measurement approach for different hospital markets and use a density measure for hospital competition that is insensitive to a certain variation in the hospital market and is seemingly different from the market share measures that are commonly used in the research at the regional level.

2 Literature Review

This chapter begins with the review of the literature of the previous empirical studies that have assessed the effect of hospital competition on health care quality. First, the chapter will give an account on the contribution of the previous research and present their measures and methods used in relation to the estimation of quality and hospital competition. Further, the section will also argue for the relevance of approaching quality measures in relation to outcome-based and utilization-based measures that highlight different aspects of health care quality in hospitals. Finally, the following two sections will provide a review of empirical studies that have used similar measures to those related to the outcome-based and utilization-based measures of health care quality.

2.1 Empirical studies

Competition between hospitals plays an important role in the delivery and financing of health care. Empirical studies in the U.S., for example, have had a very strong focus on the hospital competition within their counties (Noether, 1988; Keeler, Melnick & Zwanziger, 1999; Krishnan, 2001; Town, Wholey, Feldman & Burns, 2007; Chen & Cheng 2010; Gaynor, 2007). From these studies, there appears to be a strong correlation between hospital competition and health care quality. These studies tend to measure hospital competition by the sum of squared market share for all hospitals included in their counties. It means, they show hospital competition by using the market share and calculating the number of hospital discharges divided by the total discharge rate in a given market area (Chen & Cheng, 2010). How to measure the hospital competition is a subject of disagreement in the empirical studies (Garnick et al., 1987). Sometimes hospital competition is measured by county level data that shows a reduced mortality rate among AMI patients (Kessler, 2000). Due to the different ways of calculating hospital competition, it seems to be difficult to know exactly how to measure hospital competition and the effect on quality.

The previous studies on the health care quality and hospital competition have used the in-hospital mortality rates and hospital length of stay as a measure of health care quality (Morales, Peters & Afessa, 2003; Tetteroo, Vagenvoort, Mulder, Ince & Bruining, 1993; Finkielman, Morales, Peters, Keegan, Ensminger & Lymp, 2004). Tetteroo et al. (1993), for instance, find that there is a correlation between decreased mortality and length of hospital stay for patients with surgical intensive care which implies that shorter length of stay and decreased mortality both have similar effect when outcome of hospital care and performance of hospitals improve simultaneously. Likewise, Morales et al., (2003) also find that night admissions are associated with lower mortality rates and shorter hospital stay. Finkielman et al. (2004)

finds that, when patient face more intensive treatments patient admissions do not lead to mortality increases or an increase in the hospital stay.

Quality measures can be classified into two different types of measures. The first is outcome based indicators and then second is utilization-based indicators. There are some differences between the outcome indicators and utilization indicators in measuring quality of care. The outcome-based indicators measure the outcome-related factors associated with patient's health status. The utilization-based indicators, however, are associated with the level of health care quality. In contrast to the outcome indicators of health care, the utilization indicators account for factors that are under the control of the hospital. Therefore, the utilization measures can also be used for evaluating the health outcome in order to improve the quality of the health care system (Giuffrida, Hugh, & Martin, 1999). This means that services designed to improve that outcome related to those factors that are under the control of the hospital staff can be better predictors of quality than pure outcome-based measures (Giuffrida et al., 1999). Both outcome-based and utilization-based measures underscore the problems that exist in capturing the multifaceted value of health care quality. On the other hand, the outcome of care could itself be the source of the problem if outcomes reflect both the power of the medical staff and the outcome of health care contributing to a certain result with a given set of resources (Giuffrida et al., 1999). In short, the utilization of these measures can affect the outcome of care and thus the outcome of the quality of care.

2.1.1 Outcome-based health care and competition

Many empirical studies have postulated that the effect on quality care from hospital competition stems from the type of health insurance coverage and for-profit status of the hospital. These studies have most commonly, measured hospital competition by using Herfindahl-Hirchman Index (HHI) for hospital market shares and using AMI mortality rates as measures of health care quality. In relation to these measures, Propper, Burgess and Green (2004) were among the early papers to examine the effect of competition on quality using AMI mortality rates in the U.K. during 1991-1999. The study uses the AMI mortality rate as a measure of hospital quality whereas competition is measured by HHIs calculated for catchment areas in patient travel times (Propper et al., 2004). The study finds the existence of negative association between hospital competition and the quality of care, but the estimated effect is fairly small. Likewise, Mukamel, Zwangziger and Tomaszewski (2001) examined the risk-adjusted mortality rates for 30-days post admissions to evaluate the effect on hospital quality of care in the U.S. The analysis of the quality of clinical care examines the excess death rates for 4 specific medical conditions: AMI mortality, congestive heart failure, pneumonia, and stroke. The method to measure the excess mortality rate is to use the difference between the observed mortality rate in the hospital and the risk-adjusted mortality rate whereas the hospital competition is measured in numbers of county admissions by using the HHI's for hospital market shares (Mukamel et al., 2001). The study finds that the risk-adjusted mortality rates are significantly

higher for for-profit hospitals compared to the not-for-profit private hospitals and the excess mortality deviates by 11.5 times (Mukamel et al., 2001). Further, the study infers that market concentration for an HMO rather than hospital competition has the most significant effect on the reduction on mortality and that higher hospital expenditure contributes to lower mortality when patients' insurance is characterized by an HMO (Mukamel et al., 2001). This finding conductive to the view that patients with HMO coverage are generally likely to increase their consumption of health care leading to mortality reducing effect and improved health care status. Considering the type of hospital ownership, McClellan and Staiger (2000) found out that on average the for-profit hospitals have higher hospital mortality rates for patients with heart disease, although the difference is marginal in relation to the not-for-profit hospitals. This means that hospitals with better outcome of health care quality and lower mortality rates will to a lesser extent be hospitals with for-profit market structure. However, as McClellan and Staiger (2000) also have outlined the advantage with the for-profit hospitals comes from the specialization in the most profitable health services leading to a higher propensity to monitor hospital services by using local expertise in the specific markets.

Gowrisankaran and Town (2003) estimated the effects of competition by using the Medicare and HMO health insurance in Southern California and measuring hospital mortality with two diagnoses. That is, the risk-adjusted hospital mortality rates for pneumonia and AMI mortality patients. The method to measure hospital competition uses each insurance arrangement's patient flow in counties of Los Angeles. The study finds that an intensified competition for HMO patients is associated with a decreased risk-adjusted hospital mortality rate and competition for Medicare patients is associated with increased risk-adjusted hospital mortality rate. Therefore, an intensified competition for patients that are covered by an HMO benefits both price reductions and contributes to decreases in mortality rates (Gowrisankaran & Town, 2003). Similarly, Lie and Phelps (2008) have examined the effect of non-price managed care competition and its possible effect on the quality of care in New York State Children's Health Insurance Program (SCHIP). The method for measuring SCHIP competition uses the number of eligible children enrolled in managed care plans. The method used to measure quality of health care uses the Consumer Assessment of Health Plans Survey and three Health Plan Employer data, as well as Information Set Scores (Liu & Pheleps, 2008). By doing so the authors found the existence of negative association between non-price managed care competition and the quality of health care. Further, Escarce, Jain and Rogowski (2006) assessed the effects of hospital competition and HMO insurance on mortality for six medical conditions in California, New York, and Wisconsin. The study measures hospital competition with 75 and 90 percent radii for the hospital and quality as admissions-based 30-days morality rate for six medical conditions. By using these methods the authors found that the hospital market in highly competitive areas will tend to improve the quality of care in the absence of mature managed care plans. This implies that an increase in the hospital competition contributes to higher health care quality, but with more HMO coverage the likelihood of improving health care quality will be lower (Escarce et al., 2006).

More recent evidence outlines that hospital competition's effect on quality of care is complicated by the prevailing difference in health insurance and possibility of price competition. For instance, Volpp, Ketchman, Epstein and Williams (2005) assessed the effect of price competition and reduced health care subsidies on in-hospital mortality in the U.S. The in-hospital mortality is calculated by using hospital discharge rates for seven conditions whereas hospital competition is calculated by using patient-flow data in hospital market areas. This study finds that retaining large number of patients in hospitals will have positive effect on larger hospital capacity due to intensified price competition that, in turn, leads to worsened outcome for health care quality (Volpp et al., 2005). Their finding shows that the price competition leads to statistically significant increases in mortality for uninsured patients compared to insured patients with congestive heart failure. For instance, for insured patients, the statistically significant increases in mortality are found for patients with stroke (Volpp et al., 2005). Moreover, the study concludes that price competition may worsen the quality outcome by altering the rate of mortality in less competitive markets. This was the case in New Jersey that had smaller increases in mortality compared to the New York's average market competitiveness. This means that smaller market competitiveness seems to be an important element in determining mortality reduction for insured patients living in less competitive areas.

Most recent empirical findings can be outlined as follows. Bloom, Propper, Seiler and Reenen (2010) argue that hospital competition correlates with better management quality and lower mortality rates for emergency AMI patients. The study controls for the number of rival hospital locations in marginal districts by constructing catchment areas and measures of political vulnerability to analyze the effect of English NHS reforms. The overall objective of the study is to find out whether NHS reforms aimed at improved patient choice were able to motivate hospitals to improve their performance. The methods used for quality are difference-in-difference estimators for 30-days AMI mortality and for hospital competition using HHIs in terms of the actual and predicted patient flows. The study also uses measures of relative political marginality of constituencies and shows that there is a lower risk for closure in the absence of support from the governing party (Cooper, Gibbons, Jones & McGuire, 2011). The study finds that lower bargaining power of the governing party NHS reforms contributed to higher quality of care to a large extent owed to considerable decreases in mortality rates for patients living in more competitive areas.

2.1.2 Utilization- based health care and competition

Evidence states that, as hospitals pay particular attention to cost-containment in addressing patients' demands such that the reduction in the length of stay is often necessary condition to ensure release of hospitals capacity for treatments and provision of services (NHS, Institute for Innovation and Improvement). Therefore, hospital operation capacity has increasingly been a function of hospital's costs and the extent of patient's health care utilization (Benton, 1996). At the same time, there are differences in

the hospital ownership type that affect hospital's length of stay so that, for instance, hospitals with for-profit status will to a larger extent have higher incentive to lower length of hospital stay than public hospitals because there are greater pressures on these hospitals to reduce their costs. Magnussen and Mobley (1999) as well as Yuan, Cooper, Einstadter, Cebul and Rimm (2000) examined the association between hospital arrangements that are expected to influence hospital's mortality and the average length of hospital stay (ALOS) in the hospitalized care of Medicare beneficiaries during the 10-year period for acute care hospitals in the U.S. The study finds that patients with not-for-profit hospital status face 10 to 20 percent longer ALOS for the risk-adjusted AMI mortality patients, compared to patients in another hospital setting for most diagnoses (Yuan, Cooper, Einstadter, Cebul & Rimm, 2000). In other words, the hospital's for-profit status distinguished by higher demand for cost containment in relation to the not-for-profit hospitals leads to lower excess ALOS. However, Magnussen and Mobley (1999) also point out that for profit-status of the hospital does not generally guarantee the superior operational capacity of the hospital. The study examined the capacity utilization, productive efficiency, and the consequences of empty beds in four different market environments in highly regulated Norwegian hospitals and unregulated private hospitals in California. The study finds that Norwegian hospitals have lower degree of hospital competition in relation to California hospitals and the latter has higher level of utilization of plant capacity. Due to higher level of utilization of plant capacity hospital competition's variations in the California hospitals shows that Californian hospitals will have better reserve capacity in excess of maximum demand. However, the study also suggests that for-profit Californian hospitals do not have better operational capacity than their Norwegian counterparts.

Furthermore, the empirical evidence postulates that shorter ALOS leads to better quality of care due to an improved efficiency when hospital cost pressures rise. For example, Battleman, Callahan and Thaler (2002) assess the interaction between the quality and health care resources by using ALOS measure for antibiotic delivery in the treatment of pneumonia. The study finds that rapid initiation of antibiotics and appropriate selection in the emergency department is crucial for shortening the ALOS because it determines the effect on health care quality as a result of the shorter ALOS for patients with community-acquired pneumonia (Battleman et al., 2002; Clarke, 2002). Previously, Clarke, Row and Black (1996) have also stated that in case of correct patient allocations, the lower ALOS leads to better qualitative outcomes for patients in the form of reduction in the risk of infection in the first 10 days. That means that, with rising cost containment pressures makes it necessary for hospitals to reduce the ALOS and that improves the outcome for health care quality (Clarke, 2002). Clarke, Row and Black (1996) findings also supports use of ALOS measures which they argue justified from the point of view of efficiency in the use of hospital beds because otherwise the ineffective health care utilization represented by longer ALOS results in health deterioration for nosocomial infections (Kossovsky, Sarasin, Chopard, Louis-Simonet, Sigaud, Perneger & Gaspoz, 2002). The increase in the risk of nosocomial infections implies that the reduced postoperative in-hospital stay should be a priority because more balanced hospital stay influences the improved blood sugar and blood pressure for AMI patients (Schofield, 2005). Similar arguments were also raised by Clarke (2002)

who pointed out that increases in the ALOS are undersirable since there would be an increase in morbidity from the risks of acquiring hospital infections in the form of abdominal hysterectomy after operative surgical procedure. That is, acquiring abdominal hysterectomy infections would lead to patients being hospitalized 3.55 days longer than patients in the control group (Kandula & Wenzel, 1993). In sum, the evidence underscores that given rising cost pressures in hospitals; the ALOS is in fact a proper measure of quality of hospital services that is seen as an indicator of the risk associated with diseases and efficiency in the use of health services.

2.2 Summary

This chapter has presented empirical findings and measures used to investigate the effect of hospital competition on quality of care within the framework of outcome-based quality measures and utilization-based quality measures. In the case of the outcome-based measures the hospital mortality measures have been widely used due to their relation with the undesired health outcome from hospital treatment. Studies using outcome-based AMI mortality measures pointed out that for-profit hospital activities seemingly negatively associated with mortality rates while the nature of the relationship is not always negative due to differences in patient insurance and price competition. The methods used by these studies to calculate hospital quality and health care competition also generally vary. In the case of utilization-based measures the ALOS has also been increasingly used as a measure accounting health care service utilization that affects the outcome of hospital treatment in the context of greater hospital competition. In general, the use of quantitative methods by the regional studies to measure quality and hospital competition is also comparable to this international research because the AMI mortality and ALOS measures have been widely used. Therefore, the framework of reviewing utilization-based measures and outcome-based contribute to knowledge of how the multifaceted value of health care quality is associated with development of improved hospital performance applicable for different types of hospitals. The empirical findings also contribute to the understanding for the promotion of health care policy developments in the framework of ALOS reduction.

3 Conceptual framework

This chapter will present a theoretical argument for using hospital density as a measure of hospital competition. To the knowledge of the researcher, there seems to be basically one theory that is used to explain the notion of quantity-quality restraints of hospital services. Therefore, this chapter begins by describing the theory in relation to the present study. It then draws a link between the theory and hospital competition and the number of hospitals taken as a proxy for hospital competition. Furthermore, the chapter will discuss some of the problems that arise as a potential weakness to comparison of hospital density across different countries. Next, it will discuss the concept of health care quality and how quality

can be understood as the outcome measure, in the context of hospital's operation capacity and monitoring practices. Furthermore, related to the other quality measure used to measure quality, the length of hospital stay, the theory discusses financial incentives and health care policies priorities that were prevalent in different hospitals. The chapter then concludes with two hypotheses that formulate the underscore association between hospital competition and health care quality.

3.1 Competition in the hospital market

Newhouse (1970) developed a model of utility maximization, which was applied to the hospital sector. In the Newhouse model, hospitals aim to maximize both the quantity and quality dimensions which subject to financial constraints (Morris, Devlin, Nancy, Parkin & David, 2003). Quantity and quality will be measured as a single dimension and together they comprise of the output of the hospital. As Morris et al. (2003) argue the quantity of services could be measured in several ways, such as:

1. The number of patients treated
2. The number of days of patient care provided

The implication of the Newhouse theory assumes that hospital administrators are interested in increasing both the quality and quantity of hospital output regardless of the hospital ownership structure. In other words, if there are large concentrations of for-profit companies relative to not-for-profit companies or vice versa (Newhouse, 1970), the hospital market may show a tendency to be more competitive. According to Newhouse (1970), medical staff played a crucial role in the decision-making regarding resource allocation and who have a genuine interest in maintaining a balance between the various services provided. This still seems to be the case with Morris et al. (2009) pointing out that it is the decision-makers who choose an optimal combination of quality and quantity frontier that maximizes utility. Further, this occurs when the frontier is tangent to the highest attainable indifference curve (Morris et al., 2009).

Considering the quantity and quality domains of hospital services, it is reasonable to question how increased hospital competition can improve quality of care. Recent studies show that there are several possible ways of analyzing hospital competition in relation to the number of hospitals. First, if the number of hospitals is taken as a proxy for hospital competition it is a likely to indicate that when the quantity of hospitals in hospital market increases, hospitals will also be more competitive because of the greater choice of health care services available to the patients. Second, the presence of hospitals in a certain area shows how intense hospital competition is with respect to delivering health care services (Ecevit, Eyyup, Ciftci, Fatih, Ag & Yusuf, 2010). Finally, the hospitals that have many competitors may be compelled to increase the quality of care in order to attract patients and increase revenues (Morris et al., 2003). This means that

these pressures arise when numbers of competitors' increases since hospitals that are operating in highly competitive areas possibly encounter more pressure to improve the quality of health care relative to those hospitals that have no or few competitors (Morris et al., 2009). In this way, hospital competition also aids in improving their management capacity and quality of health care by insuring better utilization of services and lower excess capacity (Devers, Brewster & Casalino, 2003).

However, there are problems that arise when dealing with hospital competition. First, the comparability of hospital competition across countries is that countries with different healthcare systems may experience different effects from hospital competition on the quality of care. This means that countries distinguished by a greater level of financial reimbursement may incur different burdens of financial responsibility for the consumption of health services (Donaldson & Gerad, 1990). Second, countries that are confined by public financing arrangements for example might be more modest in pursuing competition in the health care since they rely on the government in the use of public funds to deliver health care services (OECD health data, 2011). For example, in Norway, Finland, Spain, Sweden, and Switzerland hospitals in the public sector will have higher incentives to increase the provision of health care relative to those countries where competition is more openly promoted (Ettelt, 2007). Therefore, countries with different healthcare systems may experience different effects from competition on health care quality.

Second, the problem with comparing hospital density among different countries is that higher quantities of health care services might, however, lead to 'inflated' expectations if there appears to be a greater incidence of hospital service available because of the tendency to expect more for additional service consumed. Countries that are characterized by cost sharing arrangements with public and private schemes, including greater use of out of pocket payments, are Japan, Korea, the U.S., and Canada will have more direct association between the provision of additional services for direct payments and the increasing use of hospital services. Hospitals are prone to provide additional services if they are reimbursed according to the (ASHA, 1997-2013) reimbursement which is a pre-payment method for a certain episode of treatment. Prospective reimbursement gives more incentives to offer additional services for hospitals that are under harder budget constraints are prone to maximize their income, which is possible by admitting more patients (Donaldson & Gerad, 1990). Thus, the large hospital density might be indicative of the differences in countries cost sharing arrangements and systems of reimbursements.

3.2 Quality of health care

The outcome-based measure of health care in the previous research is overwhelming associated with hospital deaths. The use of outcome-based mortality measures is, in turn, motivated by the desire to reduce hospital mortality for admitted patients (Sixma, Kerssens, Campén & Peters, 1998). Therefore, hospital mortality measures have also been overwhelmingly used in the previous empirical studies and are easily accessible in hospital statistics for patients' admissions. At the same time, as it has been pointed out by

Romano and Mutter (2004) mortality rates can also be used as a benchmark of quality for internal hospital failures that occur in the health care system. Therefore, the quality of health care services represented by mortality measure becomes a useful proxy only when hospital's health care delivery and treatments also manage to reduce sources of the potential risk associated with acute illness. This means accounting for factors that are positively associated with the use of hospital services and negatively associated with hospital's quality (WHO, 2008).

To assess the underlying determinants of health care mortality requires closer examination towards quantity constraint in relation to hospital's operational capacity. Recent studies pointed out that decision maker are influencing hospital's operational capacity with an appropriate balance between various services associated with the quantity of available facilities, the quantity of service provisions and equipment (Adair, Simpson, Casebeer, Birdsell, Hayden & Lewis, 2006; Romano & Mutter, 2004; Li & Benton, 2003). In other words, in determining management capacity the decision makers have a prevailing interest in maintaining operational capacity of the hospital. This means that hospitals find the optimal combination in regards to the quantity of, for instance, in-patient admissions, instant surgery, and service offerings that are likely to affect the future outcome of hospital quality. Then, the balance of the services provided should ensure that the input of emergency admissions, patients' length of stay and patient classification mix is equivalent to the increased in demand for hospital services (Li & Benton, 2003). Thus, it appears reasonable to use quantitative measures of health care services in the context of hospital competition as it provides an indication of the possible future effect on hospital quality.

The evaluation criterion for hospital health care quality in hospitals is associated with the use of heath care monitoring strategies (WHO, 2007). Health care monitoring, in turn, requires making sure that hospitals comply with quality regulations because in hospital service provisions monitoring deter defects and therefore defines the level of quality of hospital services (Brewster & Watson, 2011). At the same time, the evaluation of hospital quality may result in different practices being used in the relation to different hospital types. For example, in the case of private hospital arrangements the monitoring that is used among the not-for-profit hospitals and for-profit hospitals will have similar effects due to pronounced goals to contain hospital costs and lower hospital excess capacity. The public hospitals are however, distinguished by their larger size and operational capacity (Brewster & Watson, 2011). As a result, differences in the assessment of performance may stem from differences in hospital type that are essentially distinguished by the initial conditions of hospital's quantity and quality constraints.

Moreover, many health care systems are distinguished by financial incentives to insure that hospital's operational capacity becomes efficient in reducing the excess ALOS in hospitals. This means that financial incentives are built in health care systems to generate improvements in the quality of care by means of shortening the excess ALOS. There are a number of reasons for hospitals to pursue reduction in the excess

ALOS. First, reducing the excess ALOS insures increases in patients' admissions and incidence of hospital treatments (Clarke & Rose, 2001). That is to say, with shorter ALOS it becomes possible to increase patient admissions and simultaneously the quantity domain of hospital service delivery (Clarke & Rose, 2001). Second, the larger patient admissions are in turn only possible when there is an increase in demand for hospital services. Therefore, the management operations and financial incentives are internal to the hospitals in the assessment of quality to see whether it is possible to increase patient admissions (Rhee, 1976; Alexander, Jeffrey, Weiner, Shortell & Baker, 2007). Thus, different hospitals distinguished by the for-profit and not-for-profit status, physicians' arrangements, and accreditation are driven by different financial incentives to increase patient admissions given improved operational capacity of the hospital (Aiken, Clarke & Sloane, 2002).

The primary target of health care policy reforms in hospitals have been both the subject of hospital downsizing particularly with regard to large public hospitals and consolidation of smaller scale services in hospitals to reach acceptable levels of ALOS (Green & Nguyen, 2001). The policy priority with regard to downsizing or consolidating could be grounded in the initial size of the hospital. For instance, hospital management can be particularly concerned with the reduction in the excess of hospital capacity to ensure appropriate balance between costs and patient delays in order to reach the target occupancy rate (Green & Nguyen, 2001). Previously, health care reforms have promoted the reduction in hospital beds due to the prevailing excess capacity in public hospitals. The excess capacity in public hospitals is required to be balanced to increase the incidence of treatments (Green & Nguyen, 2001). Therefore, downsizing coupled with maintenance of large number admissions have been the preferred hospital choice to maintain the target occupancy. However, it may be difficult to determine the level of downsizing in the relation to the target occupancy rate. Green and Nguyen (2001) make a valid point that measuring occupancy levels could be misleading because there is no obvious relation to the excess capacity. That is, it is difficult to know exactly how the excess capacity and the actual occupancy requirement that is needed in hospitals in order to achieve quality goals in relation to hospital services.

3.3 Hypotheses

The study presents the two hypotheses in relation to the two hospital quality measures used. First, the argument is that greater hospital competition has the tendency to improve the quality when hospitals attract patients' demand thereby increasing the consumption of health care related services. That means that hospitals are expected to increase the provision of medical treatments and quantity of services such that an increase in hospital' service provisions would be equivalent to higher demand for hospital services. Thus, in light of the increase in quantity of service provisions and greater patient consumption of health care services hospital competition is likely to improve the quality of their hospital services.

The following hypothesis describes the association that depicts the expected effect of hospital competition on the outcome of hospital quality.

Hypothesis 1 In the context of increased hospital competition hospitals increase the provision of services that aids in improving hospital quality when patient consumption of medical services increases.

Second, the argument is that the greater utilization of hospital treatments comes from the greater use of hospital resources in the hospital facilities (Hensher, Edwards & Stokes, 1999). Therefore, an increase in the demand for hospital services is likely to increase pressures to reduce hospital's excess ALOS with goal to increase efficiency and improve operational capacity of the hospital. Therefore, lower excess ALOS leads to freer operational capacity for patient admissions and treatments regardless of the hospital market type and ownership form (Cooper, Gibbons, Jones & McGuire, 2011). Further, as the excess ALOS in hospitals decreases it becomes possible to make treatments and hence health care utilization more intensive when patients also simultaneously consume more services at the margin. Thus, with more intensive hospital treatment the operational capacity of the hospital improves when hospital competition rises.

The following hypothesis describes the expected association between hospital competition and health care quality with respect to utilization of health care services.

Hypothesis 2 Greater hospitals competition leads to lower excess capacity when hospitals are better able to utilize health service delivery by offering better patient treatments.

3.4 Summary

The theoretical framework has approached density measure of hospital competition and quality of care as the outcome-based measure and as a measure of hospital utilization by arguing that hospital decision-makers aim to maximize hospital's utility by determining an optimal combination of quality and quantity constraints. Further, the chapter has discussed the problems in comparability in hospital density across countries, such as differences in the financial reimbursements and hospital operational capacity. Then, the quality of health care is discussed in relation to the quantity of health services provided and by using health care monitoring strategies that guides the process of health care quality improvements. Next, in relation to the use of health care services the conceptual framework points out that hospital characteristics and hence practices are subject to different priorities depended on the financial incentives in different hospitals such as health care systems, for-profit status and management of operational capacity. Finally, the chapter argued by using the two hypotheses that hospital competition aids in providing improved hospital quality when there is a growing competitive pressure to increase the provision of services.

4 Data

The annual data for the variables used to assess the quality of care and hospital competition have been collected from the OECD health statistics, except for the control variable the out-of-pocket expenditure, which have been retrieved from the World Bank, 2012. Further, the data extracted is available approximately between 2000 and 2009. The two quality measures are used in the assessment of hospital quality of care. That is, the in-hospital admissions-based 30 days mortality rate for AMI patient measured in percentages and the length of hospital stay by acute AMI patients measured in days. The hospital competition measure is the number of hospitals per million of the population available at the country level. Then, the control variables added to the regression model associated with the outcome of hospital care, hospital's operational capacity, demographic characteristics and health care expenditure.

4.1 The empirical strategy

This chapter will present an empirical strategy used for the two regression models to estimate the effect of hospital competition on the quality of health care. Further, the sub-chapter argues that all countries are heterogeneous in their hospital market development. Due to this, there may be unobserved factors that will influence the performance of hospitals, which are not possible to control specifically. Therefore, country dummy variables are used in the regression models to control for unobservable factors. Next, the chapter develops another regression model to control the differences in health care systems. According to Bjegović and Donev (2004) there are two basic models that can be used in analyzing channels of health care delivery that are characteristic in general to the OECD countries: the public model and mixed models. These two main models are suitable for the analysis of this research because separating the regression models allow control specifically for the differences in the health care system. Moreover, by having two regression models, it becomes possible to answer two questions of the thesis by focusing on two different approaches to hospital competition, that is, observed and unobserved factors in countries. The chapter then presents different specification models that are adequate in relation to the comparison of the results between the two different regression models used that account for observable and unobservable characteristics.

4.2 Method

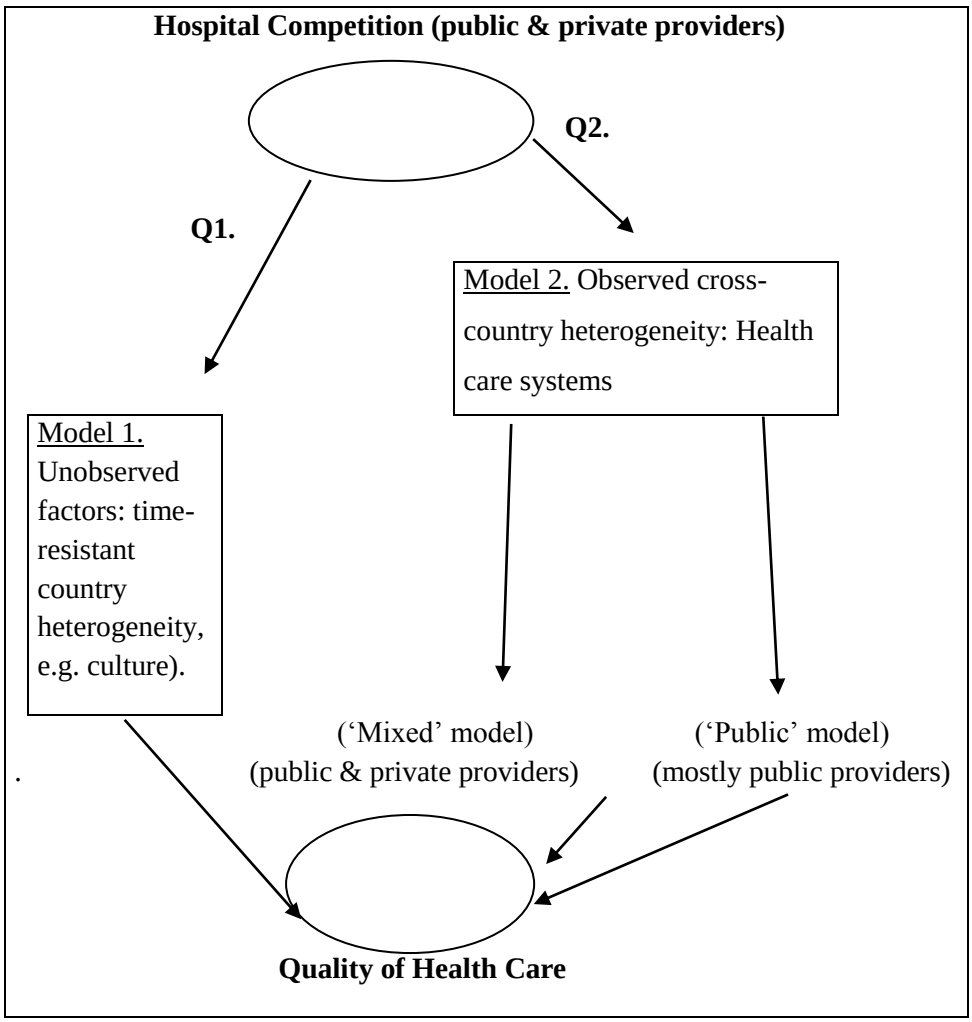
The empirical analysis examines the ordinary least square (OLS) regression model of the two measures of health care quality and hospital competition. The first measure of quality is the percentage of admissions-based in-hospital, 30-days acute AMI mortality rate available for 19 OECD countries. The second measure

is the length of in-hospital stay for acute AMI mortality for 18 OECD countries. There are 18 countries in the second regression models due to Sweden's country profile missing for the variable average length of in-hospital stay. All the results are delivered by using EViews 6, correcting for heteroscedastisity and potential autocorrelation with robust standard errors. In relation to heterogeneity in the hospital market development countries are expected to have unobserved characteristics at the country level that are controlled by using country dummies in first regressions of both models. Next, to specifically analyze whether the results are comparable across different specification regressions the second model considers distinguishing countries' health care system according to the two main models. That is, the public model and health insurance model. The public model characterized by government ownership and the prominence of public providers as in countries such as New Zealand, the UK, and Sweden. The characteristic of the public model is the state-budgeted financing of health care unrelated to income (Bjegović & Donev, 2004) and the NHS that is funded from general taxes and the free access to all citizens (Mills, 2011). Thus, due to the predominance of public hospital providers that limits hospital competition in the public model an increase in hospital competition is likely to be associated with an increase in the quantity domain of hospital's service provision. The health insurance model which is also known as mixed model is characterized by a public contract system as in Germany and Netherlands and reimbursement system as in Belgium. The underlying characteristic of the model is compulsory social insurance that is funded by the employers and employees with a combination of public and private hospital providers. That is to say, the health insurance model emphasizes the contractual relationship between the provider and the purchaser of health services. In this model, the purchasers of health care are active negotiators for the price of health care which indicates greater competitive pressures in the promotion of hospital competition compared to the public model (Anell, 1996).

In the case of the United States the health care system is characterized by private health care insurance. In this health care system the financing mechanisms of health care system are largely driven by the market forces in which there are employers that are the direct purchases of health insurance. There are also the Medicare and Medicaid insurance channels of health care provision that possess the elements of both the public and mixed models (Bjegović and Donev, 2004). Thus, considering the view of Bjegović and Donev (2004) that point out different elements of health care provision motivates the inclusion of the U.S. in the public and mixed models of health care system.

The idea of analyzing the two questions as of how hospital competition is expected to influence the quality of care is illustrated in the figure 1.

Figure 1 The observed and unobserved factors influencing hospital competition's effect on health care quality.



To address the two underlying questions of the thesis Figure 1 portrays the two methods used to analyze hospital competition's effect on the quality of care. The first approach of the model 1 shows that hospital performance is expected to influence quality in the context of the channel influenced by unobserved country heterogeneity. This is due to differences in stages of development towards hospital competition in different countries that may be causing countries to experience different effects from hospital competition on the quality of care. Therefore, country dummy are associated with factors that are not possible to control specifically and that might be resistant towards the implementation of health care policy reforms. They, therefore, may pick up factors that capture, for instance, cultural and institutional heterogeneity of the countries included. Second, in the model 2 the analysis aims to control for the observed country-

heterogeneity that distinguish health care systems in the framework of public and mixed models. This means that countries that basically belong to these models are expected to experience hospital competition's impact on health care quality outcome according these models' system-related financial reimbursement. The model 2 then assumes the prevalence of private channels of health care provision in the mixed model will have the tendency to deliver higher degree of hospital competition.

The effect of hospital competition on mortality and length of hospital stay for AMI patients is also influenced by the factors that are associated with the outcome of health care and utilization of health care in both models. As a result, these factors are classified according to the characteristics associated with outcome of hospital care, operational capacity of the hospital, demographic characteristics and the type of health care expenditure. Later, the control variables are specified in all regression models and analyzed with respect to their reinforcing effect on the variable hospital competition and then closely examined on the two quality indicators.

1. The admissions-based in-hospital 30-days mortality rate for acute AMI and hospital competition.

The first regression model is specified by using admissions-based 30-days in-hospital mortality rate for acute AMI patients as the dependent variable:

Regression model 1:

$$Q_{it} = \alpha + \beta_1 * Nu\ of\ hosp_{it} + \beta_2 * PTCA_{it} + \beta_3 * GP_{it} + \beta_4 * GSP_{it} + \beta_5 * hospital\ beds_{it} + \beta_6 * Disch_{it} + \beta_7 * Pop65_{it} + \beta_8 * Females_{it} + \beta_9 * Healthx_{it} + \beta_{10} * OOP_{it} + D_i + Error\ term_{it}$$

In the regression model 1 Q_{it} is the dependent variable that denotes *i* for a country at time *t* for all available years denoted as the percentage of admissions-based 30-days mortality rate for acute AMI. The AMI mortality rate measures in-hospital deaths within 30 days of emergency admissions because acute mortality measure aid in omitting possible patient self-selection when the health condition is acute (Propper et al., 2002). Then, the hospital competition measure is denoted by $Nu\ of\ hosp_{it}$ for country *i* at time *t* and represent the number of hospitals per million of the population available as a hospital density at the country level. $\beta_1, \ldots., \beta_{10}$ denote the size of the coefficient for each variable. Further, additional control variables are considered. First, the $PTCA_{it}$ and stenting that denotes percutaneous transluminal coronary angioplasty for 10000 population at time *t* for country *i*. The PTCA and stenting measures the number of invasive procedures performed that controls for the quality for hospital care for AMI patients. The primary physicians and specialized physicians are similarly used as measures influencing the outcome of hospital treatment. Namely, GP_{it} denotes general medical practitioner for 1000 population and GSP_{it} denotes a specialized medical practitioner for 1000 population. Second, in relation to hospital's operation capacity $Hospital\ beds_{it}$ denotes the number of beds per million of population and measures hospital's relative size. The $Disch_{it}$ denotes discharge rates for the diseases per circularly per 100 000 population and

measures the number of patients that leave the hospitals after the finalization of treatment. Third, to account for demographic characteristics in the use of health services $Pop65_{it}$ denotes the number of people at the age of 65 years or older and measures the share of the old age individuals that use the health care services. Further, the regression includes $Females_{it}$ that measures the use of health services by the females in the population for country *i* at time *t*. In most countries the percentage of females will slightly be higher than for males which indicates greater use of health services by females. Forth, to control for the channel of health care expenditure the $Healthx_{it}$ measures total health care expenditure as a percentage of GDP. The OOP_{it} denotes the out-of-pocket expenditure as percentage of private health expenditure and measures the percentage of private health expenditure on health. To control for unobserved heterogeneity among countries the first regression model specifies the dummy variable D_i for country *i* which used to account for the unobserved country characteristics of the model 1. In the second model the regression model drops the dummy variable and specifies countries into two separate regressions for the mixed and public models that include the identical variables.

Regression model 2:

$$Q_{it} = \alpha + \beta_1 * Nu\ of\ hosp_{it} + \beta_2 * PTCA_{it} + \beta_3 * GP_{it} + \beta_4 * GSP_{it} + \beta_5 * hospital\ beds_{it} + \beta_6 * Disch_{it} + \beta_7 * Pop65_{it} + \beta_8 * Females_{it} + \beta_9 * Healthx_{it} + \beta_{10} * OOP_{it} + Error\ term_{it}$$

2. Average length of stay as dependent variable

The second empirical model specifies the dependent variables as the average length of hospital stay (ALOS) in days, by acute AMI patients as the measure of quality and includes the identical independent and control variables. The regression is, therefore, estimated to:

Regression model 1:

$$Q_{it} = \alpha + \beta_1 * Nu\ of\ hosp_{it} + \beta_2 * PTCA_{it} + \beta_3 * GP_{it} + \beta_4 * GSP_{it} + \beta_5 * hospital\ beds_{it} + \beta_6 * Disch_{it} + \beta_7 * Pop65_{t+1} + \beta_8 * Females_{it} + \beta_9 * Healthx_{it} + \beta_{10} * OOP_{it} + D_i + Error\ term_{it}$$

Regression models 2:

$$Q_{it} = \alpha + \beta_1 * Nu\ of\ hosp_{it} + \beta_2 * PTCA_{it} + \beta_3 * GP_{it} + \beta_4 * GSP_{it} + \beta_5 * hospital\ beds_{it} + \beta_6 * Disch_{it} + \beta_7 * Pop65_{it} + \beta_8 * Females_{it} + \beta_9 * Healthx_{it} + \beta_{10} * OOP_{it} + Error\ term_{it}$$

4.3 Summary

This chapter has argued for the use of two regression models in answering the two questions in the context of models for observed and unobserved country heterogeneity. The first model included the country dummies in controlling for heterogeneity that are associated with unobserved factors at the country level

whereas the approach of the second model is to distinguish countries according to the public and mixed models of health care systems. The second model then distinguished public and mixed models by the channels of reimbursement influenced by the private and public hospital providers. Then, the two approaches were illustrated in the figure where the second approach argued that mixed model is likely to generate greater positive impact from hospital competition on the quality of care in regards to the predominance of private channels of hospital providers in relation to the public model. Next, the chapter described the two identical specifications by using the two closely related but essentially different quality indicators. That is, the admission-based hospital mortality rate for acute AMI patients accounting for the outcome of care and the ALOS for acute AMI patients accounting for the use of health care services. These quality indicators used as dependent variables in the assessment of the impact of hospital competition on quality of care by first and second regression models respectively. The chapter then introduced 10 other control variables in the regression model in the assessment of the relation between quality of care and hospital competition.

5 Variables

The chapter begins with the description of variables used to measure hospital quality and hospital competition. First, the chapter describes the two measures used in the estimation of health care quality in relation to outcome of health care and utilization of health care services. In the following sections the reader is expected to find the available information about the average values used for each indicator available between 2002 and 2009 for each country. The average values of the control variables can be found in the Appendix. The chapter then describes the variable for the number of hospitals which is taken as a proxy for hospital competition and analyzes how the measure is expected to influence the desired outcome for hospital quality. Finally, the chapter presents control variables and argues for these controls relation to the quality of care, hospital capacity, demographics, and health care expenditures and reviews the OECD countries' statistical trends.

5.1 Quality measures - Dependent Variables

In this section the two quality measures will be reviewed. Both measures are used as dependent variables to answer the two questions of the research in first and second models respectively.

5.1.1 Admissions-based in-hospital AMI mortality rate.

The cardiovascular diseases account for main cause of mortality in most OECD countries and by 2009 the estimate has reached 35 percent of overall deaths (OECD health report, 2011). Therefore, hospital's disease related mortality rates have been used as measures of hospital quality due to mortality's direct association with undesired outcome from hospital treatments (Propper, Burgess & Green, 2004; Mukamel, Zwanziger & Tomaszewski, 2001; Keeler, Melnick & Zwanziger, 1999). Previous empirical studies were predominantly focused on using these measures especially for acute diagnosis as proxies of hospital quality. Therefore, this study motivates the use of AMI measures as responsive towards the outcome for emergence treatment that reflects hospital's internal failures (Milcent, 2005; Propper et al., 2004; Keeler, Melnick & Zwanziger, 1999). In the context of OECD there is a considerable variation in the rate of AMI mortality among countries. For example, the largest mortality rate is observed in Austria, Germany, Belgium, Ireland, Finland, Spain, Netherlands, and USA which is between 7 and 20 percent per year during the 2003 and 2009 (see table 1). The U.S. has approximately 19 percent mortality rate from hospital treatments which is the largest overall mortality rate in the OECD, followed by Germany and Spain as the next large countries with relatively high mortality rates for patients suffering from increases in AMI mortality. Australia as well as relatively smaller countries such as Czech Republic, Italy, New Zealand, and Sweden all experience the variations in AMI mortality rates at approximately 5 and 8 percent.

Table 1 Average admissions-based in-hospital, 30-days AMI- mortality rate, percentage.

Australia	6.314[a]
Austria	10.185[a]
Belgium	13.9[c]
Canada	7.825[b]
Czech Republic	7.825[b]
Finland	11.014[a]
Germany	10.6167[a]
Ireland	8,8857[a]
Israel	7.2714[a]
Italy	6.7[c]
Luxemburg	6.3167[b]
Netherlands	8.1667[a]
New Zeeland	5.8[b]
Norway	7.1285[a]
Poland	6.414285[a]
Portugal	10.785[a]
Spain	9.5857[a]
Sweden	7.657[a]
Switzerland	7.1571[a]
USA	19.3157[a]

Source: OECD health data

a 2003-2009

c 2006-2009

b 2004-2009

5.1.2 Average length of in-hospital stay in days by acute AMI.

The average length of hospital stay (ALOS) in days by acute AMI is the measure of utilization of hospital services that contributes to the outcome of hospital treatments (McDermott & Stock, 2007). The ALOS measures also reflect both the duration of patient's illness and the possibility to discharge patients from the hospital when hospital's operation capacity improves in efficiency (Barros & Olivella, 2011). This means that the ALOS can be used not only in the assessment of hospital performance but also to determine whether the use of hospital services represented by ALOS measure contributes to lower hospital excess capacity (Devers, Brewster & Casalino, 2003). There was a particular interest in the ALOS measures in the previous research in the assessment of hospital's cost, hospital efficiency, quality of care, speed of service delivery as these measures related to hospital's performance (Clarke, 2002; Clarke, Row & Black, 1996; McDermott & Stock, 2007; Bundred, Maguire, Reynolds, Grimshaw, Morris, Thompson, Barr & Baildam, 1998; Kossovsky, Sarasin, Chopard, Louis-Simonet, Sigaud, Perneger & Gazpoz, 2002). These studies motivate the applicability of ALOS measures in the hospital cost containment requirement in relation to hospital services. The trend in OECD countries has shown steadily decreased bed occupancy levels as a result of increased number of patients treated as a consequence of overall reduction in the ALOS by hospitals. The table 2 shows that there is a relatively high levels of ALOS in Finland, Germany, and Ireland and relatively lower ALOS values in Austria, Canada, Spain, Portugal, Poland, Italy, and Switzerland. The lowest value for ALOS is found in the U.S., Norway, and Australia with average of 5 to 6 days for acute AMI patients (Table 2).

Table 2 Average length of stay in days, by acute AMI.

Country	
Australia	6.24[a]
Austria	9.03[a]
Belgium	7.7[f]
Canada	7.088[b]
Czech Republic	7.3[e]
Finland	11.92[a]
Germany	10.95[e]
Ireland	9.99[a]
Israel	6.58[a]
Italy	7.85[f]
Netherlands	8.522[c]
New Zeeland	8.4333[e]
Norway	5.1375[d]
Poland	7.575[d]
Portugal	8.91[a]
Spain	9.21[a]
Switzerland	8.86[a]
USA	5.47[a]

Source: OECD health data

[a] 2000-2009
[f] 2006-2009
[b] 2000-2008
[e] 2004-2009
[c] 2001-2009
[d] 2002-2009

5.2 Hospital competition measure

The density measures for hospital competition are insensitive to the structure of the hospital market and are therefore expected to reflect patient's possibility to choose hospitals for a service (Gresenz, Rogowski & Escarce, 2004). Therefore, a count of available hospitals per million of the population represent an appropriate measure for hospital competition as high hospital density reflects the competitive pressure on hospitals to influence the patient's demand for higher quality treatments (Ecevit, Ciftci & Ag, 2010). Further, the data for hospital competition provides information at a geo-political level of aggregation of the country in which individuals reside (Andersen, 1983). That means that to the extent that the number of hospitals is high the distribution of medical resources in a country will also be high. The variable does not capture the relative sizes of hospitals which might be important to know if one wants to know hospitals' potential entrance to the hospital market (Ecevit et al., 2010). However, the assumption is that the more hospitals there are in the country the better is the condition to improve hospital performance that would be a prerequisite for higher hospital quality. This means that when number of hospitals in the country is large the level of competition among hospitals will also be higher. The average OECD hospital density statistics is shown in table 3. Several countries have a comparatively large number of hospitals per million of the population which are Australia and Finland with 54–59 hospitals, and there is a relatively smaller share of hospitals in Germany, Ireland, New Zealand, and Switzerland with 35–46 hospitals per million of the population (Table 3). Most countries have approximately 20 hospitals per million of the population, except for Netherlands with only 12 hospitals. The hospital density in the U.S. is 19.7 hospitals which might be explained by the tendency of monopolistic hospital structure captured by the difference of hospital to population density. That is, countries' smaller share of hospitals can be explained by larger hospital size in densely populated areas.

Table 3 Average number of hospitals for millions of the population.

Australia	64.115[a]
Austria	32.431[a]
Belgium	19.613[f]
Canada	22.0867[b]
Czech Rep.	25.042[e]
Finland	59.321[a]
Germany	40.92[e]
Ireland	43.71[a]
Israel	17.06[a]
Italy	21.3875[c]
Netherlands	12.15[c]
New Zeeland	35.16[e]
Norway	15.356[d]
Poland	22.835[d]
Portugal	19.467[a]
Spain	17.62[a]
Switzerland	46.234[a]
USA	19.729[a]

Source: OECD health data

a 2000-2009

f 2006-2009

b 2000-2008

e 2004-2009

c 2001-2009

d 2002-2009

5.3 Control variables

The evidence on hospital quality classifies quality indicators as the outcome-based and the utilization-based measures. Therefore, the outcome on quality can be affected by the utilization of health care that is associated with hospital related factors. First, as the medical personnel perform surgical procedures health care outcome is influenced by the ability to respond and address patient's requests and that determines an outcome on health care quality (Li & Benton, 2003). It means that surgical procedures measures showing higher incidence of medical operation give rise to the expectation that patients' health status should improve. Therefore, the utilization-based indicators are overwhelmingly are characterized by the actual quantity of hospital service provisions whereas the use of health care services is fixed by the proxy for operational capacity, most commonly, measured in the number of available beds (Li & Benton, 2003). Second, the utilization of hospital services may reflect hospital capacity as well because by having, for instance, larger discharge rate reflects hospital's capacity to perform higher incidence of hospital treatments. It is therefore possible to view the discharge rate as the capacity of the hospital to reduce excess ALOS when hospital treatments improve in efficiency. Third, it is also possible to consider demographic characteristics such as gender and age as the greater use of health care services is believed to be due to the larger share of health service consumption in the population (Andersen, 1983). Therefore, by the inclusion of the elderly and females allows analyzing the extent of health care consumption by these groups. Finally, to determine the type of health care expenditure the regression considers the total health care expenditure as percentage of GDP and Out-of-Pocket (OOP) expenditure as a percentage of private health expenditure. Higher share of public and private health care expenditure is an indication of the amount of resources spent on the consumption of health care services. This means that, with larger health expenditures one would expect to reflect higher level of hospital quality.

5.3.1 In-patient Percutaneous Transluminal Coronary Angioplasty and stenting for 100 000 population

The surgical procedures known as in-patient Percutaneous Transluminal Coronary Angioplasty (PTCA) and stenting per 100 000 of the population is a revascularization procedure used for treating the heart disease of AMI mortality as the leading cause of death in the OECD countries (Table 4, Appendix). The PTCA and stenting procedures are therefore related to the outcome of health treatments as these procedures effect the health outcome for patients with AMI diagnosis. Therefore, the PTCA and stenting is used as control for the outcome of hospital quality related to the hospital's capacity to perform surgical treatments if large numbers of PTCA procedures are performed. The highest incidence of procedures is observed in Germany and Belgium with 460-542.6 procedures on average between 2004 and 2009. The relatively large countries such as the U.S. have lower rates of PTCA interventions, that is, 212 procedures on average per year. In Australia and Canada the rate is 144 and 133 procedures respectively. However, there are unexpectedly high numbers of PTCA procedures for smaller countries such as Norway, Israel, and Sweden with 239, 231 and 162 procedures per year (Table 4, Appendix).

5.3.2 General medical practitioners per 1000 of the population

General medical practitioners per 1000 of the population measure the quality of hospital services in the provision of hospital's primary care due to general medical practitioner role as a reference for patients' visits to hospital facilities (Barros & Olivella, 2011; Dranove & White, 1994). In some NHS's the use of the general medical practitioner is motivated by screening before the referral to hospital treatment is possible. Therefore, general physicians are determining patient admissions and responsible for the co-ordination to clinical specialists (Dranove & White, 1994). Referral by the general practitioner varies across different systems and is mandatory in Italy, Netherlands, Norway, Spain, and the United Kingdom. However, the role the general practitioner has lower significance in France, Germany, and Belgium because the NHS is organized around the well-defined catchment areas and the capitation fees. This means that doctors are treating patients first at primary care facilities and detect health problems in time before making a hospital visit (Dranove & White, 1994). The highest share of general medical practitioners is observed in Germany, Portugal and Norway whereas the lowest incidence is found in Switzerland and the U.S. (see table 5, Appendix).

5.3.3 Specialized medical practitioners per 1000 of the population

The number of specialized medical practitioners per 1000 of the population is related to the outcome of hospital quality because the performance of surgical operation is only conducted by specialized medical professionals. The use of specialized medical practitioner is, therefore, increases the likelihood of improved hospital quality (OECD health data, 2011). Thus, the number of specialist medical practitioners influences the provision of health care services on the patient's health status as a result of the increased use of surgical interventions (Barros & Olivella, 2011). In highly competitive hospital markets one might expect that an increase in the use of specialized medical practitioner by the hospital is likely to lead to the improved quality of hospital treatments. Therefore, within the context of the growing demand for hospital services there is an incentive for hospitals to attract specialized practitioners aimed to influence the desired outcome from hospital treatments (Iversen, 2003; Noether, 1987). On average, the statistics for OECD countries show that there are 1 to 2 specialized practitioners per 1000 of the population for most OECD countries. There are more than 2 specialized practitioners in Czech Republic, Israel, Italy, Spain, and Switzerland and 1 or at most 2 specialized practitioners in the U.S., Australia, Canada, and Germany (Table 6, Appendix).

5.3.4 Hospital beds per 100 000 inhabitants

Hospital beds per 100 000 inhabitants' defines hospital's operational capacity related to the number of patients for possible hospital treatments (Table 7, Appendix). Therefore, the number of hospital beds is an indicator of relative hospital's size as numbers of available beds determine the availability of hospital admissions (Tay, 2003). The measure can therefore be considered as a benchmark with respect to hospital's operational capacity to carry out large number of possible surgery. The OECD health report (2011) suggests that there has been a slight reduction in the number of beds per capita during the period 2000–2009 due to the progression in medical technology that allowed reductions in the needed patient hospitalization. Moreover, reduced need for hospitalization together with the reduction in the ALOS has been possible owed to increased incidence of surgeries that have increased the rate of discharged patients. The largest number of hospital beds is observed in Germany, Austria, Czech Republic, Finland and Belgium whereas the lowest numbers are found in New Zealand, Sweden and the U.S. (Table 7, Appendix).

5.3.5 Hospital discharge rates by disease of the circularly per 100 000 population

The discharge rate by disease of the circularly, per 100 000 population is an indicator of hospital's operational capacity as the increased patient admissions are possible when the rate of discharged patients received an AMI-related treatment increases (Table 8, Appendix). Furthermore, hospitals that are able to discharge patients at a faster rate might show a tendency to have higher relative efficiency due to an improved outcome for treated patients. Therefore, the larger discharge rate is likely to come as a result of improved quality for hospital treatments applicable in prevention of future AMI-related illness and identification of possible treatment (Health at a Glance, 2011). The largest discharge rates are found in Austria, Germany, Finland, Czech Republic, Norway, and Luxemburg whereas the lowest is in Canada and Spain (Table 8, Appendix).

5.3.6 Percentage of elderly at the age of 65 or older

The percentage of the population that has reached the age of 65 or older measures the percentage of old age individuals in the population and reflects demographic characteristics of the elderly in use of health care services. For most countries the percentage of the elderly at the age of 65 varies between 12 to 17 percent (Table 9, Appendix) which is indicative of the tendency of disproportionate use of health care services (Evashwick, Rowe, Rowe, Paula & Laurence, 1984). The underlying reason for this is that there have been demographic transitions together with advances in medical technology that significantly improved the access to health care facilities for the elderly. Moreover, the average visits per year are one and a half times

higher in the group for people at the age of 65 years or older than the people at the age 45–64 years due to demographic transitions. This led to elderly's generally higher ALOS and rising cost pressures for hospitals (Health at a Glance, 2011; Evashwick et al., 1984; Coulton & Frost, 1982). Recent evidence shows that the budgetary pressure rise in areas with high proportion of elderly which led to reductions in the health care consumption by the elderly in Sweden (Gerdtham, Lundin & Saez-Marti, 2005). In the U.S. the decline in the admissions for the elderly is tend to be explained by the differences in the health care status across different socioeconomic areas (Lagoe, 1986). The decline in admissions is, in turn, explained by fact that the elderly in different socioeconomic areas have encountered differences in the health care status due to differences in the consumption of health care (Evashwick et al., 1984). The highest number of elderly that use health care services more at the margin is observed in Japan, Belgium, Sweden and Spain whereas the lowest numbers of elderly are observed in Israel and Ireland (Table 9, Appendix).

5.3.7 Percentage of females

The female variable measures the percentage of females as a share of the population that represents the use of health care by the females. On average, the share of females in the population is larger than males for most countries according to (OECD trend in Table 10) which mean that females use health care services more extensively than males. This indicates that females require greater consumption of the health care service confirmed by the evidence (Bertakis, Helms, Callahan & Robbins, 2000). There are also gender differences in the utilization of health care services with higher percentage of females using health care services due to greater episodes of acute illness. This leads to the assumption that an increase in the proportion of elderly females that may encounter AMI illness contributes to greater female use of health care service (Owens, 2008). The demographic characteristics in the population confirm that there are on average more females than males that use health care services for most countries included where the female population constitutes 50.5 and 51 percent (Table 10, Appendix). Thus, gender-related population characteristics also tend to explain higher overall female health care utilization.

5.3.8 Total health expenditure as percentage of GDP

The total health expenditure as a percentage of GDP measures the level of health care expenditure in the country (Table 11, Appendix). This means that countries that spend more on the consumption in the relation to countries that spend less will encounter possibility for improved quality of hospital services. Thus, higher share of richer country's resources is allocated towards funding the use of health care services and the health service delivery will therefore have direct association with better hospital quality. Moreover, the demand for health care is also determined by income elasticity showing that consumption of medical care occurs at the margin of medical expenses where countries that spend more are characterized by better

fixed capital and hence a possibility for patients to consume more hospital services (Parkin, 1987). The data for total health care expenditure available over the period 2000–2009 that shows the largest total health expenditure in the U.S compared to the rest of the OECD countries with 15.68 percent of its GDP allocated in the consumption of health care. Further, the largest health expenditure is found in Austria, Germany and Canada whereas the lowest health care expenditure is observed in Czech Republic, Ireland and Israel (Table 11, Appendix).

It should be noted, however, that it is difficult know exactly the relation between quality of care health care expenditure as a percentage of GDP because at the margin, health care expenditure reflects rather the possible consumption of health care and not the actual patient health outcome (Parkin, 1987). For example in the U.S., the average physician-and-nurse-to population ratio has been considerably lower than in most OECD despite very high levels of GDP per capita allocated for health care services. At the same time, the health care expenditure has also increased more than twofold in the U.S. in relation to the average level in most OECD countries with 4.0 percent versus 1.6 percent respectively, while the physician-to-population ratio grew at one percent (OECD Health at a Glance, 2011; Reinhardt, Hussey & Anderson, 2004).

5.3.9 Out-of-pocket expenditure as a percentage of private health expenditure

The out-of-pocket (OOP) expenditure is a measure of private health expenditure allocated to the consumption of health care services (World Bank, 2013; Table 12, Appendix). This means that, higher share of OOP expenditure reflects the differences between public and private health insurance schemes of the public and mixed models of health care systems. Higher percentage of OOP expenditure expectedly leads to larger burdens for private health expenditure in paying bills for the additional service consumed and might, in turn; result in overall reduced consumption of health care services (OECD Health at a Glance, 2011). For OECD countries, the OOP expenditure constitutes approximately 19 percent of health care spending (OECD health at a Glance, 2011) with 35 percent for the U.S. and 89 percent for Czech Republic (Table 12, Appendix). This means that the OECD variation in the OOP expenditure is generally very high. Moreover, the other OECD countries with high shares of OOP expenditure are Poland, Spain, Switzerland, and Belgium and a very high in Norway whereas the relatively low share are found in Netherlands, U.S and Canada (Table 12, Appendix).

5.4 Summary

This chapter has first presented the two variables used in relation to health care quality such as admissions-based in-hospital mortality rate for acute AMI patients and the ALOS for acute AMI patients. These measures have also been reviewed in relation to OECD statistical trends available for the period 2000 and 2009. Then, the variable hospitals per million of the population was introduced as proxy for hospital competition argued suitable to account for heterogeneity in hospital markets that distinguish countries

within the OECD. Next, the chapter has presented arguments for the use of control variables by drawing the link between the underlying characteristics of health care quality and the use of health care services. The control variables are suitable because they primarily related to the outcome of hospital care, hospital capacity, demographic characteristics and health care expenditure. Measures such as PTCA, specialized practitioners and general practitioners were introduced in controlling for factors associated with the outcome of hospital quality. Further, in relation to hospital capacity hospital beds and discharge rates were introduced as these measures reflect the possibility of health care utilization. Then, the percentage of females and number of the population at the age 65 or older were introduced as controls for the consumption of health care associated with gender and age that have increased the use of hospital services. Finally, the OOP expenditure and the total expenditure as share of GDP are considered in controlling for the financial channels of health care expenditure that have an effect on the increased consumption of health care services. The chapter then presented the average values used in the regression models and reviewed OECD statistical trends for different countries.

6 Results

The chapter 6 presents the results of the two regression models used for admissions-based 30 days in-hospital mortality rate for AMI patients and the average length of hospital stay for acute AMI patients as measures of health care quality. The number of hospitals per million of the population is used as the measure of hospital competition. The control variables are added to the regression model according to their association with the outcome of health care quality, hospital operational capacity, demographic characteristics and type of health care expenditure. The control variables are primarily analyzed by reviewing their effect on the coefficient of hospital competition and the effect on the two measures of hospital quality. The chapter then discusses the results by drawing the analogy to whether they support the two hypotheses formulated in the theoretical framework.

6.1 Admissions-based mortality rate of acute AMI in percentage and hospital competition

The results from regression using mortality in-hospital 30 days admissions-based rate for AMI patients are shown in the table 13. In all regressions p-values are presented accordingly and significance level is denoted by an asterisk. One asterisk indicates significance at the 10 % level, two asterisks 5 % level and three asterisks 1 % level. Further, the statistical results are corrected for heteroscedastisity and potential autocorrelation by using robust standard errors. The regression specifications are also controlled for country unobserved effects by using country-dummies in first regression of the two models and differences in countries' health care systems in two regressions of two models. From the 1 specification in the table 13 one unit increase in the coefficient hospital competition leads to increase in mortality by 0.183 units. This means that one unit increase in hospital competition is associated with an increase in mortality for AMI patients by 0.183 units that represent an increase in 18.3 percent in mortality. The mortality increasing results from hospital competition in the baseline specification, therefore, does not confirm the improvement in quality according to *hypothesis 1*. However, the hospital competition appears to reduce an increase in mortality controlling for outcome of hospital treatment by PTCA and stenting, general practitioners and specialized practitioners where the effect represent an insignificant 0.0919 units. This means that hospital related characteristics associated with outcome of hospital care have an important reducing effect on the rate of mortality. The inclusion of general practitioners reduces mortality rate and shows that an increase in one unit is associated with a decrease in hospital mortality by -4.285 points (specification 2). The decrease in mortality is significant at 1 percent controlling for the number of hospital beds and discharge rates and remain consistently throughout the next 3 specifications. The coefficient for hospital competition is statistically distinguished from zero and negative in the specifications 3, 4 and 5. That is, with one unit increase in hospital competition is associated with a decrease in hospital mortality by -0.1945 units controlling for hospital beds, discharge rates and -0.187 controlling for gender and age related characteristics. Further, the inclusion of controls such as health expenditure as percentage of GDP and OOP

expenditure represent -0.109 which is significant at 10 percent level (see table 13). The overall results seem to confirm negative association between hospital competition and mortality rate for most specifications, ranging between 10 and 19 percentage points. This means that hospital competition reduces the mortality rate by at least 10 percent with the inclusion of health care expenditure as a share of GDP and OOP expenditure. That is, the inclusion of health expenditure as a share of GDP is associated with statistically insignificant increases in hospital mortality by 12.93 percent and inclusion of OOP expenditure by 4 percent (see specification 5, Table 13). The two controls influence hospital competition's mortality reducing effect with 10.9 percent and the coefficient is also significant at 10 percent level. The R-square is 0.9299 in the specification 1 and 0.9751 in specification 5, suggesting the negative association becomes stronger with the addition of hospital related controls. Further, from table 13 one can see that an increase in the number of beds by one unit yields a decrease in mortality rate by 19.45 percent which is significant at 1 percent level (specification 3). An increase in mortality rate controlling for the number of beds can be explained by improved health outcomes for patients treated with AMI diagnosis in larger hospitals. In the following 5 specifications the coefficient is negative when controlling for age and gender and controlling for the type of health care expenditure. The coefficient for hospital competition after the inclusion of the number of beds has negative sign which means that hospital competition reduces the mortality rate when hospitals have larger size. Next, an increase in the percentage of people at the age of 65 by one units is associated with -1.0254 statistically significant reductions in mortality represented by an increased use of health care by the elderly and females (specification 4). This indicates that increases in the use of health care services by the elderly and females increase pressure on hospitals to improve services when hospital competition increases. Expectedly, an increase in health care expenditure as a share of GDP and OOP expenditure both reduce the risk of mortality in different hospital markets even if the consumption of health care might consequentially decrease when individual have to pay more for additional services consumed. Therefore, the coefficient for OOP expenditure represents an increase in mortality even though the mortality coefficient is still negative. These results can therefore confirm that controlling for unobserved country heterogeneity there is a negative association between hospital quality and hospital competition which is in accordance with the *hypothesis 1*.

Table 13. Admissions-based in-hospital mortality and hospital competition.

Dependent variable	Admissions based in-hospital 30 days mortality rate				
2000-2009	Method OLS				
Independent variables	Competition measure				
Specification	1	2	3	4	5
Number of hospitals					
density per million p.	0,183**	0,09195	-0,1945***	-0,1866***	-0,109*
	0,077983	0,072692	0,073905	0,060902	0,65465
PTCA and stenting for 100000 p.		-0,013	-0,01468**	-0,003005	-0,003
		0,004555	0,004116	0,004199	0,0041
General medical practitioners,		-4,28478***	-5,46294***	-5,00309**	-4,8***
density per 1000 p.		1,587713	0,777671	0,578582	0,67877
Specialized medical practitioners,		-1,587713	-1,043665	-0,976556**	-0,928**
density per 1000 p.		1,244284	0,641312	0,44455	0,4169
Hospital beds, per 100 000 p.			1,95903***	1,74225***	1,264***
			0,412421	3,46E-01	0,346198
Discharge rates,			0,000736	1,49E-04	0,000237
diseases of the circularly per 100 000 p.			0,000875	0,000821	0,00079
Population over 65 and older,				-1,02542***	-0,95***
percentage of total p.				0,242807	0,24965
Females,				0,506709	0,3266
percentage of total p.				0,8486	0,83416
Total health expenditure,					-0,1293
percentage of GDP					0,15035
Out-of-pocket health expenditure,					0,0407
percentage of private health expenditure					0,025
Country dummies/Australia as a reference	Yes	Yes	Yes	Yes	Yes
Sample	1123	1123	1123	1123	1123
Observations	123	123	123	123	123
R-square	0,927798	0,954375	0,965961	0,973875	0,97508
S.E	0,959913	0,77442	0,675693	0,598097	0,5902

Table 14. Admissions-based in-hospital mortality in percentage and hospital competition for countries with a public model of health care system.[17]

Dependent variable	Admissions based in-hospital 30 - days mortality rate				
2000-2009	Method OLS				
Independent variables	Competition measure				
Specification	1	2	3	4	5
Number of hospitals					
density per million p.	-0,06223	-0,054603	0,04149	-0,01445***	-0,15033***
	0,038582	0,034459	0,039478	0,057001	0,031712
PTCA and stenting for 100000 p.		0,018128***	0,01515***	0,01326***	0,008635***
		0,003822	0,00354	0,003827	0,00264
General medical practitioners,		-4,6368**	-2,38637*	-1,76936	-1,89865**
density per 1000 p.		1,87604	1,227875	1,396108	0,84786
Specialized medical practitioners,		-1,500753	-3,16458**	0,841546	-1,675984
density per 1000 p.		1,208369	1,224275	1,54226	1,5608
Hospital beds, per 100 000 p.			-2,8890***	-4,27936***	2,17134***
			0,51883	5,63E-01	0,56395
Discharge rates,			0,0056***	0,004854***	-0,000757
diseases of the circularly per 100 000 p.			0,001113	0,001118	0,000876
Population over 65 and older,				1,2709***	-0,9117***
percentage of total p.				0,309496	0,209304
Females,				4,7963*	-0,017896
percentage of total p.				2,5249	2,603987
Total health expenditure,					2,0254***
percentage of GDP					0,23546
Out-of-pocket health expenditure,					0,036946
percentage of private health expend.					0,03004
Sample	157	157	157	157	157
Observations	57	57	57	57	57
R-square	0,025552	0,296474	0,58695	0,684383	0,925886
S.E	4,124332	3,604076	2,816255	2,512551	1,24373

[17] The countries included in the 'mixed' model of the health care system are Germany, Holland, Belgium, France, Austria, Switzerland, Israel, Japan, CSEE and FSU countries, see also Bjegovic & Donev, 2004.

Results for countries in the public model of health care system are presented in the table 14. The estimated hospital competition coefficient shows that an increase in hospital competition by one unit is associated with a decrease in hospital mortality by -0.062 units (specification 1). Therefore, this result is in line with the predictions of the *hypothesis 1*. Further, the inclusion of controls confirms the decrease in mortality from hospital with the exception when capacity controls are specified (specification 3). Thus, the size of the hospital has slightly a mortality increasing effect in this regression model from hospital competition. Further, the specification 5 represents the largest, that is, 15.03 percent decrease in mortality when hospital competition rises controlling for demographics and the type of health care expenditure (see specifications 4 and 5). These mortality reducing results from hospital competition suggests that the use of health services by females and elderly improve significantly health outcomes, especially when health outcomes when health care expenditure is controlled (specification 5). Thus, this underlying association between hospital competition and health care quality confirm the *hypothesis 1* for the public model of health care system and the previous findings.

Table 15. Admissions-based in-hospital mortality in percentage and hospital competition from countries with mixed model of health care system.

Dependent variable	Admissions based in-hospital 30 day mortality rate				
2000-2009	Method OLS				
Independent variables	Competition measure				
Specification	1	2	3	4	5
Number of hospitals					
density per million p.	-0,0293	0,002811	-0,5417***	-0,13836***	-0,055***
	0,019218	0,01839	0,020868	0,017268	0,020375
PTCA and stenting for 100000p.		0,011826	0,03054***	0,00818	-0,0150***
		0,09559	0,012065	0,009785	0,004811
General medical practitioners,		-1,042848	-2,56376***	-2,096083***	-1,003641
density per 1000 p.		0,635506	0,74329	0,448335	0,616701
Specialized medical practitioners,		1,039044	1,01913	4,3962***	2,27282*
density per 1000 p.		0,837649	0,968998	1,55252	1,32387
Hospital beds, per 100 000 p.			2,388879***	2,78118***	2,0858***
			0,427098	3,24E-01	0,414032
Discharge rates,			-0,00355***	-0,001253	-0,00063
diseases of the circularly per 100 000 p.			0,001106	0,000885	0,000923
Population over 65 and older,				-1,66178***	-0,8573**
percentage of total p.				0,268396	0,34552
Females,				3,19457***	0,777041
percentage of total p.				0,55848	0,520965
Total health expenditure,					1,4494***
percentage of GDP					0,267428
Out-of-pocket health expenditure,					0,048042
percentage of private health expenditure					0,04201
Sample	173	173	173	173	173
Observations	73	73	73	73	73
R-square	0,018852	0,140294	0,368787	0,756042	0,859268
S.E	3,7936	3,62859	3,155978	1,992442	1,537511

[18]Countries included in the public models are UK, Ireland, Sweden, Norway, Finland, Denmark, Italy, Spain, Portugal, New Zealand, Spain, Canada, Australia, see also (Bjegovic & Donev, 2004).

The results for countries in the mixed model of health care system are presented in the table 15. In the specification 1 the estimated hospital competition coefficient is -0.0293 units which mean that one unit increase in competition is associated with a decrease in AMI mortality with 2.93 percent. The decrease in mortality is, therefore, in line with the previous results. Controlling for PTCA, general practitioners and specialized practitioners, the estimated coefficient is positively insignificant, that is, 0.28 percentage points (see specification 2). In the next 3 specifications the estimated coefficient for hospital competition is strongly negative and statistically significant. That is, one unit increase in hospital competition associated with -0.542 units decrease in hospital mortality from the inclusion of capacity controls such as hospital beds and number of discharge rates (specification 3). Thus, increases in mortality reductions from hospital competition confirm that hospital's operational capacity measured in the number of beds have the most significant positive impact on the outcome of hospital quality. Namely, the mortality reduction is observed in the specification where both the hospital beds and discharge rate are included representing the largest negative effect, that is, 54.2 percent on hospital mortality. Further, with the inclusion of age and gender characteristics the hospital competition' negative effect on mortality appear to be considerably reduced and the estimated coefficient now represents 13.8 percent from increased use of health care services by elderly and females. The possible explanation for this that greater patient health care use results in an increase in mortality although the overall effect still remains mortality reducing. The inclusion of health care expenditure as percentage of GDP and OOP expenditure increase the coefficient to 5.5 percent decrease in morality (specification 5). This confirms the previous results that found support for negative association between mortality and hospital competition and hence positive association between hospital competition and outcome of hospital quality. These results also confirm previous findings on the mortality reducing effects for acute AMI patients from hospital competition and the positive association between quality and hospital competition in the mixed model of health care system. Hence, these results also provide no reasons to reject the *hypothesis 1*.

6.2 The average length of stay for acute AMI in days and hospital competition

The regression results from the hospital competition association with the ALOS are presented in table 16. The first regression result indicates that a one unit increase in hospital competition is associated with a decrease in the ALOS by -0.00374 units (see specification 1). This means that, with an increase in hospital competition one would expect to see a decrease in the excess ALOS. Therefore, a decrease in the ALOS confirms the prediction that hospital competition leads to lower excess ALOS when hospital treatments improves in efficiency. Furthermore, for most specifications in the regression model the coefficient for hospital competition appear to be negative on the ALOS. Thus, the regression results from different specifications generally favor positive association between hospital quality and hospital competition. The coefficient for hospital competition is also statistically distinguished from zero and generally negative except for when controlling for PTCA and stenting, general practitioners and specialized practitioners. In the case of the inclusion of PTCA and stenting the ALOS increases that represents an increase in the 1.672 percentage points

(specification 2). Thus, the result controlling for the outcome of hospital quality shows that an increase in the ALOS undermines the assumption that an improved hospital quality is likely to be possible as a result of lower excess ALOS. However, this positive association between hospital competition and the ALOS does not hold in the next 3 specifications showing a variation between -2 to - 2.65 statistically significant percentage points decrease in the ALOS when hospital competition increases. Hence, the effect of hospital competition on quality of hospital care finds larger positive association because hospital competition insures a decrease in excess ALOS.

Table 16. ALOS by acute AMI in days and hospital competition.

ALOS by AMI (2000-2009)					
Specifications	1	2	3	4	5
Number of hospitals	-0,00374	0,01672**	-0,0212**	-0,02144*	-0,0265**
Per million population	0,008043	0,008326	0,0109	0,011135	0,012345
PTCA and stenting for		-0,01447***	-0,01202***	-0,00984***	-0,0099***
100 000 population		0,003452	0,003125	0,003052	0,003235
General medical practition.		-2,179224***	-0,555471	-0,776016	-1,137249
Density per 1000 pop.		0,626139	0,878549	0,882962	0,727582
Specialized medical p		-2,167751***	-2,08847***	-1,773874**	-1,21178
Practitioner 1000 pop.		0,698215	0,59871	0,749571	0,757155
Hospital beds, per			1,74049***	1,505166***	1,49169***
100 000 population			0,40942	0,400479	0,364084
Discharge rates, diseases per			0,000265	0,000301	0,000253
circularly per 100 000 pop.			0,000786	0,000772	0,000716
Population 65 years old and older				-0,328719	-0,261102
				0,199279	0,19773
Females, percentage of total				-1,174494	-0,362544
population				0,612032	0,601372
Total health expenditure,					-0,20108
percentage of GDP					0,12842
Out-of-pocket health expenditures					0,000255
% of private expenditure					0,00921
Country Dummies/Australia	Yes	Yes	Yes	Yes	Yes
Sample	1150	1150	1150	1150	1150
Observations	150	150	150	150	150
R-square	0,810639	0,913594	0,934801	0,936618	0,938796
S.E.	0,916823	0,626477	0,54846	0,545076	0,539963

Expectedly, decreases in the ALOS is that hospital competition leads to the reduction in time patients spent in hospital beds which is reflected in the negative sign for hospital competition coefficients in the specifications 3, 4 and 5. Moreover, as hospital competition reduces the excess ALOS, increasing hospital beds, however, yields a statistically significant increase in the ALOS with 1.74 units which mean that in larger hospitals there will have longer ALOS.

However, the inclusion of demographic controls associated with females and elderly, causes hospital's competition to reduce its impact on the ALOS. That is, one unit increase in the female and elderly is associated with a decrease in the ALOS by -0.021 (see specification 4). This result also represents an increase in hospital competition's negative effect on the ALOS. Thus, a general decrease in the ALOS is supportive of the expectation that an increase in the use of health care services by females and elderly is leading to a decrease in excess hospital stay. Further, controlling for the health care expenditure an increase in the health care expenditures by one unit confirms the previous findings and decreases the ALOS to -0.0265 (specification 5). However, the health care expenditure with inclusion of OOP shows that one unit increase in the private health expenditure is associated with an insignificant increase in ALOS to 0.0002 while the control's impact on the hospital competition remains negative. This means that the inclusion of OOP expenditure by one unit tends to increase the ALOS by -0.0265 when hospital competition rises (specification 5). This finding can be explained by that patients' propensity to pay contributes to lower excess ALOS in a model controlling for unobserved country heterogeneity. Thus, the overall results appear to favor the assumption of *hypothesis 2* for the reduced excess ALOS.

Table 17. ALOS by acute AMI and hospital competition for countries with public model of health care system.

ALOS by acute AMI					
Specifications	1	2	3	4	5
Number of hospitals	0,04677***	0,0329**	-0,0269***	-0,0244***	-0,0285***
Per million population	0,016505	0,01494	0,00517	0,004779	0,004747
PTCA and stenting for		-0,029***	-0,0342***	-0,0304***	-0,0191***
100 000 population		0,001967	0,00213	0,002654	0,00403
General medical practitioners		0,035207	-4,0357***	-0,4077***	-0,8587***
Density per 1000 pop.		0,16053	0,12863	0,14204	0,184502
Specialized medical p		0,384392	-0,4955**	-0,66046**	0,323297
Practitioner 1000 pops.		0,257971	0,219833	0,31632	0,43771
Hospital beds, per			0,6789***	0,7711***	1,2437***
100 000 population			0,183801	0,176813	0,248422
Discharge rates, diseases per			0,00126***	0,00097***	-6,49E-05
circularly per 100 000 p.			0,000297	0,000298	0,00048
Population 65 years old and older				-0,00125	-0,2975***
				0,0605	0,105436
Females, percentage of total				0,5498**	1,3285***
Population				0,225806	0,28425
Total health expenditure,					-0,2547***
percentage of GDP					0,057994
Out-of-pocket health expenditures					0,012328
% of private expenditure					0,007876
Sample	187	187	187	187	187
Observations	87	87	87	87	87
R-square	0,140867	0,633614	0,91993	0,924932	0,937201
S.E	2,1028	1,39811	0,661709	0,648869	0,60124

The table 17 presents the results for the ALOS by acute AMI patients and hospital competition for countries included in the public model of health care system. From the specification 1 one unit increase in hospital competition is associated with an increase in the ALOS by 0.046 units. The result represents 4.6 percent rise and remains positively and statistically significant with the inclusion of controls associated with the outcome of hospital care such as PTCA and stenting, general and specialized practitioners (see specification 2). This means that, positive association of the first two specifications does not favor the

hypothesis 2 although the model does not have a good fit with R-square in the first two specifications being 0.14 and 0.633 respectively. Considering the specification 3, the model's R-squire is 0.91 with the inclusion of controls associated with hospital capacity such as hospital beds and discharge rates. The estimated coefficient of hospital competition in this regression also finds stronger negative association between ALOS and hospital competition. This means that with an increase in hospital competition controlling both the hospital beds and discharge rates the coefficient finds support for the reduced ALOS with -0.0269 units. Moreover, the association between hospital competition and ALOS remains negative in the specifications 3, 4 and 5, controlling for gender, demographic characteristics and health care expenditures. This means that as the results in different specifications vary but the negative association is somewhat stronger between hospital competition and ALOS. Thus, the positive relation between quality of care and hospital competition in the public model seems to be stronger. The association between hospital competition and the ALOS is negative in latter 3 specifications and positive in first 2 specifications. Therefore, as the model increase in the number of control variables the results found in the latter 3 specifications indicate positive relation in the public model. These findings also confirm the results found in the regression model for unobserved country heterogeneity and support the *hypothesis 2*.

Table 18. ALOS by acute AMI and hospital competition for countries with mixed model of health care system.

ALOS by acute AMI					
Dependent variables:	1	2	3	4	5
Number of hospitals	0,08785***	0,0882***	0,0541**	0,04448*	0,0714***
Per million population	0,014433	0,014127	0,02331	0,02496	0,018363
PTCA and stenting for		0,00029	-0,00045	-0,00171	-0,001388
100 000 p.		0,000291	0,001082	0,001734	0,001229
General medical practitioners		1,2598**	1,0897**	0,84364	-0,541056
Density per 1000 pop.		0,51668	0,4674	0,593596	0,693132
Specialized medical p		-1,197**	-0,321887	-0,2738	-0,503765
Practitioner 1000 pops.		0,519249	0,743487	0,68734	0,737537
Hospital beds, per			0,4200**	0,46735*	0,49486***
100 000 p.			0,20791	0,268443	0,186258
Discharge rates, diseases per			-0,000332	-0,00016	0,000517
circularly per 100 000 p.			0,000255	0,000354	0,000406
Population 65 years old and older				0,090698	0,1519***
				0,072863	0,057908
Females, percentage of total				-0,66671	-2,093*
Population				1,0906	1,07662
Total health expenditure,					-0,3415***
percentage of GDP					0,06037
Out-of-pocket health expenditures					-0,0269***
% of private expenditure					0,00781
Country Dummies/Australia					
Sample	174	174	174	174	174
Observations	74	74	74	74	74
R-square	0,336957	0,61699	0,65978	0,66914	0,776883
S.E	0,014433	1,109102	1,0608	1,06208	0,885909

The table 18 shows the regression results for the ALOS and hospital competition for countries with mixed model of health care system. From the specification 1 one unit increase in hospital competition is associated with an increase in the ALOS by 0.087 units. That is, it represents 8.7 percent increase in the ALOS when hospital competition increases which is notable because the regression model suddenly finds a positive association between ALOS and hospital competition. Therefore, the assumption of the *hypothesis 2* is generally undermined in this regression model. In the specification 2 the inclusion of general and specialized practitioners is associated with an increase in the ALOS with 0.0882 units from an increase in hospital competition while the impact from the specialized practitioners on the ALOS is expectedly negative. The positive relation is henceforth confirmed in the next 3 specifications. Next, the inclusion of discharge rates reduces the hospital competitions' increasing effect on the ALOS from 8 to 5 percent and contributes to overall picture of generally higher ALOS from increased hospital competition (see specification 3). Furthermore, the effect becomes even smaller, that is, 4.4 percent when demographic variables are controlled (specification 4). Health care expenditure controls increase hospital competitions' effect on ALOS further by 7.14 percent (specification 5). At the same time, the coefficients of health care expenditure as a share of GDP and OOP expenditures themselves remain negative. That means they reduce ALOS due to increases in hospital competition. Namely, one unit increase in the health expenditures represent reduction in the ALOS by -0.3415 and - 0.0269 units irrespective of whether hospital competition has an increasing impact on the ALOS, that is 7.14 percent rise. Thus, in the mixed model of health care system findings do not confirm previous regression results and reject the *hypothesis 2.*

6.2 Summary

The chapter has reviewed the regression results for hospital competition's effect on the two quality measures used in two different models. The underlying finding indicates that hospital competition tends to decrease mortality rate for acute AMI patients in both models in general although the results from different specifications vary. The result is statistically significant and varies between -2 and 20 percentage points' decrease from an increase in hospital competition. Specifically, these results apply for countries in a regression model that uses country dummies as well as regressions with public and mixed models, confirming the *hypothesis 1*. Concerning the use of health care services, the ALOS for acute AMI patients shows less consistent results with regard to the sign of the coefficient for hospital competition. For instance, using the country dummies the results confirm that hospital competition decreases the ALOS which also generally applies for the countries in the public model. For countries included in the public model the specification including the number of hospital beds and discharge rates has the most significant impact on this relation as it changes the sign of hospital competition coefficient from positive to negative. Mortality reductions results from hospital competition mean that hospital capacity determined by the initial hospital's size has most sensitive positive impact on the outcome on hospital quality. That is, hospital

competition is able to reduce the excess ALOS when hospitals are able to utilize their services in the context of larger operational capacity. However, concerning the regression of the mixed model of health care system the results undermine the assumptions of the *hypothesis 2* and reflect instead that an increase in hospital competition leads to an increase in the ALOS.

7. Conclusions

The aim of this thesis was to contribute to the understanding of whether the relationship between hospital competition and health care quality is positive and to determine to what extent hospital competition influences the quality of hospital services. Theory suggests that hospital competition is likely to improve quality when hospitals able to maximize both the quantity and quality domains of their services by insuring better utilization of services in regards to operational capacity, the outcome of hospital treatments and system related financial incentives. The difference between this thesis and other related studies of the regional research is captured by the two main factors. Firstly, few have looked at the heterogeneity in hospital market development in the setting of the international study by accounting for unobserved country characteristics. Secondly, this paper involves the use of different health care systems in a model where hospital competition is limited due to prevalence of public hospital providers and in a model where hospital competition is influenced by private health insurance. This allows capturing the levels of reimbursements in the public and private providers of both models. In doing so a density measure of hospital competition was adopted that is distinctly different from the HHIs as market share measures that were overwhelmingly used in regional research. Finally, the study approached AMI mortality measure as the outcome based measure and ALOS as the utilization based measures. The AMI mortality reflects hospital's internal failures whereas the ALOS has allowed measuring health care use as a source that may contribute to lower excess capacity in the process of health care quality improvement. These measures used together, while generally applicable to the regional research, offered more nuanced portrayal of the possible positive quality impact from hospital competition in different hospital markets. Moreover, the general findings of this study are in line with many studies at the regional level that found the positive association between hospital competition and quality of care. That is, the results generally found support for mortality reduction and reductions in the excess capacity from lower ALOS for acute AMI patients owed to increases in hospital competition.

The two hypotheses are presented in the study. The results support *hypothesis 1* which states that hospital competition aids in positive outcome of health care quality when the amount of hospital services consumed increase for patients. Furthermore, the results favor *hypothesis 2* (except for when ALOS used as quality measure in the mixed model) that states that hospital excess capacity is likely to be reduced when hospitals

are able to identify priorities in the utilization of health care services by offering better treatments. So for instance, for admissions-based AMI mortality rate the results showed a tendency to a decreased mortality when hospital competition increases in most specifications with the exception of the first specification, presumably due to the incoherent aggregate effect on health care quality represented by the proxy for hospital competition itself.

In general, the control variables behave in line with the theoretical expectations. The regression results showed that hospital competition has the tendency to decrease the mortality rate and that is confirmed with the inclusion of controls associated with operational capacity such as the number of hospital beds and discharge rates. These controls are seemingly affecting the behavior of controls associated with demographic characteristics and the type of health care expenditure. Moreover, mortality reducing effects from hospital competition provides support for the *hypothesis 1* even though inclusion of controls associated with the type of health care expenditure diminishes the mortality reducing effect from the measure of hospital competition. In this case, a slight increase in mortality are in line with the theoretical prediction that as individuals increase their private expenditure on health care there will be a tendency to be reluctant to use services when they have to pay more for additional services consumed. Thus, larger OOP has a reducing effect on the proxy for hospital competition's effect on mortality.

Using the ALOS for acute AMI patients as an indicator of qualitative health care use shows that the hospital competition leads to generally statistically significant decreases in the ALOS. That is, the ALOS is negatively associated with hospital competition at approximately 2 percent rate. Therefore, the hospital competition relation with hospital quality has a tendency to be positive. However, the regression results for both the public model and mixed models underscore different relational tendencies. For example in the public model, an increase in hospital competition generally leads to a decrease in excess ALOS at approximately -2.4 to -2.8 percentage points. Expectedly, this finding provides no reasons to reject the *hypothesis 2* that views hospital quality improvements to come as a result of lower excess ALOS when hospitals offer better health care services for patients. Thus, for the public model of health care system hospital competition reduces the ALOS influenced by improved hospital's operational capacity measured both in number of hospital beds and discharge rates that confirm the assumptions of the *hypothesis 2*. The implication of the finding for countries in the public health care model provides reasons to believe that hospitals will see largest reducing impact on the ALOS with an increase in the availability of hospital beds for countries with predominantly public hospital providers. The reductions in the ALOS are also likely to mirror improved hospital performance which is established as a result of improved use of hospitals services. Moreover, the result for the public model is an indication that countries with higher share of public providers' will manage to reduce the ALOS when hospitals also have larger size.

In the mixed model of health care system an increase in the hospital competition leads to an increase in the ALOS, which indicates it worsens quality of care according to the *hypothesis 2*. This means that the effect of hospital competition of quality of care is statistically distinguished and positively correlated across all specifications that represent an increase in the ALOS by 4.5-8.7 percentage points when hospital performance improves. There are two possible explanations that the result that does not generally support hospital competition for countries in mixed model of healthcare system. One explanation is that the countries are less responsive to the effect of hospital competition on health care quality due to presumably already well developed framework for hospital performance. The second explanation is that as a result of the increase in the additional efforts to sustain the scope of hospital competition may lead to the opposite effect than what is initially anticipated. Consequentially, when hospital competition increases the effect on quality will be lower at the margin for countries in this model of health care system which contradicts the initial expectation that with greater share of private providers would be better for hospital quality improvements in the context of OECD health policies for public-private partnerships. Possibilities for future studies should definitely explore some of the underlying mechanisms that point to the differences between public models and mixed model so that reasons for different effects from hospital competition can be further assessed. Another interesting area for future research is to delve deeper into institutional factors as well as health system related factors that influence the quality of hospital services and thus contribute to the comprehensive knowledge of the sources that may be at play for these different effects.

7.1 Suggestions for future policies

The results of this study provide robust and positive association between hospital competition and the outcome of hospital quality in the framework of reduction of mortality rate for AMI patients. This means that as far as future policies are concerned the health care policy could aim to improve hospital performance in the context of outcome of hospital care associated with hospital treatments to decrease mortality for acute diseases. Moreover, in the context of continued promotion of health care policy reforms to ensure better hospital performance in the OECD framework may help to establish mortality reductions particularly for hospitals that deliver greater quantity of hospital care. Therefore, the promotion of health care reforms that affect the outcome of hospital mortality would presumably give larger effect on the reduction in the excess hospital capacity for larger public hospitals in the public and mixed models of health care systems.

Results for the quality measure ALOS for acute AMI patients also, in principle, confirm the theoretical argument that an increase in the hospital competition increases the likelihood of improved quality for countries in the model controlling for unobserved country heterogeneity as well as the public model of health care system. However, this is not the case for countries in mixed model where there is opposite

relationship between hospital competition and ALOS is established judging by results of the data. The latter findings challenge the view that private hospital market development should be considered as a benchmark for public hospital policy promotion in establishing greater hospital competition. Thus, as far as future policies are concerned, governments in the OECD may not be entirely convinced to follow the direction of private hospital providers for future quality improvement in mixed model of health care system. However, the ALOS reducing effects are partially found for countries included in the public model it confirms reasons behind the current reformations of hospitals in the public sector. Thus, this international study believes that the policies for continued reduction in the excess hospital capacity are justified in the public model confirmed by the hypothesis and results of the study.

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Appendix:

Table 4. In-patient PTCA and stenting for 100 000 population.

Country	
Australia	144.57[a]
Austria	182.86[a]
Belgium	460.675[f]
Canada	133.6[b]
Czech Republic	203.17[e]
Finland	116.89[a]
Germany	542.58[e]
Ireland	72.3[a]
Israel	231.91[a]
Italy	128.25[f]
Netherlands	134.84[c]
New Zeeland	107.4[e]
Norway	23.9[d]
Poland	64.44[d]
Portugal	80.86[a]
Spain	83.92[a]
Switzerland	100.485[a]
USA	212.55[a]
Sweden	162.02[a]

Source: OECD health data

[a] 2000-2009
[f] 2006-2009
[b] 2001-2008
[e] 2004-2009
[c] 2001-2009
[d] 2002-2009

Table 5. General medical practitioners per 1000 of the population.

Country	
Australia	1.428[a1]
Austria	1.461[a1]
Belgium	1.1575[e2]
Canada	1.0311[a1]
Czech Republic	0.715[d3]
Finland	1.0165[a1]
Germany	1,48333[d]
Israel	0.7325[a1]
Italy	0.94[e2]
Netherlands	1.205555[b4]
New Zeeland	0.795[d]
Norway	1.87875[c5]
Poland	0.445[c5]
Portugal	1.684[a1]
Spain	0.7245[a1]
Switzerland	0.505[a1]
USA	0.301[a1]

Source: OECD health statistics

[a1] 2000-2009
[e2] 2006-2009
[d2] 2004-2009
[b2] 2001-2009
[c3] 2002-2009

Table 6. Number of specialized practitioners per 1000 population.

Country	
Australia	1.242[a]
Austria	2.082[a]
Belgium	1.71[f]
Canada	1.12[b]
Czech Republic	2.7133[e]
Finland	1.426[a]
Germany	2.01[e]
Ireland	0.7255[a]
Israel	2.2695[a]
Italy	2,73[f]
Netherlands	1,5089[c]
New Zeeland	1.235[e]
Norway	1.5075[d]
Poland	1.72[d]
Portugal	1,797[a]
Spain	2.1575[a]
Switzerland	2.335[a]
USA	2.091[a]
Sweden	1.9514[a]

Source: OECD health data

[a] 2000-2009
[f] 2006-2009
[b] 2000-2008
[e] 2004-2009
[c] 2001-2008
[d] 2002-2009

Table 7. Hospital beds per 100 000 inhabitants.

Country	
Australia	3.882[a6]
Austria	7.751[a6]
Belgium	6.6025[f7]
Canada	3.42555[b8]
Czech Repubic	7.37[e9]
Finland	7.025[a6]
Germany	8.34[e9]
Ireland	5.316[a6]
Israel	3.778[a6]
Italy	3.785[f7]
Luxemburg	5.7566[e9]
Netherlands	4.6322[c10]
New Zeeland	1.6067[e9]
Norway	3.93625[d11]
Poland	6.59[d11]
Portugal	3.528[a6]
Spain	3.404[a6]
Sweden	3.029[a6]
Switzerland	5.637[a6]
USA	3.265[a6]

Source: OECD health data

[a6] 2000-2009
[f7] 2006-2009
[b8] 2001-2009
[e9] 2004-2009
[c10] 2000-2008
[d11] 2002-2009

Table 8. Hospital discharge rates by disease of the circularly, per 100 000 population.

Country	
Australia	1670.4[a12]
Austria	3407.01[b13]
Belgium	2100.25[f14]
Canada	1181.533[c15]
Czech Republic	2854.2[e17]
Finland	3150.13[a12]
Germany	3400.2[g16]
Ireland	1297.34[a12]
Israel	1598.45[a12]
Italy	2097.85[f14]
Japan	1331.975[g16]
Luxemburg	2213.45[e17]
Netherlands	1473.83[b13]
New Zeeland	1396[e17]
Norway	2449.275[d18]
Poland	2566.24[d18]
Portugal	1196.6[a12]
Spain	1334.94[a12]
Sweden	2427.45[a12]
Switzerland	1694.28[a12]
USA	2045.44[a12]

Source: OECD health data

[a12] 2000-2009
[b13] 2000-2008
[f14] 2006-2009
[c15] 2001-2009
[g16] 2007-2009
[e17] 2004-2009
[d18] 2002-2009

Table 9. Percentage of elderly at the age of 65 or older, percentage of total population.

Country	
Australia	12.86[a19]
Austria	16.22[a19]
Belgium	17.125[f20]
Canada	13.1778[b21]
Czech Republic	14.43[e22]
Finland	15.83[a19]
Germany	19.55[e22]
Ireland	11.07[a19]
Israel	9.84[a19]
Italy	16.02[f20]
Japan	22.1[g23]
Luxemburg	14.033[e22]
Netherlands	14.077[d24]
New Zeeland	12.333[e22]
Norway	14.7375[c25]
Poland	13.2125[c25]
Portugal	16.97[a19]
Spain	17.36[a19]
Sweden	17.36[a19]
Switzerland	15.99[a19]
USA	12.53[a19]

Source: OECD health data

[a19] 2000-2009
[f20] 2006-2009
[b21] 2001-2009
[e22] 2004-2009
[g23] 2007-2009
[d24] 2000-2008
[c25] 2002-2009

Table 10. Percentage of females.

Country	
Australia	50.33[a26]
Austria	51.43[a26]
Belgium	51.025[f27]
Canada	50.4555[b28]
Czech Republic	51.1167[e29]
Finland	51.08[a26]
Germany	51.05[e29]
Ireland	50.2[a26]
Israel	50.63[a26]
Italy	51.425[f27]
Netherlands	50.5222[c30]
New Zeeland	51.0167[e29]
Norway	50.3125[d31]
Poland	51.65[d31]
Portugal	51.63[a26]
Spain	50.8[a26]
Switzerland	51.03[a26]
USA	50.76[a26]

Source: OECD health data

[a26] 2000-2009
[f27] 2006-2009
[b28] 2000-2008
[e29] 2004-2009
[c30] 2001-2009
[d31] 2002-2009

Table 11. Total health expenditure as a percentage of GDP.

Country	
Australia	8.45234[a]
Austria	10.3555[a]
Belgium	9.9612[g]
Canada	9.9662[b]
Czech Republic	6.9776[f]
Finland	8.10953[a]
Germany	10.83[f]
Ireland	7.63396[a]
Israel	7.7482[a]
Italy	8.9545[g]
Netherlands	9.585[c]
New Zeeland	8.833[f]
Norway	9.26[d]
Poland	6.4545[d]
Portugal	9.905[a]
Spain	8.172[a]
Switzerland	10.89[a]
USA	15.6777[a]
Sweden	9.2143[e]

Source: OECD health data

[a] 2000-2009
[g] 2006-2009
[b] 2000-2008
[f] 2004-2009
[c] 2001-2009
[d] 2002-2009
[e] 2003-2009

Table 12. Out-of-pocket expenditure as a share of private health expenditure.

Country	
Australia	58.59[a]
Austria	65.93[a]
Belgium	78.95[e]
Canada	50.644[a]
Czech Republic	88.983[d]
Finland	76.96[a]
Germany	56.4667[d]
Ireland	62.06[a]
Israel	73.04[a]
Italy	86.725[e]
Netherlands	29.3111[b]
New Zeeland	68.3[d]
Norway	96.85[c]
Poland	85.975[c]
Portugal	79.97[a]
Spain	78.11[a]
Switzerland	75.19[a]
USA	35.86[a]

Source: World Bank

[a] 2000-2009
[e] 2006-2009
[d] 2004-2009
[b] 2001-2009
[c] 2002-2009

Figure 2. Out of pocket expenditure as a share of private health expenditure.