COMPETITION AND THE PROVISION OF HOSPITAL COMMUNITY BENEFITS

by

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Dedication

To my supportive wife, Sevda, and our lovely daughter, Feraye; my loving parents, my sisters and brothers, and anyone who fostered my personal growth and became an important part of my own personal journey over my PhD years.

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Abstract

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Federal tax law provides tax exemptions for nonprofit hospitals in exchange for community benefit provisions. One justification for tax-exempt status is the 'community benefits standard,' which has evolved over the years. The current community benefit standard for nonprofit hospitals, which gives them tax exemption, expects nonprofit hospitals to promote the health of the public or community — to be charitable. A significant problem with the community benefit standard is the inconsistency between the legal rationale of tax exemption for nonprofit hospitals, and the federal antitrust law's approach to nonprofit hospitals. Currently, nonprofit hospitals rarely receive special treatment in antitrust law cases, which might increase the market power of nonprofit hospitals. I argue in this dissertation that by studying nonprofit hospitals' community benefits provision and their market power, it is possible to evaluate both the current inconsistency and the rationale of the community benefit standard. To shed light on this, I test two hypotheses in this dissertation. As a first hypothesis, I study whether nonprofit hospitals provide more community benefits once they gain more market power in the first two chapters. Second, I study whether nonprofit hospital promote the health of public or their community with more market power in the third and final chapter.

In the first chapter, I investigate whether nonprofit hospitals increase(decrease) with more(less) market power using the 2010-2016 IRS Form 990 Schedule H, American Hospital Association Annual Survey, and Healthcare Cost Report Information (HCRIS) database at the national level. The results show that higher levels of hospital concentration lead to a higher provision of community benefits when total market fixed-effects are controlled for. When hospital fixed-effects are controlled, the association between hospital concentration and community benefits provision becomes negative. This suggests that hospital-specific and market-level characteristics might explain the provision of community benefits better than a hospitals' market power.

In the second chapter, I add insurer market concentration to the analysis by adding Decision Resource Groups (DRG) dataset. Using Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID), I also estimate hospital choice model of patients to calculate hospital competition to address endogeneity issues of traditional competition measure. As a trade-off, I investigate the same hypothesis for only the following states from 2012 to 2016: Florida, New York, Vermont, Massachusetts, Arizona, and Utah. The results show that, considering the insurer competition, nonprofit hospitals do have increased community benefit provisions with more market power; however, there is no statistically significant evidence of the effect of hospital and insurer competition on the community benefit provision of nonprofit hospitals.

In the third and final chapter, I argue that the IRS and the hospitals do not observe whether community benefit activities actually promote the communities' health. I investigate this issue by examining how hospital market power affects the prevention quality indicators of uninsured patients — as an indication of community health. I use the data from IRS Form 990, HCRIS, and HCUP State Inpatient Database for six states from 2012 to 2016. The results show no significant evidence that nonprofit hospitals improve their communities through community benefit provisions in more concentrated markets. Unlike the hospital competition, there are supporting evidence that prevention quality indicators improve in more concentrated insurer markets.

Chapter 1: The Effect of Hospital Competition on Community Benefits Provision

1.1 Introduction

Most hospitals in the United States are operated as non-profit(NP) organizations. In 2017, NP community hospitals accounted for 56% of all U.S community hospitals, while shared beds for NP hospitals made up nearly 63% of total staffed beds at US hospitals. [1]. In addition, church-based NP hospitals accounted for 22% of those NP community hospitals. Almost all NP hospitals are tax-exempt under 501(c)(3) of the Internal Revenue Code. NP hospitals are expected to provide some public benefits which are considered as community benefits (CBs) in exchange for special tax treatments. The United States Code has regulations as to how charitable organizations can qualify for tax exemption. In this context, NP hospitals qualify as charitable organizations; however, the type of CBs that NP hospitals are expected to provide, and whether NP hospitals deserve to get special tax treatments is the source of ongoing discussion in the health policy field.

To qualify for tax exemption, NP hospitals are expected to provide CBs or engage in community activities that they partially or fully subsidize, even though there is still no standard for the provision of CBs at federal, state, and local level. The total value of tax exemption for NP hospitals in 2011 was $24.6 billion, while the total CBs provision for NP hospitals in the same year was $64.6 billion (Rosenbaum, Kindig, Bao, Byrnes, & O'Laughlin, 2015). Herring et al. examined whether incremental CBs by NP hospitals relative to for-profits(FPs) exceeded the tax exemption, with the results that FPs only exceeded 62% of NP hospitals' CBs (Herring, Gaskin, Zare, & Anderson, 2018).

[1] The data comes from American Hospital Association, Fast Fact on US Hospitals, January 2017

Justification for tax-exempt status comes from the Internal Revenue Service (IRS), however the definition of CBs continues to evolve. Due to the lack of standardization, measures, and qualifications for CBs, the IRS and Congress decided to introduce new changes. The first major change that significantly redefined the CBs was introduced by the IRS in 2009 (Hellinger, 2009). The new policy, which revised Schedule H form, requires each NP hospitals to fill out the form as an attachment of Form 990 with the information of CBs provision. Schedule H redefines expenditures for what IRS considers as CBs.

The new policy, which revised the Schedule H form, required each NP hospital to fill out this form as an attachment of Form 990, to provide information about their CBs provision. Schedule H reconsidered what the IRS viewed as CBs expenditures, to ensure that financial assistance was available to patients in need, including Medicaid patients and other means-tested programs such as the State of Children's Health Insurance Program. The IRS also considered research, health professions education, and health improvement activities as CBs expenditure. Schedule H also required NP hospitals to provide community-building activities, which the IRS did not consider as CBs activities. The purpose of the community-building activities was to improve social, economic, and environmental conditions of the communities [2].

The second major change was enacted in the 2010 Affordable Care Act (ACA) which required NP hospitals to conduct a community health needs assessment (CHNA) every three years. The CHNA identified which NP hospitals could keep their tax-exempt status (Internal Revenue Service, Treasury, 2013).). In line with the CHNA, every hospital needed to develop and post an implementation strategy, which met the specification outlined in the CHNA. In addition to the IRS tax exemption requirements, NP hospitals also have other legally binding contracts which require them to provide charity care, such as The Emergency Medical Treatment and Active Labor Act (EMTALA). The EMTALA requires that each Medicare hospital has an emergency room, so that these hospitals can provide basic stabilizing treatment to patients (independent of their race, insurance status, and

[2]Community-building activities can be considered as upstream investment or intervention for social determinants of health (SDOH). The data could be a great source for SDOH literature

ability to pay) [3]. The unpaid portion of this care becomes uncompensated care (UC), which includes charity care and bad debt in hospitals' accounts [4]. Medicare and State agencies provide subsidies to hospitals so that they can provide this UC. Overall, legally binding agreements for NP hospitals prevent the level of CBs provision declining further [5]

The relationship between hospital competition and CB provision, which is the subject of this paper, has not been given much attention in the economics and health policy literature. Setting aside the demographic effects and uninsured rate in the local community as factors which affect CB provision, the ability of NP hospitals to provide socially beneficial activities is a salient factor that needs to be examined. Capps et al developed a theoretical model showing that some degree of market power was a necessary condition for the uninsured to receive care, especially when NP hospitals face a financing constraint. The main hypothesize of the paper is that NP hospitals provide more public benefits once they acquire more market power. Their study examined the California hospitals' financial data for 2001-2011 (C. S. Capps, Carlton, & David, 2020). The data showed that NP hospitals do not provide more charity care provisions once they have more market power, and concluded that there is no support for lenient antitrust treatment in NP hospitals.

The other study that directly examine the relationship between hospital competition and CB provision found that there was no statistically significant evidence to show that increased competition led to a reduction in charity care in Florida and Texas (Garmon, 2006). The studies by Capps et al. and Garmon were limited as they only explored the UC as a sum of charity care and bad debt, and only selected one or two states for their studies.

Other studies which have examined direct relationships in this subject area are (Gruber, 1994; Mann, Melnick, Bamezai, & Zwanziger, 1995). Gruber's article studied the effect of

[3]This act is for only hospitals that provide services for Medicare patients in order to receive Medicare payments.

[4]The main difference between charity care and bad debt is that bad debt is uncompensated/ unreimbursed amount from patients and not counted as charity care.

[5]After ACA, some states expanded Medicaid while some states did not. As expected, the number of uninsured Americans decreased due to Medicaid expansion and the provision of UC, therefore, declined in Medicaid expansion states relative to Medicaid nonexpansion states (Dranove & Ody, 2016).

increased price when shopping in California's hospital markets over the period of 1984-1988. They found that charity care dropped in relatively competitive markets, in response to regime change—price shopping. Mann et al. supported these findings, as their results showed that charity care decreased faster in relatively competitive markets than in uncompetitive markets, in response to an exogenous reimbursement change – from a charge-based system to a prospective payment system for Medicare, which affected all hospitals.

In addition, some literature found evidence that hospitals cross-subsidy for unprofitable services. It is well-established that NP hospitals and FPs respond similarly to financial incentives (David, Lindrooth, Helmchen, & Burns, 2014; Duggan, 2002). however, none of these studies closely examined the effect of hospital competition on CBs provision. This gap in the empirical literature shows that more research is required in order to understand whether hospitals need to have some level of market power in order to provide CBs. To shed light on this relationship, the current study will empirically examine whether NP hospitals provide more CBs activities once they acquire more market power, which was tested through the ability of NP hospitals to set the price above the competitive equilibrium level.

1.2 Method and Data

As explained in the previous section, the goal of this study was to examine the possible association between hospitals' market power and its CBs provision. Firstly, financial data was collected from hospitals with access to UC, and CBs data was collected for all types of hospitals. Secondly, hospital characteristics needed to be assembled so as to be the control variables. For that purpose, the following data resources were used to conduct the analysis: The American Health Association (AHA) survey, Healthcare Cost Report Information (HCRIS) database, and IRS form 990 Schedule H data. The AHA survey does not have financial information about hospitals; therefore, the HCRIS database was used to access both financial data and UC data. As the HCRIS database included only bad debt expenses and charity care expenses, the IRS form 990 Schedule H data was used

to obtain the most complete measure of CBs provision, which included other community-related categories as well. The IRS form 990 is publicly available in a machine-readable format [6].

The IRS Form 990 provides detail of the CBs activities and policies required from a NP hospital in Schedule H. If the filer has at least one hospital in its organization, they must complete Schedule H as part of Form 990. Schedule H provides not only comprehensive CBs provision for NP hospitals, but also provides the CHNA and facility information of the filer. The ACA enacted new requirements (section 501[r]) for tax-exempt hospitals to meet, in order to qualify for tax exemption as discussed in the previous section. In addition to the CHNA, hospitals also need to report: their financial assistance policy, emergency medical care policy, billing and collections, and charges for medical care in Schedule H. The IRS expanded the definition of CBs to include research, health education, and other CBs expenses after Medicaid and Medicare were introduced. The IRS considers eight categories of CBs as part of Schedule H which are as follows: (1) Charity Care or Financial Assistance which includes free or discounted healthcare services to patients in need and those eligible to the criteria of hospitals' financial assistance program; (2) Unreimbursed Medicaid where the difference between the cost of treating Medicaid patients and the payment received for treatment is taken; (3) Unreimbursed costs which includes other means-tested programs such as the State of Children's Health Insurance Program, and other state and local programs. With these costs, the difference between the cost of treating the patient and the payment received for those treatments is taken; (4) Community Health Improvement Services and Community Benefit Operations, which include programs and activities, operated or subsidized, by the health organization for the purpose of community health improvement; (5) Health Professions Education, which are educational programs that not only cover the education of organizations' employees, but also education of health professionals in the community; (6) Subsidized Health Services which includes the costs that organizations provide to clinical services, even though it causes financial loss to the organization. This does not

[6]IRS Form 990 tax forms can be found in https://registry.opendata.aws/irs990/.

include bad debts and means-tested program costs, so there is no double accounting in the reporting; (7) Research, which includes any research that aims to increase the generalized knowledge of the public, such as knowledge about behavioral or sociological studies related to health or diseases; (8) Cast and In-kind Contributions for Community Groups, this is the final category. This includes any report that offers cash contributions or other types of donations to organizations, through these offers they can provide other aforementioned categories. In addition to these eight categories, Schedule H also covers community-building activities spending which is not considered as CBs by the IRS (Rosenbaum, 2016). Table 1.1 below presents the summary statistics of CBs from the IRS Form 990 Schedule H data and Figure 1.1 shows the percentage of each category in the graph.

The total CBs provision was approximately $59 billion in 2010, and nearly $73 billion in 2016. In 2016, hospitals provided roughly $46 billion to charity care and unreimbursed care from means-tested government programs, which accounted for 62.8% of the total CBs provision. Charity care, financial assistance, means-tested government programs, and subsidized health services are only related to patient care expenses among the eight categories; whereas the rest of the eight categories are non-patient CBs expenses. Patient-related CBs account for 72% of the total CBs in 2016, and an average of 68% for CBs in the total dataset [7].

[7]Patient-related CBs consist of charity care (column 3), Unreimbursed Medicaid (column 7), unreimbursed costs (column 8), subsidized health services (column 9).

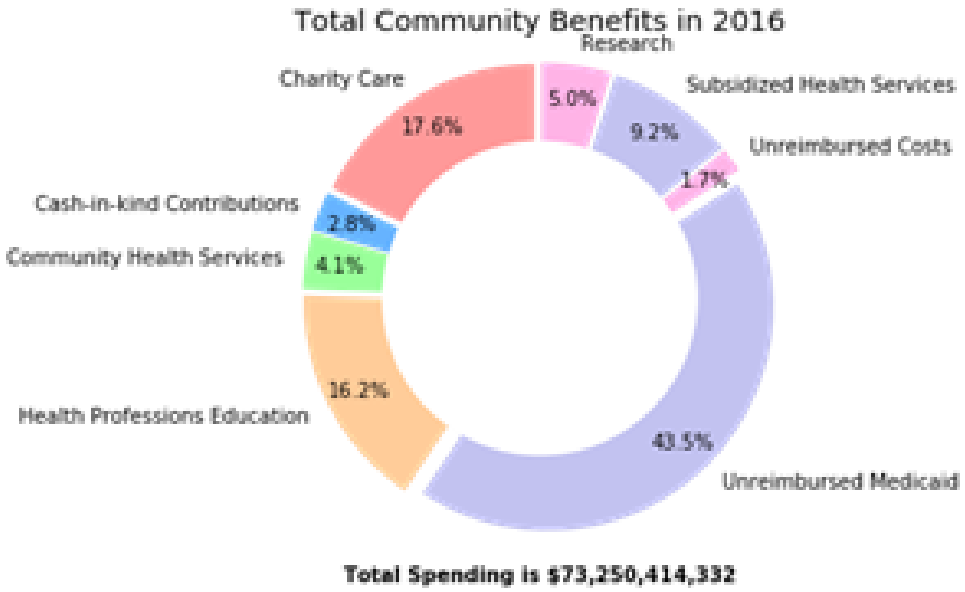


Figure 1.1: Total Community Benefits in US in 2016

Table 1.1: Community Benefits Provision by 8 Categories

Year	Total Community Benefits($B)	Charity Care(%)	Cash-in-kind Contributions(%)	Community Health Services(%)	Health Professions Education(%)	Unreimbursed Medicaid(%)	Unreimbursed Costs(%)	Subsidized Health Services (%)	Research(%)
2010	59.3	24.0	2.4	4.4	15.1	30.0	2.1	8.2	13.9
2011	64.2	24.1	3.2	4.3	14.8	29.9	2.1	8.3	13.3
2012	68.3	24.2	2.6	4.3	14.8	30.4	2.2	8.4	13.1
2013	63.3	24.8	2.8	4.2	16.2	35.6	2.1	9.1	5.2
2014	63.6	20.5	3.2	4.3	16.5	39.0	1.7	9.5	5.3
2015	68.3	18.0	2.8	4.3	16.8	42.2	1.6	9.1	5.2
2016	73.3	17.6	2.8	4.1	16.2	43.5	1.7	9.2	5.0

The data is obtained from IRS Form 990, Schedule H. It covers nonprofit hospitals from 2010 to 2016.

Numbers in the second column are in Billion dollars and each number shows the amount of community benefits in the US for that year. The rest of columns show the percentage of each category of community benefit provision as a percentage

The next data source which was used for our study is HCRIS data. Each Medicare-certified provider must submit an annual report to Center for Medicare and Medicaid Services (CMS) which provides HCRIS data. This data includes provider information such as facility characteristics, utilization data, cost and charges by cost center (in total and for Medicare), Medicare settlement data, and financial statement data which forms a comprehensive relational database. In addition, HCRIS uses hospital reports CMS-2552-10 to define UC in the instruction document as 'the sum of charity care, non-Medicare bad debt, and non-reimbursable Medicare bad debt'. UC does not include: courtesy allowances; discounts given to patients that do not meet the hospital's charity care policy, or discounts given to uninsured patients that do not meet the hospital's financial assistance program (FAP); as well as bad debt reimbursed by Medicare (Please see Appendix A for calculations of UC). HCRIS provides both gross charges and costs of UC rather than actual expenses. The gross charges are based on the list price that a hospital would obtain, if the payment was made based on the list. The costs of UC are the product of multiplication of gross charges by the cost-to-charge ratio. Generally, the cost-to-charge ratio is obtained by dividing the difference of total operation expense and non-patient expense by total inpatient and outpatient charges.

The other data source for this study was AHA survey, which is one of the most comprehensive surveys of US hospitals. This survey uses data from nearly 80% of all US hospitals, and covers health care services, utilization, finances, and staffing. Contrary to the IRS data, it has individual-hospital level data and also provides system memberships. For the purpose of this study, two datasets were built using data from 2010 to 2016. These datasets were built by merging AHA with IRS and HCRIS separately. HCRIS and AHA both have a unique key variable (Medicare provider number) and so the two datasets were merged based on the Medicare provider numbers. Table 1.2 displays the summary statistics for AHA-HCRIS data from 2010 to 2016.

Table 1.2: Summary Statistics for AHA-HCRIS Merged Data

	Mean	Median	SD	Max	Min
Price per Discharge ($)	5564.05	4765.664	3310.81	15969.59	986.89
Beds-staffed	219.7	160	209.58	2829	3
HHI (Bed)	5974.86	5468.9	3596.34	10000	383.72
HHI (Patient Days)	6080.23	5635.43	3559.57	10000	415.71
Uncompensated Care ($)	15,918,303	8,820,000	18,372,980	79,664,860	18011
Cost to Charge Ratio	.323	.277	.697	30.07	.113
Total Revenue ($)	644,581,185	446,413,781	587,956,649	2,640,739,271	34,998,759
Operating Expense ($)	207,542,929	134,006,899	216,141,383	1,271,828,226	3,886,867

The data consists of AHA and HCRIS data and merged based on Provider ID. It covers non-federal, general short-term hospitals from short-term acute 2010 to 2016.

Table 1.3: Summary Statistics for IRS-AHA Merged Data

	Mean	Median	Max	Min	SD	N
Staffed Beds (#)	193.017	123	2540	4	220.603	8039
Inpatient Days (#)	46536.73	26499	761889	280	62158.44	8039
HHI (Bed)	7035.517	10000	10000	522.77	3346.17	5138
HHI (Inpatient Days)	7129.65	10000	10000	587.31	3280.7	5138
Community Benefits (%)	7.71	7.26	20.16	.14	3.97	7625
Total Operating Expense ($)	202,124,142.6	105,751,060	1245,589,405	8,049,350	233,531,805	7639

The data consists of AHA and IRS data and merged based on hospital name and address. It covers non-federal, general short-term hospitals from short-term acute 2010 to 2016.

Unlike AHA and HCRIS, the IRS Form 990 does not provide a unique key ID to match this data with other data sources. However, the IRS form can be matched with AHA-HCRIS using names and addresses [8]. Matching was successful for 1325 hospitals using IRS and AHA data. Table 1.3 shows the summary statistics for the merged IRS-AHA data.

There are both benefits and limitations to using each data source. The IRS Form 990 offers a more comprehensive and accurate list of NP hospitals' CBs provision; however, the data does not cover FP hospitals. In contrast, the HCRIS data outlines the UC for both FP and NP hospitals, but it only provides data from bad debt and charity care. Furthermore, the HCRIS data also allows for examination of individual hospitals in the system, whereas IRS Form 990 Schedule H reports hospitals as a group. For example, INOVA Health System has 5 NP hospitals in their system, which are located in Northern Virginia. In accordance with IRS Form 990 Schedule H, INOVA reports the CBs provision of the four hospitals in one form due to tax regulatory reasons. Therefore, to capture every individual hospital for our analysis, this study used cross-walking between AHA and IRS data to get accurate information regarding hospitals and their systems. This study also disaggregated hospital system-wide CBs reporting, based on the fraction of each hospital's level of CBs in HCRIS data. A great source for CB provision expenses is financial statements from hospitals. Unfortunately, the financial statements of hospitals are not in machine-readable format and are released as text documents [9].For future study, those numbers could be obtained from the financial statements of FP hospitals.

1.2.1 Measuring Market Competition

The impact of market concentration on the CBs provision was estimated by relating the level of Herfindahl-Hirschman index (HHI) to the level of CBs provision. As discussed in the previous section, this study hypothesized that the ability to provide unprofitable services, such as the CBs provision, depended on the market power of the hospital. The HHI was

[8]The matching algorithm that I use to match hospitals is available here github.com/mehmet-sari/communitybenefits_sdoh

[9]It can be downloaded from a hospital website and if the hospital sells tax-exempt bonds the financial document can be downloaded from EMMA database as a pdf file

calculated by summing the square of the market share of each type of hospital (NP, FP, and government) in a health care market, based on the total staffed beds and inpatient days. Three different market definitions were utilized to capture the market power of the hospital, since the market power can vary with the market definition. Access to admission or patient-level data does not observe patient preferences, so this study relied on the HHI approach to calculate market shares.

Antitrust literature shows how the market definition plays a crucial role in understanding the market power of a firm. Merger cases show that metropolitan statistical area level market definitions can be too broad, such that most hospitals would have less market shares. On the other hand, zip code level or county level definitions can be too narrow, resulting in most hospitals showing unconcentrated levels. Due to insufficient access to patient-level data, which would allow for accurate estimations of the market power using structural approaches, this study employed the HHI to calculate market power as a proxy of the health services area (HSA). The HHI shows how the change in market concentration at different market levels affects the change in the CBs provision.

This study also tested sensitivity of the market definition selection by estimating the market concentration at county and commuting zone(CZ) level. Labor economics literature uses CZs to define the labor market (Tolbert & Sizer, 1996; Autor, Dorn, Katz, Patterson, & Reenen, 2017), as an alternative to other labor market definitions. Garthwaite et al. used CZs as the health care market definition in their study, with the result that CZs, rather than more narrow geographic definitions, better captured the spillover of UC to the remaining hospitals after a hospital closure. . CZs were first estimated by Tolbert and Killian for Economic Research Service which is a part of the United States Department of Agriculture (Killian et al., 1987).Furthermore, Tolbert and Sizer (1996), who provided an update after their first study, estimated CZs using county-level data. They created 741 clusters by calculating the commuting ties of counties based on 'Journey to Work' data. The CZs method groups counties based on commuting flows or ties. In addition to commuting ties, CZs cover the entire US. For this current study, the CZs method by Autor et al. was

utilized to delineate the health care market. The dataset included 3294 HSAs and 2536 counties coded in AHA which were used to calculate the market shares of hospitals at these levels. CZs were calculated using county codes.

For each market definition, the market share of each hospital based on total staffed beds was calculated using AHA data. Only short-term acute care hospitals were included to estimate the index. HHI was calculated as follows:

$$HHI_{it} = \sum_{i=1}^{N} s_{it}^2 \tag{1.1}$$

- s: market share of hospital in market
- N: number of hospitals in the market
- i: one unit of hospital
- t: time

Market share of each hospital is calculated as follows:

$$s_{it} = \frac{q_{it}}{\sum_{j=1}^{N} q_{jt}} \tag{1.2}$$

A higher HHI for a market indicates that the market is more concentrated. To test the sensitivity of output selection for HHI, the index based on inpatient days was also calculated. Since the unit of data is not patient level, patient preferences were not observed in order to calculate the willingness to pay (WTP) method. The WTP method may be, theoretically, a better approach to measuring market power of hospitals when compared to ad hoc approaches (WONG, ZHAN, & MUTTER, 2005). It is derived from a logit demand model of patient choice of providers, which allows researchers to estimate hospitals' bargaining power by calculating the value of hospitals in the managed care network (C. Capps, Dranove, & Satterthwaite, 2003; Gaynor, 2007; Gowrisankaran, Nevo, & Town,

2014). However, in this study, the market share of hospitals could only be calculated based on the market-level data.

The method utilized for market concentration may suffer from endogeneity bias due to the mechanism of market share hospital price of the CBs provision. Hospital prices can determine the market share and hospitals can provide unprofitable services such as CBs, if they are able to raise the price high enough to cross-subsidize UC to those in need. To alleviate the bias, one of the HHI output measures was employed, as the empirical approach is derived from total inpatient and adjusted outpatient admissions. These cover not only elastic hospital services, which allow hospitals to exercise market power to set higher prices, but also inelastic hospital services such as prevention and emergency visits (Ellis, Martins, & Zhu, 2017).

1.2.2 Measuring Community Benefits

The primary source of the CBs used in this study was IRS 990 Form Schedule H. Despite this form providing a more reliable and standardized measure of CBs, it only covers NP hospitals. Therefore, to measure UC costs provided by both NP hospitals and FP hospitals, HCRIS data was obtained.

Three dependent variables (DVs) were constructed to measure CBs in the IRS data. The first DV measured the total CB costs as the sum of eight categories; and the second DV measured charity care and bad debt, as reported in the IRS data. As discussed above and in the appendix, HCRIS resource offers data regarding UC, solely consisting of bad debt and charity care; whereas, IRS data provides additional non-patient related care in dollar value. Therefore, the second DV allows for comparison of the CBs provision in two datasets. Lastly, a third direct DV was constructed using charity care, financial assistance, unreimbursed Medicaid, unreimbursed costs, and subsidized health services categories, solely related to patient care expenses. These three DVs were divided by shared beds and total operating expenses to allow for a comparable result across the hospitals.

A key relationship between hospital market structure and CBs provision, is the hospital's

ability to set higher prices which may affect the level of CBs provision. Unfortunately, transaction prices of hospitals could not be observed, so an average price per discharge for hospitals was calculated using the same approach as (L. Dafny, 2009). The approach is to calculate average price per discharge (excluding Medicare payments and discharges), to estimate the ratio of non-Medicare inpatient revenue to non-Medicare discharges (Dafny, 2009; Lewis & Pflum, 2017) (Please see the Appendix for a detailed explanation of the formula). This approach enabled this study to calculate the average price per discharge of patients with private insurance (excluding Medicare payments and discharges). As Dafny et al. reports in their study (Dafny, Ho, & Lee, 2019), this approach to price construction using HCRIS data, provides similar results compared to more detailed sources such as claims data [10].

1.3 Econometric Specification

The specifications begun with a basic regression model that estimated the effect of hospital competition on CBs provision, controlling for other variables such as market-level characteristics and hospital-specific characteristics.

$$(\Upsilon)^{r}_{i,h,t} = \alpha_{i,h} + \beta HHI_{h,t} + \gamma \chi_{h.t} + a_h + a_m + \varepsilon_{i,h,t} \tag{1.3}$$

$(\Upsilon)^{r}_{i,h,t}$ represents the CBs provision for hospital h, its type i, at time t. "r" displays the type of provision which are total CB costs and total UC costs. The coefficient β represents the marginal effect of hospital market concentration on CBs provision and it varies with the hospital type. $HHI_{h,t}$ is HHI for hospital h, at time t. γ captures the effect of control variables that vary over time such as unemployment and uninsured rate. a and a_m are hospital and market level fixed effects. Hospital type interactions are added to observe if hospital type is important factor for the level of CB provision. The presence of a teaching

[10] I trimmed the log(price/discharge) at 5th and 95th to take the outliers out from the sample which are generated as an entry errors.

hospital in the same market can affect the CB provision and therefore it is added as control variable in the model. Also, demographic and economic factors might explain differences in the level of CB provisions across the market with different market concentration levels. To control for market-level characteristics; the population of the area, income level and uninsured rate are calculated at county, HSA and CZ level using American Community Survey (ACS) as a population-weight based average of the zip code level. Robust standard errors are used to account for heteroscedasticity. Our models were estimated at the CZ level, as an alternative market definition for sensitivity analysis.

Unobserved hospital-level characteristics or unobservable market factors which may affect the CB provision can cause the downward bias for the estimation of CB coefficients. To account for this, the fixed-effect(FE) model was employed to examine whether the concern about the cross-sectional approach is valid and to eliminate the problem.The FE model also removes unmeasurable time-independent market and hospital characteristics which may affect the dependent variable over the time and estimates the effect of change in the market concentration on the change in CBs controlling for both measurable hospital and market characteristics. If those factors might be correlated with the hospital market concentration, the cross-sectional analysis might give bias estimates.

1.4 Results

Table 1.4 presents regression results for total CBs expenses as a percentage of total operation expenses from the IRS data. When the CBs variable is used as a ratio of total operating expenses, there is a significant positive relationship between the market concentration level and the provision level. The estimated impact of higher concentration becomes negative in the model with hospital fixed effects. However, when substituting wider market level fixed effects for hospital level fixed effects in columns 3 and 4 in Table 1.4, the association returns to positive. In a sense, these market level fixed effects capture the configuration of omitted characteristics of the market, as opposed to omitted characteristics of the hospital alone. These models imply that when the total market fixed effects are controlled, higher levels of

concentration as measured by HHI, lead to higher provision of CBs.

If the hospital is part of a system that has more than one hospital in its network, those hospitals tend to provide more CBs when HHR fixed effects and CZ fixed effects are included. Even though teaching hospitals provides more CBs provision once they have more market power, the spillover effect of other teaching hospitals in the same area does not seem to be case.

The effect of hospital competition on CBs per bed was examined in Table 1.5. These specifications are the same as in Table 1.4; however, Table 1.5 shows the regress of the CBs provision per bed in log form on those model specifications, instead of CBs provision by total expenses. The main result is that the marginal effect of HHI is negative, but insignificant this time. As expected, teaching hospitals provide more CBs provision once market power is accounted for. Interestingly, rural hospitals tend to have less CBs provision in more concentrated markets once time-invariant characteristics of hospitals have been accounted for. One possible reason as to why the CBs by bed behaves differently from the CBs by total operating costs, could be that total operation cost is a better factor than bed size when comparing CBs provision across hospitals, due to high occupancy rates.

As discussed in the method section, the UC variable (consisting of charity care and bad debt) was also regressed, based on the same model specifications. The UC variable was divided by total operating expenses and shared beds at each hospital. This variable can be identified in both datasets; thus, it enables me to compare the results. 1.7 (UC by total expenses) and 1.8 (UC by shared beds) shows regression results for these DVs. These results are similar to the regression results of total CBs provision. Contrary to 1.4 and 1.5, uninsured rate variable was statistically significant and positive as expected. The possible explanation for this, is that UC variable has more patient-related expenses, while total CBs provision includes other non-patient categories.

Table 1.9 and 1.10 shows the regression results for the UC variable with different specifications using HCRIS data. After year and hospital fixed-effects are included, the relationship between HHI and UC provision is negative and insignificant. Uninsured rate in

the population increases the UC provision for NP hospitals, but the sign for FP and public hospitals become insignificant. When wider fixed-effects are added, such as Health Referral Region(HRR) and CZ, there is a statically significant and positive relationship between market power and UC provision of both NP and FP hospitals, but not for public hospitals. In other words, NP and FP hospitals provide more CBs provision once their market power increases, however this is not the case for public hospitals. This difference could explain the variation in charity care volume which was not observed in the data. The measure that was observed is the dollar value of CBs provision, not the volume or quantity. Capps et found that government hospitals provide lower provision of charity volume in concentrated market (C. S. Capps et al., 2020)).

The model was also run with price as the DV, to examine how the hospital prices affect the market concentration. The average price per discharge, calculated using HCRIS data, does not eliminate Medicaid patients. In most cases, Medicaid patients represent a relatively small share of a hospitals' discharges. Table 1.11 shows the price regression results. These results show that the coefficient of price has a positive relationship with market concentration level rise, once the hospital fixed-effect is added. This means that hospitals increase prices once they face less competition.

1.4.1 Sensitivity Analysis

The HHI for each hospital was calculated based on inpatient admissions as an alternative to staffed beds output. The HSA was replaced with county zones and CZ as the market definition. County as a market definition is defined based on geographical border compared to both HSA and CZ. CZ is not defined based on geographical order, but on commuting patterns of people who live in that area (this is wider than HSA) . Table 1.12-1.15 shows the same regression performed in our analysis using different market definitions and output competition measures. These findings seem reasonable for the results and are consistent with our conclusion that: NP hospitals do not provide more CBs provision in less competitive markets. The only important result that was captured in the sensitivity analysis is that:

once the market level is CZ and the output is either staffed beds or inpatient admissions, public hospitals provide less CBs provision in more concentrated markets.

1.5 Conclusion

Overall, the impact of a hospital's market power on CBs is mixed in the regression models. The results showed that the association between market power and the level of CBs provisions can be negative or positive depending on whether the model accounts for hospital fixed-effects or wider market-level fixed-effects such as HRR and CZ. One possible explanation for these mixed results is that once the variations of the unmeasured hospital-specific factors are allowed, and market-specific factors that might be correlated with market concentration are eliminated, hospitals tend to provide more CBs in more concentrated markets. This shows that hospital-specific and market-specific characteristics play a more crucial role than hospital competition or market power. Even though some market and population characteristics were controlled, such as uninsured population and income level of the market area, there are other unobserved community characteristics that may have affected the level of CBs provision. It is also possible that there are unobserved or unmeasured factors that may affect hospital competition level which were not captured by the data; such that hospital-specific and market characteristics may be a more important determinant of CBs provision than market power. Lastly, there is also some evidence to suggest that FP hospitals provide more CBs provision once the market concentration increases; however, this study did not find any evidence to show that public hospitals provide more CBs in more concentrated markets.

Despite these significant results, there are some limitations to the analysis. The first part of the analysis, which uses IRS data, only captures two thirds of NP hospitals. In contrast, the second part of the analysis, which uses HCRIS data, only captures UC, which is a narrow definition of CBs compared to the IRS data. Thus, it is hard to generalize the results for all NP hospitals and all type of CBs categories. Another limitation is that hospitals and health insurance companies bargain over the price of inpatient care, and therefore the impact of

insurers on market power of hospitals cannot be ignored. This limitation highlights the need for future work, to account for insurers when studying hospitals' market power. The final limitation is that the analysis does not take into account the fact that there were some mergers and acquisitions (M&A) over the sample period (during 2010-2016) due to the data limitations. Therefore, further analysis should be conducted with supporting M&A data.

1.6 Tables

Table 1.4: IRS Regression Results for Total Community Benefit Expenses

	(1) Total CB(%)	(2) Total CB(%)	(3) Total CB(%)	(4) Total CB(%)
Ln (HOSP-HHI-BED)	0.018*	-0.087**	0.020***	0.014*
	(0.009)	(0.036)	(0.006)	(0.007)
Ln (Population)	0.032	-0.378	0.052***	0.059***
	(0.023)	(0.434)	(0.015)	(0.018)
Ln (Income)	0.143	0.160	-0.076	0.010
	(0.143)	(0.147)	(0.093)	(0.132)
Uninsured Rate	0.005	0.012	0.006	0.009
	(0.006)	(0.009)	(0.005)	(0.007)
Major Teaching	0.179**	0.134	0.161***	0.260***
	(0.070)	(0.099)	(0.044)	(0.056)
Minor Teaching	0.031	0.048	0.091***	0.157***
	(0.045)	(0.032)	(0.023)	(0.026)
# Teaching Hospitals	0.041**	-0.014	0.024	0.018
	(0.019)	(0.032)	(0.019)	(0.024)
#Hospitals in System	0.017	-0.012	0.020***	0.013**
	(0.011)	(0.009)	(0.006)	(0.006)
Rural	-0.030	-0.096	0.078**	0.151***
	(0.064)	(0.114)	(0.039)	(0.044)
Year Effect	Yes	Yes	Yes	Yes
Hospital Effect	No	Yes	No	No
HRR Fixed Effects	No	No	Yes	No
CZ Fixed Effects	No	No	No	Yes
constant	-4.952***	0.833	-2.942***	-3.958***
	(1.416)	(5.694)	(1.015)	(1.473)
Obs.	6142	6142	6142	6142
R-squared	0.026	0.720	0.264	0.458

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.5: RS Regression Results for Total Community Benefits per Bed

	(1) Total CB Per Bed	(2) Total CB Per Bed	(3) Total CB Per Bed	(4) Total CB Per Bed
Ln(HOSP-HHI-BED)	-0.021	-0.053	-0.020*	-0.015
	(0.022)	(0.043)	(0.010)	(0.012)
Ln(Population)	0.074*	0.880*	0.067***	0.151***
	(0.043)	(0.500)	(0.021)	(0.026)
Ln(Income)	0.320	0.138	-0.025	0.409**
	(0.219)	(0.148)	(0.145)	(0.199)
Uninsured Rate	-0.005	0.010	0.006	0.012
	(0.011)	(0.009)	(0.008)	(0.009)
Major Teaching	0.314*	0.220	0.349***	0.842***
	(0.190)	(0.147)	(0.097)	(0.123)
Minor Teaching	-0.202**	0.021	-0.013	0.137***
	(0.082)	(0.036)	(0.037)	(0.041)
Teaching Hospitals(#)	-0.007	-0.090	-0.039	-0.138**
	(0.052)	(0.072)	(0.041)	(0.061)
Hospitals in System(#)	0.131***	-0.006	0.126***	0.101***
	(0.028)	(0.016)	(0.018)	(0.020)
Rural	-0.212**	-0.162	-0.172***	0.034
	(0.105)	(0.109)	(0.055)	(0.063)
Year Effect	Yes	Yes	Yes	Yes
Hospital Effect	No	Yes	No	No
HRR Fixed Effects	No	No	Yes	No
CZ Fixed Effects	No	No	No	Yes
constant	6.594***	-1.403	10.203***	4.326*
	(2.212)	(6.519)	(1.588)	(2.212)
Obs.	6144	6144	6144	6144
R-squared	0.076	0.885	0.341	0.544

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.6: IRS Regression Results for Direct Patient-Related Expenses

	(1) Direct Patient(%)	(2) Direct Patient(%)	(3) Direct Patient(%)	(4) Direct Patient(%)
Ln (HOSP-HHI-BED)	0.037***	-0.125***	0.034***	0.021**
	(0.011)	(0.042)	(0.007)	(0.008)
Ln (Population)	0.034	-0.276	0.053***	0.072***
	(0.027)	(0.465)	(0.016)	(0.021)
Ln (Income)	-0.008	-0.001	-0.063	-0.132
	(0.153)	(0.143)	(0.101)	(0.146)
Uninsured Rate	0.004	0.002	0.005	0.006
	(0.006)	(0.009)	(0.006)	(0.008)
Major Teaching	-0.040	0.293*	-0.092*	-0.114
	(0.080)	(0.171)	(0.053)	(0.073)
Minor Teaching	-0.085*	0.023	-0.028	0.036
	(0.050)	(0.034)	(0.025)	(0.030)
Teaching Hospitals(#)	-0.015	-0.015	-0.004	0.038
	(0.019)	(0.044)	(0.024)	(0.031)
Hospitals in System(#)	-0.005	-0.013	0.004	-0.007
	(0.010)	(0.010)	(0.007)	(0.007)
Rural	-0.010	-0.078	0.103**	0.189***
	(0.070)	(0.118)	(0.041)	(0.050)
Year Effect	Yes	Yes	Yes	Yes
Hospital Effect	No	Yes	No	No
HRR Fixed Effects	No	No	Yes	No
CZ Fixed Effects	No	No	No	Yes
constant	1.012	6.055	1.289	(1.632)
	(1.496)	(6.016)	(1.119)	6145
Obs.	6145	6145	6145	0.413
R-squared	0.013	0.692	0.247	(1.632)

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.7: IRS Regression Results for Uncompensated Care by Total Expenses

	(1) U.Care(%)	(2) U.Care(%)	(3) U.Care(%)	(4) U.Care(%)
Ln(HOSP-HHI-BED)	0.034***	-0.058*	0.050***	0.027***
	(0.010)	(0.032)	(0.006)	(0.007)
Ln(Population)	-0.007	-0.232	0.022*	0.045***
	(0.029)	(0.452)	(0.013)	(0.016)
Ln(Income)	-0.031	-0.003	0.030	0.175
	(0.140)	(0.104)	(0.081)	(0.107)
Uninsured Rate	0.039***	0.006	0.014***	0.015**
	(0.006)	(0.008)	(0.004)	(0.006)
Major Teaching	-0.135*	0.096	-0.075	-0.155**
	(0.076)	(0.121)	(0.049)	(0.079)
Minor Teaching	-0.058	0.027	-0.072***	0.014
	(0.043)	(0.032)	(0.022)	(0.026)
Teaching Hospitals(#)	-0.015	0.024	-0.030	0.041
	(0.025)	(0.049)	(0.020)	(0.031)
Hospitals in System(#)	-0.016	-0.014	-0.016**	-0.018**
	(0.012)	(0.009)	(0.006)	(0.007)
Rural	-0.178***	-0.007	-0.060**	-0.010
	(0.066)	(0.079)	(0.029)	(0.034)
Year Effect	Yes	Yes	Yes	Yes
Hospital Effect	No	Yes	No	No
HRR Fixed Effects	No	No	Yes	No
CZ Fixed Effects	No	No	No	Yes
constant	1.747	5.253	0.842	-0.898
	(1.426)	(5.745)	(0.895)	(1.194)
Obs.	6280	6280	6280	6280
R-squared	0.079	0.762	0.331	0.468

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.8: IRS Regression Results for Uncompensated Care by Bed

	(1) U.Care per Bed	(2) U.Care per Bed	(3) U.Care per Bed	(4) U.Care per Bed
Ln(HOSP-HHI-BED)	-0.003	-0.023	0.014	-0.001
	(0.022)	(0.034)	(0.009)	(0.012)
Ln(Population)	0.034	1.165***	0.049**	0.131***
	(0.054)	(0.378)	(0.020)	(0.023)
Ln(Income)	0.187	-0.059	0.060	0.582***
	(0.217)	(0.102)	(0.123)	(0.171)
Uninsured Rate	0.029***	0.003	0.014*	0.021**
	(0.009)	(0.007)	(0.008)	(0.009)
Major Teaching	0.022	0.191	0.152*	0.463***
	(0.175)	(0.126)	(0.084)	(0.115)
Minor Teaching	-0.312***	-0.019	-0.205***	-0.029
	(0.077)	(0.031)	(0.034)	(0.039)
# Teaching Hospitals	-0.060*	-0.055	-0.090**	-0.104*
	(0.035)	(0.050)	(0.036)	(0.055)
#Hospitals in System	0.095***	-0.003	0.087***	0.068***
	(0.024)	(0.012)	(0.017)	(0.019)
Rural	-0.360***	-0.067	-0.295***	-0.100*
	(0.105)	(0.076)	(0.048)	(0.057)
Year Effect	Yes	Yes	Yes	Yes
Hospital Effect	No	Yes	No	No
HRR Fixed Effects	No	No	Yes	No
CZ Fixed Effects	No	No	No	Yes
constant	8.192***	-2.999	9.397***	2.698
	(2.125)	(4.921)	(1.358)	(1.893)
Obs.	6282	6282	6282	6282
R-squared	0.064	0.907	0.330	0.543

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.9: HCRIS Regression Results for Uncompensated Care by Total Expenses (Year and Hospital Fixed Effect)

	(1) UC(%) Nonprofit	(2) UC(%) Forprofit	(3) UC(%) Public	(4) UC(%) Nonprofit	(5) UC(%) Forprofit	(6) UC(%) Public
Ln(HOSP-HHI BED)	0.074	0.331***	0.066	-0.007	-0.131*	-0.029
	(0.051)	(0.040)	(0.092)	(0.121)	(0.077)	(0.163)
Ln(Population)	-0.224*	-0.139	-0.133	0.985	-0.063	0.459
	(0.114)	(0.088)	(0.136)	(0.826)	(0.365)	(0.571)
Ln(Income)	-0.128	-0.231	-1.148	0.868**	-0.042	1.619
	(0.520)	(0.549)	(0.988)	(0.425)	(0.623)	(1.108)
Uninsured Rate	0.258***	0.117***	0.304***	0.183***	0.006	0.066*
	(0.035)	(0.019)	(0.044)	(0.021)	(0.028)	(0.038)
Major Teaching	-1.138***	-0.591	0.193	0.467***	0.879	-0.428
	(0.197)	(0.521)	(0.617)	(0.160)	(0.779)	(0.807)
Minor Teaching	-0.536***	0.673***	-1.211***	0.107	0.221	-0.053
	(0.125)	(0.171)	(0.372)	(0.068)	(0.138)	(0.121)
#Teaching Hospitals	0.147**	0.247***	-0.102	0.180**	0.148	-0.141
	(0.066)	(0.053)	(0.167)	(0.077)	(0.090)	(0.262)
# Public Hospitals	-0.123	0.083	0.350***	-0.231**	0.006	-0.095
	(0.109)	(0.081)	(0.111)	(0.095)	(0.094)	(0.284)
rural	0.251	3.181***	0.080	-0.183	0.547	0.109
	(0.240)	(0.666)	(0.305)	(0.200)	(0.454)	(0.283)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Hospital Effect	No	No	No	Yes	Yes	Yes
HRR Fixed Effects	No	No	No	No	No	No
CZ Fixed Effects	No	No	No	No	No	No
constant	1.514	0.726	9.840	-23.399**	1.921	-22.737
	(5.585)	(5.629)	(10.273)	(11.218)	(8.593)	(14.260)
Obs.	15688	7747	5950	15688	7747	5950
R-squared	0.177	0.247	0.191	0.767	0.745	0.836

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.10: HCRIS Regression Results for Uncompensated Care by Total Expenses (HRR and CZ Fixed Effect)

	(HRR) UC(%) Nonprofit	(HRR) UC(%) Forprofit	(HRR) UC(%) Public	(CZ) UC(%) Nonprofit	(CZ) UC(%) Forprofit	(CZ) UC(%) Public
Ln (HOSP-HHI BED)	0.202***	0.371***	0.010	0.170***	0.363***	-0.050
	(0.021)	(0.019)	(0.040)	(0.026)	(0.022)	(0.045)
Ln (Population)	-0.034	-0.107*	-0.234***	0.140***	0.201*	-0.024
	(0.038)	(0.064)	(0.055)	(0.048)	(0.110)	(0.069)
Ln (Income)	1.169***	0.317	0.529	0.861**	1.798***	1.643**
	(0.238)	(0.380)	(0.478)	(0.356)	(0.551)	(0.643)
Uninsured Rate	0.117***	0.052**	0.085***	0.123***	0.051	0.082***
	(0.015)	(0.021)	(0.019)	(0.016)	(0.033)	(0.023)
Major Teaching	-1.066***	-0.217	-0.093	-0.893***	-0.581*	0.970
	(0.113)	(0.267)	(0.468)	(0.114)	(0.321)	(0.606)
Minor Teaching	-0.507***	0.653***	-0.792***	-0.333***	0.738***	-0.046
	(0.059)	(0.093)	(0.217)	(0.065)	(0.099)	(0.228)
#Teaching Hospitals	0.159***	0.293***	-0.221*	0.180***	0.279***	0.409*
	(0.038)	(0.037)	(0.114)	(0.047)	(0.058)	(0.233)
# Public Hospitals	-0.204***	0.022	0.015	-0.145**	0.118	-0.142
	(0.079)	(0.047)	(0.104)	(0.067)	(0.087)	(0.108)
rural	0.835***	2.906***	0.689***	0.906***	3.658***	0.761***
	(0.140)	(0.291)	(0.121)	(0.194)	(0.380)	(0.144)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Hospital Effect	No	No	No	No	No	No
HRR Fixed Effects	Yes	Yes	Yes	No	No	No
CZ Fixed Effects	No	No	No	Yes	Yes	Yes
constant	-14.42***	-4.721	-3.47	-13.18***	-24.77***	-17.68**
	(2.595)	(4.225)	(5.128)	(3.959)	(6.498)	(6.939)
Obs.	15688	7747	5950	15688	7882	5950
R-squared	0.337	0.351	0.468	0.444	0.458	0.592

Table 1.11: Price log-log Regression results

	(1)	(2) Hospital FE	(3) Market-Level Fixed Effect
Ln(HOSP-HHI BED)	-0.024***	0.065***	0.019***
	(0.003)	(0.014)	(0.004)
for profit x HHI	0.013***	-0.006	0.017***
	(0.002)	(0.006)	(0.003)
Government x HHI	0.003	-0.013**	0.021***
	(0.002)	(0.006)	(0.004)
Ln(Population)	0.008	1.001***	1.524***
	(0.005)	(0.157)	(0.265)
Ln(Income)	0.503***	0.207***	0.203**
	(0.028)	(0.056)	(0.087)
Uninsured Rate	0.019***	0.008**	0.007
	(0.001)	(0.003)	(0.004)
Major Teaching	0.323***	0.044*	0.265***
	(0.020)	(0.025)	(0.021)
Minor Teaching	0.093***	0.022**	0.042***
	(0.011)	(0.011)	(0.014)
#Teaching Hospitals	-0.006	-0.052***	-0.073***
	(0.005)	(0.011)	(0.020)
# Public Hospitals	-0.003	-0.019	-0.057**
	(0.006)	(0.012)	(0.022)
Rural	-0.022	0.079	-0.012
	(0.029)	(0.049)	(0.068)
constant	2.726***	-7.408***	-13.987***
	(0.287)	(2.164)	(3.581)
Obs.	13853	13853	13853
R-squared	0.093	0.875	0.663

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Table 1.12: HCRIS Cross-sectional Regression Results with County and Patient Days

	(NP) U.Care per Bed	(FP) U.Care per Bed	(Public) U.Care per Bed	(NP) U.Care (%)	(FP) U.Care (%)	(Public) U.Care (%)
Ln(HOSP-HHI COUNTY)	0.043***	0.125***	0.049***	0.166***	0.294***	0.207***
	(0.011)	(0.016)	(0.013)	(0.036)	(0.031)	(0.077)
Ln(Population)	0.033	0.014	0.110***	-0.075	-0.187*	-0.083
	(0.027)	(0.032)	(0.030)	(0.076)	(0.106)	(0.136)
Uninsured Rate	0.056***	0.066***	0.061***	0.301***	0.148***	0.294***
	(0.005)	(0.011)	(0.007)	(0.027)	(0.016)	(0.042)
Major Teaching	-0.045	0.127	-0.251	-1.198***	-0.527	0.181
	(0.048)	(0.357)	(0.263)	(0.189)	(0.504)	(0.695)
Minor Teaching	-0.034	0.241***	0.074	-0.628***	0.808***	-1.286***
	(0.034)	(0.069)	(0.082)	(0.130)	(0.164)	(0.361)
#Teaching Hospitals	0.018	0.055**	-0.085	0.163***	0.141***	-0.220
	(0.011)	(0.026)	(0.066)	(0.048)	(0.050)	(0.147)
# Public Hospitals	-0.106***	-0.038	-0.053	-0.402***	-0.008	-0.027
	(0.016)	(0.028)	(0.044)	(0.049)	(0.042)	(0.136)
rural	-0.232***	0.064	-0.234***	0.064	2.774***	-0.263
	(0.061)	(0.092)	(0.065)	(0.224)	(0.504)	(0.310)
constant	7.906***	5.606***	6.660***	-3.538***	-2.230*	-3.527*
	(0.365)	(0.396)	(0.401)	(0.978)	(1.161)	(1.859)
Obs.	13155	4357	4664	14769	7301	5605
R-squared	0.139	0.181	0.174	0.201	0.247	0.189

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

All regressions include year effects and HHI is calculated based on patient days in a county.

Table 1.13: HCRIS Cross-sectional Regression Results with Commuting Zones and Patient Days

	(NP) U.Care per Bed	(FP) U.Care per Bed	(Public) U.Care per Bed	(NP) U.Care (%)	(FP) U.Care (%)	(Public) U.Care (%)
Ln(HOSP-HHI CZ)	0.023**	0.113***	-0.290***	-0.041	0.211***	-0.315*
	(0.011)	(0.012)	(0.094)	(0.031)	(0.031)	(0.180)
Ln(Median Income)	0.406**	0.740***	2.451*	0.701	-0.593	-1.984
	(0.164)	(0.261)	(1.314)	(0.714)	(0.670)	(1.406)
Ln(Population)	-0.106	0.024	-0.535	-0.552**	0.081	-0.460
	(0.071)	(0.061)	(0.396)	(0.259)	(0.217)	(0.632)
Uninsured Rate	0.069***	0.060***	0.098**	0.327***	0.109***	0.013
	(0.008)	(0.011)	(0.043)	(0.048)	(0.020)	(0.071)
Major Teaching	0.016	0.337	2.178**	-0.848***	0.011	1.559
	(0.050)	(0.317)	(0.813)	(0.236)	(0.471)	(0.982)
Minor Teaching	-0.029	0.168	0.868*	-0.512***	0.718***	1.752
	(0.042)	(0.107)	(0.506)	(0.178)	(0.192)	(1.086)
#Teaching Hospitals	-0.003	-0.011	-0.304*	-0.002	-0.074	-0.187**
	(0.021)	(0.027)	(0.159)	(0.097)	(0.060)	(0.089)
# Public Hospitals	-0.039***	0.015	0.367***	-0.172***	0.066*	0.063
	(0.014)	(0.014)	(0.116)	(0.039)	(0.039)	(0.150)
rural	-0.140*	0.492***	2.298**	0.617**	3.790***	3.578
	(0.084)	(0.120)	(1.019)	(0.238)	(0.718)	(2.228)
constant	5.377**	-1.143	-12.293	-3.620	2.542	27.665**
	(2.387)	(2.719)	(12.965)	(7.899)	(5.952)	(13.332)
Obs.	14102	4697	178	15937	7867	849
R-squared	0.164	0.149	0.459	0.202	0.191	0.095

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

All regressions include year effects and HHI is CZ level and calculated based on patient days.

Table 1.14: HCRIS Fixed Effect Regression Results with County and Patient Days

	(NP) U.Care per Bed	(FP) U.Care per Bed	(Public) U.Care per Bed	(NP) U.Care (%)	(FP) U.Care (%)	(Public) U.Care (%)
Ln(HOSP-HHI COUNTY)	0.032**	0.032**	0.043	-0.263	-0.154**	-0.094
	(0.013)	(0.016)	(0.046)	(0.252)	(0.073)	(0.059)
Ln(Population)	0.127**	0.020	0.862**	13.004*	-0.468	-0.280
	(0.054)	(0.063)	(0.371)	(6.608)	(0.298)	(0.374)
Uninsured Rate	0.033***	0.053***	0.064***	-0.126	0.219***	0.124***
	(0.004)	(0.005)	(0.012)	(0.107)	(0.025)	(0.041)
Major Teaching	0.117	0.208***	0.276	0.455	0.443***	1.035
	(0.099)	(0.048)	(0.372)	(0.284)	(0.154)	(1.314)
Minor Teaching	0.005	0.001	-0.046	-0.204	0.153**	0.187
	(0.017)	(0.020)	(0.045)	(0.193)	(0.069)	(0.141)
#Teaching Hospitals	0.008	0.013	0.017	-0.145	0.075	0.191*
	(0.017)	(0.016)	(0.049)	(0.161)	(0.051)	(0.105)
# Public Hospitals	0.029	0.032	0.012	-0.322**	-0.342***	-0.031
	(0.020)	(0.031)	(0.045)	(0.160)	(0.082)	(0.136)
rural	0.025	-0.060	0.155		-0.057	-0.060
	(0.042)	(0.062)	(0.123)		(0.209)	(0.525)
constant	7.283***	8.576***	-3.392	-144.411*	3.954	2.083
	(0.659)	(0.785)	(4.624)	(78.868)	(3.708)	(4.978)
Obs.	22240	13155	4421	171	14769	7429
R-squared	0.823	0.782	0.860	0.974	0.777	0.760

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

All regressions include year effects and HHI is calculated based on patient days in a county.

Table 1.15: HCRIS Fixed Effect Regression Results with Commuting Zones and Patient Days

	(NP) U.Care per Bed	(FP) U.Care per Bed	(Public) U.Care per Bed	(NP) U.Care (%)	(FP) U.Care (%)	(Public) U.Care (%)
Ln(HOSP-HHI CZ)	0.032***	0.031***	0.058*	-0.151	-0.055	-0.052
	(0.008)	(0.011)	(0.031)	(0.139)	(0.049)	(0.078)
Ln(Median Income)	0.024	0.201*	-0.267	-4.619**	1.097**	0.307
	(0.093)	(0.113)	(0.248)	(1.774)	(0.474)	(0.731)
Ln(Population)	0.335***	0.020	4.800***	22.305***	0.000	2.004
	(0.106)	(0.107)	(0.829)	(6.390)	(0.457)	(1.540)
Uninsured Rate	0.039***	0.060***	0.037***	-0.199**	0.207***	0.143***
	(0.004)	(0.005)	(0.011)	(0.087)	(0.024)	(0.036)
Major Teaching	0.110	0.198***	-0.075	0.255	0.419***	0.729
	(0.098)	(0.047)	(0.400)	(0.272)	(0.151)	(1.337)
Minor Teaching	-0.002	-0.007	-0.070	-0.287*	0.107	0.159
	(0.016)	(0.019)	(0.043)	(0.172)	(0.067)	(0.136)
#Teaching Hospitals	0.012	0.028*	0.019	-0.077	0.112**	0.220**
	(0.017)	(0.016)	(0.050)	(0.155)	(0.049)	(0.102)
# Public Hospitals	0.009	-0.010	-0.019	0.168	-0.250***	-0.171*
	(0.011)	(0.018)	(0.029)	(0.137)	(0.060)	(0.102)
rural	0.004	-0.075	0.087		-0.022	0.204
	(0.040)	(0.057)	(0.120)		(0.188)	(0.521)
constant	3.965**	6.003***	-51.811***	-229.336***	-13.519*	-31.938
	(1.671)	(1.853)	(10.978)	(74.302)	(7.839)	(20.915)
Obs.	24183	14102	4697	178	15937	7867
R-squared	0.815	0.783	0.853	0.974	0.760	0.739

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

All regressions include year effects and HHI is CZ level and calculated based on patient days.

Chapter 2: The Effect of Hospital and Insurer Competition on Community Benefits Provision

2.1 Introduction

Nonprofit(NP) hospitals in the United States are the largest nonprofit sector, accounting for 56% of non-government, community hospitals in 2018 according to the American Hospital Association [1]. NP hospitals can take advantage of their exemption from federal, state, and local taxes, when compared to FP hospitals; however, they can only receive tax exemption if they meet the federal requirements specified in Section 501(c)(3) of the Internal Revenue Code [2]. If NP hospitals, which are primarily operated and organized for charitable purposes, qualify for tax exemption, then they are required to provide community benefit (CB) activities to maintain their status (IRS, 2020).

Tax exemption offers possibly an advantage in a competitive health market, as it provides indirect subsidies to NP hospitals [3]. As a result, one may expect that better financial health and increased market power for NP hospitals may necessitate CB provisions. In the meantime, NP hospitals do not receive special treatment in antitrust law cases for the activities that might increase their market power. There is little understanding and research in the literature as to how competition in the health care market affects NP hospitals' behavior on CB provisions. This study, therefore, aims to examine this relationship between competition and CB provision.

Federal tax law has provided tax exemption for NP organizations since the start of federal taxation in 1913 (Fremont-Smith, 2008).To have tax-exempt status, entities must

[1]The percentage of NP hospitals compared to for-profit(FP) hospitals has been declining over the years; however, more than half of all hospitals are still NP hospitals.

[2]It is worth highlighting that there is no consensus that tax-exemption status is an advantage for NP firms (Alm & Teles, 2018).

[3]From the perspective of law, whether tax-exemption is subsidy is an ongoing debate (Halperin, 2010).

meet at least one of the purposes listed in the Code which includes "religious, charitable, scientific, educational, testing for public safety, literary, or to foster national or international amateur sports competition, and preventing cruelty to children and animals". It is worth to note that IRS considers qualifying NP hospitals as charitable organization under the federal tax law (IRS, 2020) [4].

One of the justifications for tax-exempt status is the 'community benefits standard', which has evolved over the years. The current rationale for the CB standard is that tax-exempt NP hospitals are expected to promote the health of the public or community in order to meet the requirements of being 'charitable'. The IRS has described the CB standard as that which "benefits the community it serves through the promotion of health" and "is operated to serve a public rather than a private interest". From 1956 to 1969, a narrow definition of the CB standard was employed regarding tax-exempt status; during which time the IRS ruled that 'the charity care standard' would require NP hospitals to provide health care for free or at below-cost price to those who were unable to pay (IRS, 1956).

In 1965, the need for charity care was reduced due to the enactment of Medicaid and Medicare as a national public health insurance. This led to the introduction of a broader definition of CB in 1969, which replaced the previous definition, such that 'community benefit' was and is now considered a legal standard for qualification of tax-exempt status (IRS, 1969). Federal tax law no longer requires NP hospitals to provide only charity care for tax-exemption.

One of the problems with this new definition is that it is too ambiguous compared to the previous requirement. With the new definition, a hospital can qualify for tax-exempt status even without an operating emergency room (Colombo, 2005).Another critique of the legal rationale of tax-exemption for NP hospitals is that government regulators and the public find it difficult to differentiate between the activities of NP hospitals, which increasingly resemble their competitors, and FP hospitals, especially when considering uncompensated

[4]This classification is not subject to only hospitals. It may include other kind of health care organization such as managed care organizations, homes for the aged, ambulatory care providers and so on.

care (UC) provisions (Sloan, 1998, 2000). [5] For instance, both NP and FP hospitals must provide necessary treatment to those in need, even though they may not have the resources to pay for an emergency room, as this is a federal law (enacted in 1986 by the Emergency Medical Treatment and Labor Act) [6]. In addition, FP hospitals, like NP hospitals, provide UC to those in need, which is recorded as bad debt; however, unlike NP hospitals, some FP hospitals also provide other types of CB activities, rather than just UC (Authority, 2018).

An important problem with the CB standard, which is related to the subject of this paper, is the inconsistency between the rationale of tax exemption for NP hospitals, and federal antitrust law's approach to NP hospitals. Given that the CB provision is unprofitable services, one potential financing of CB provision is cross-subsidization — NP hospitals may charge higher prices to some patients to finance unprofitable services [7]. Capps et al. posits that market power is necessary for cross-subsidization and higher market power may enhance NP hospitals' ability to provide more CBs (C. S. Capps et al., 2020) [8]. As Capps et al. highlights in their article, federal antitrust departments do not provide special treatment for NP hospitals or differentiate NP hospitals from FP hospitals in antitrust cases. A report titled: 'Improving Health Care: A Dose of Competition,' issued by the Federal Trade Commission and the Antitrust Division of the Department of Justice, analyzed the court cases and concluded that "although institutional status has loomed large in debates and

[5] An important difference is that private inurement (transfer of profits) or benefit defined by the IRS is not permissible for NP organizations. NP hospitals can earn profits like those for FP hospitals, but lack of profits for NP hospitals can inure to the benefits of any individuals. As far as similarity of FP and NP hospitals goes, (Sloan, 1998) and (Colombo, 2005) conclude that there is no significant difference between FP and NP hospitals in UC provision.

[6] Before the EMTALA, a hospital without an emergency room would not be qualified for tax-exempt status as the IRS 1969 ruling implied that if there was another hospital in the area with a proper emergency room; the second emergency room would be duplicative and unnecessary. The IRS addressed this problem in 1983 issuing the Revenue Ruling 83-157, allowing state and local health planning agencies to decide if the second emergency room would be needed. For example, if an eye hospital without an emergency room meets other requirements and shows that the hospital promotes health through CB, then it qualifies for tax-exemption under section 501(c)(3) (IRS, 1983).

[7] David et al. examined whether hospitals cross-subsidize unprofitable services and found empirical evidence supporting cross-subsidizations (David et al., 2014).

[8] Modelling the NP hospitals' behavior, which requires setting assumptions about the objectives of NP hospitals, plays an important role regarding cross-subsidization. In addition, market entry and exit of FP hospitals affects cross-subsidization of NP hospitals. Horwitz and Nichols model the objectives of NP hospitals as output maximization which allows cross-subsidization. They found that cross-subsidization decreases, while FP hospitals penetration increases. As competition from FP hospitals increases, NP hospitals behave like FP hospitals, and offer less unprofitable services (Horwitz & Nichols, 2009).

legal disputes, the best available evidence indicates that NPs exploit market power when given the opportunity to do so. Accordingly, the FP/NP status of the merging hospitals should not be considered a factor in predicting whether a hospital merger is likely to be anticompetitive" (Commission & of Justice, 2004).

Despite this approach from the antitrust department, the federal tax law still encourages NP hospitals to provide social benefits to their communities by granting them tax exemption. A memorandum from the General Counsel of the IRS in 1991 issued a contradictory position to its policy toward the CB standard. The General Counsel Memoranda examined a series of hospital-physician joint ventures and concluded that "obtaining referrals or avoiding new competition may improve the competitive position of an individual hospital, but that s not necessarily the same as benefitting its community" (IRS, 1991; Ball, 1992). This IRS memoranda suggests that the IRS' position towards CB is that: an increase in the market share or power through joint ventures, does not necessarily mean that the hospital in question is providing more charitable services. Despite these inconsistent approaches, if NP hospitals are considered as charitable organizations, then any advancement on NP hospitals' financial position would serve the purpose of tax exemption.

At present there is a gap in the literature, such that researchers have questioned whether NP hospitals should get a competitive advantage in the health care market by obtaining tax exemption, in addition to receiving special treatment in antitrust cases. This emphasizes the importance of understanding how NP hospitals provide CB provision with more market power. If competition in the hospital market limits the ability of NP hospitals to provide more CBs, or increased market power raises the level of CB provision, then there is an inconsistency caused by the IRS and federal antitrust cases which may undermine the charitable activities of NP hospitals. It is salient to understand both the competition in the health care market and its effect on the NP hospitals' behavior towards charitable activities.

The market structure of the health care sector has been extensively studied in literature. Research has shown that competition in the health care market, especially insurer and hospital competition, plays an important role in the allocation of health care resources. The

literature in this field tends to focus on the effect of market structure units on healthcare prices and qualities (Gaynor, Ho, & Town, 2015; Ho & Lee, 2017; Pauly, 2019). A vast amount of research shows that hospital prices are higher in more concentrated hospital markets, and lower in less concentrated insurer markets. In more concentrated markets, hospitals and physicians charge higher prices to commercially insured patients (Melnick, Shen, & Wu, 2011; Gaynor et al., 2015; Cooper, Craig, Gaynor, & Van Reenen, 2019). A vast amount of research shows that hospital prices are higher in more concentrated hospital markets, and lower in less concentrated insurer markets. In more concentrated markets, hospitals and physicians charge higher prices to commercially insured patients (L. S. Dafny, 2010; L. Dafny, 2019) resulting in insurer mergers which lead to higher premiums (L. Dafny, Gruber, & Ody, 2015) [9].

The negotiation between hospitals and insurers determines prices and it also affects the insurers' provider network. By building a provider network, insurers gain leverage in a negotiation as it enables them to steer patients' demands and choice of hospital selection (C. Capps et al., 2003; C. S. Capps & Dranove, 2014; Gaynor et al., 2015). If a system of hospitals offers an alternative hospital that an insurer can select instead, then that insurer can leverage the network provider, while negotiating with that hospital over the price. As a reaction to this, hospitals then increase their market power by merging, in order to have greater bargaining leverage when negotiating with the insurer. The lower hospital prices, due to insurer market power, raise a concern regarding consumer welfare, as the lower hospital price can cause an increase in consumer welfare.

Pauly(1998) examined consumer welfare under the managed care monopsony and concluded that health insurers can exercise monopsony power over the health care providers, as they can set input prices below the competitive level (welfare-reducing), or exercise monopsony power to break up health care providers' monopoly power (welfare-increasing) (Pauly,

[9]For a comprehensive analysis about the competition in the health care market, you can find Mark Pauly's recent article https://bit.ly/2q3AIYH

1998). Pauly suggested that one way to distinguish these two cases is to conduct an empirical analysis on the quantity of medical inputs. Research has shown that there is some evidence of welfare-increasing monopsony power. This means that hospitals in highly concentrated insurer markets offer more hospital services, rather than lowering the utilization of hospital services (Pauly, 1998; Feldman & Wholey, 2001; Bates & Santerre, 2007).

At present, little is known about how hospital-insurer competition in health care markets affects NP hospitals' behavior on CB provision. The literature, so far, has only provided limited empirical analysis of hospital competition and CB provision. To my knowledge, there is still no theoretical modelling explaining how hospital-insurer bargaining or competition affects the hospitals' ability to provide public services.

The economics literature has extensively studied the impact of competition on both private and public goods. Within this literature, it is particularly important to determine whether CB provision is a private or public good. Even though some studies consider CB provision as a public good, it does not fit the economics definition of a public good. The textbook version of pure public goods highlights two key characteristics inherent in goods and services: non-rivalrous and non-excludable. Most health care services in hospital are private goods, which are rivalrous and excludable. One would consider community benefit provision, which makes the community better off, as a public good with the assumption that altruistic members of that community would be better off if everyone in the community has access to proper medical services (Nicholson, Pauly, Burns, Baumritter, & Asch, 2000; Francois, 2003) [10].

However, as the CB provision was not homogeneous, it is hard to assume that all CB provision can fall into just one type of goods. The IRS, with its latest requirement in 2009, accepts different types of CB provision — from medical research to community health improvement services as well as UC to those in need. Medical research, for example, can

[10]In addition to this argument, Burton Weisbord discusses in his article "collective-consumption services of individual-consumption goods" that some health care services such as medical care services for indigents, emergency rooms and open-heart surgery facilities are public goods. For these services, hospitals charge prices below profit-maximizing level and benefit many potential users simultaneously; he calls these services public goods with "output value", which is the option to utilize goods in the future. (Weisbrod, 1964, 1986)

be considered as a public good, as medical knowledge is non-rivalrous and non-excludable to some degree (Kaul, Grunberg, & Stern, 1999).

Providing indigent care to those who cannot afford to pay is unprofitable. Therefore, NP hospitals are expected to play an important role in providing these services, as they accommodate for the failures in promoting public health seen in FP hospitals or government hospitals (H. B. Hansmann, 1980; Salamon, 1995; Steinberg, 2003) [11]. NP hospitals exemption from federal, state, and local taxes; as well as other implicit subsidies, such as the ability to access tax-exempt bonds, provides some advantages for NP hospitals (Gentry & Penrod, 1998).

An important theoretical advantage is that tax exemption provides cost advantages to NP hospitals as an indirect subsidy (Harrison & Seim, 2019). Another advantage is that exemption from local taxes in states and cities is associated with higher market shares for NP firms, when compared to FP firms providing similar services (H. Hansmann, 1987). Although Hansmann examined several different NP firms along with NP hospitals and nursing homes, a separate study has shown empirical evidence to suggest that higher state corporate income and local property tax rates are associated with a higher market share for NP hospitals (Gulley & Santerre, 1993).

Despite the empirical evidence of possible advantages of tax-exemption status for NP hospitals, there are very few studies which examine both the theoretical and empirical benefits of hospital competition and CB provision. All the aforementioned studies examine the effect of hospital competition for UC (charity care or bad debts [12]); however, this is only one category of CB.

The theoretical arguments on the association between competition and CB in the literature postulate various objectives of NP hospitals. The study by Frank and Salkever (1991)

[11] Even though this sentence is a simplified version of the argument, the existence of NP firms is still an open question (Steinberg, 2003)

[12] Hospitals record unrecoverable patient payment as bad debt. Garmon and Capps et al use the sum of bad debt and charity care as UC (Garmon, 2006; C. S. Capps et al., 2020).

modelled the supply of charity care by NP hospitals. This model assumed that most hospitals aim to maximize both revenue and indigent care with differing motivations (Frank & Salkever, 1991). To accommodate the different motivations, they proposed two theoretical models: The first model hypothesized that the objective of NP hospitals is to maximize the utility of revenue and total level of charity care in the market. As a result, there may be a crowding-out effect in charity care supply in unconcentrated markets, as hospitals may supply less charity care in the presence of other hospitals in the same market, due to the demand for charity care; the second model hypothesizes that a hospitals' utility depends not only on the charity care, but also the reputation for providing charity care. Consequently, NP hospitals compete with other hospitals in the same market to provide charity care to improve their reputation for supply.

The result of the study supports the second model, as it found that the total level of charity care increases as the total number of hospitals in the market increases; however, the theoretical model assumes that price is exogenous, and this study uses data from Maryland, where hospital prices are regulated. Gruber (1994) does not directly examine the association between charity care and competition, but analyzes how NP and FP hospitals respond to price shopping. This was due to a policy change in California which allowed selective contracting for insurers for charity care provisions (Gruber, 1994). Gruber's study uses the modified version of Frank and Salkaver's model, in which hospital price is considered endogenous instead of exogenous. Their results showed that net revenues and income decreased in relatively competitive markets after this policy change. The study also found that charity care provision fell more in relatively competitive markets. It is also worth mentioning that several studies support this empirical finding, such that when payments to NP hospitals decrease (increase), charity care provision decreases (increases) as a response [13].

[13] Although it is not directly related to the topic of this study, FP hospitals and NP hospitals respond differently to payment cuts. A recent study by (He & Mellor, 2016) examines the effect of Medicare payment on the provision of uninsured outpatient care. They found that once there is a Medicare payment cut, NP hospitals provide less uninsured outpatient care, but FP hospitals increase the share of outpatient care to uninsured patients

While Frank and Salkaver (1991) and Gruber (1994) modelled the supply of charity care for NP hospitals, Bank et al. developed another model for the supply of charity care in FP hospitals (Banks, Paterson, & Wendel, 1997). Their model posited that the objective of FP hospitals was to provide charity care as a "business decision which may enhance a hospital's reputation, reduce the likelihood of civil liability or Medicare sanctions and strengthen relations with physicians" [14]. An important part of this objective was that it included expected penalty cost, which could be defined as 'the perception of under-producing charity care to the model'. Authors gave the following examples of expected penalty cost in their articles: "legal liability, Medicare sanctions, physician dissatisfaction or negative impact on demand by compensated care patients " (p. 135). The expected penalty cost is a key parameter in the model, as it explains how FP hospitals respond to market changes compared to NP hospitals' response. The expected penalty cost increases if the difference between the expected and actual level of charity care provision increases.

The theoretical model by Bank et al. implies that NP hospitals may reduce their supply of charity care as a response to an increase in competition; while FP hospitals may provide more charity care when facing increased competition. The premise is that NP hospitals decrease charity care when demand falls, as the objective of NP hospitals is subject to financial constraint (zero profit). In comparison to FP hospitals, when demand falls, they provide more charity care by lowering the marginal cost of producing charity care. Bank et al.'s study empirically examines Californian hospital data from 1981 to 1989, with the principal findings supporting the theoretical model developed in the article.

Despite Banks et al. empirically testing how the supply of charity care in different market environments and payment policies change, their paper does not directly study the association between competition and charity care. In contrast, a study by Garmon does directly examine the relationship between hospital competition and charity care; however, the findings showed no statistically significant evidence that increased competition leads to a reduction in charity care in both Florida and Texas (Garmon, 2006). Additionally, a recent

[14] As Bank et al highlight in their article, the objective of FP hospital to supply charity care comes from Gray's analysis (Gray, 1993).

study which directly examined the relationship between hospital competition and charity care provision, in the context of antitrust law, found that NP hospitals do not provide more charity care provisions once they have more market power. Their study concluded that there is no support for lenient antitrust treatment of NP hospitals (C. S. Capps et al., 2020).

The model used in the paper by Capps et al. is a modified version of Phillipson and Posner's model (2009) in which Philipson and Posner posit that antitrust law does not distinguish NP firms from FP firms (Philipson & Posner, 2009). Their key finding, which was based on their model, was that regardless of the objectives of the firms, NP firms exploited market power as they are profit-maximizing firms; thus, competition increases this surplus whether in the mixed market or NP dominating market. Capps et al. modify Philipson and Posner model by changing assumptions and postulating that some degree of market power is necessary for NP hospitals to provide charity care or unprofitable services. The study, however, finds that NP hospitals with higher market power do not provide more charity care. This was based on Californian hospital data taken from 2001 to 2011.

Theoretical arguments on competition and charity care, have only considered hospital competition so far, not taking into account the hospital and insurer competition together. A recent strand of literature in health economics and industrial organization examines how hospital-insurer bargaining affects hospital prices, premiums, and more generally, equilibrium outcomes in the health care market. At present, there is no empirical study in the literature which examines how hospital and insurer competition affect the CB provision. This current study, to my knowledge, is the first paper that examines the impact of hospital and insurer competition on hospitals' CB provision. To understand this impact, models of UC provision of hospitals with different ownership, and CB provision in NP hospitals will be examined.

2.2 Identification

In a simple regression model, the effect of hospital and insurer competition would act as independent variables on CB provision. As a dependent variable, CB provision would be the dollar value of total CB provision provided by a hospital during the tax year. The key independent variables indicate the concentration of hospital markets and insurer markets. These variables are based on patient choice of hospitals and insurance enrollment which are calculated by following concentration methods in the literature. A well-known and traditional method is Herfindahl- Hirschman index (HHI), which intends to capture the change and level of competition in a defined market. This has been used in the literature from economics to health services research.

The HHI approach is considered as non-generalizable, in that it is not derived from a theory but an institution. This approach defines the market area based on geographic and political boundaries, and takes into account patients that hospitals draw from said defined area. Different studies use distinct approaches to define the market area, from zip codes to counties, Metropolitan Statistical Areas, and/or community zones (CZs) (Dranove & Ody, 2016; Azar, Marinescu, Steinbaum, & Taska, 2020) [15]. There have been some critiques of these approaches regarding measurement issues. The main concern is that calculation of market concentration based on geographic or political boundaries, may have potential bias that misleads the result of any analysis using HHI.

As such, imposing natural market boundaries assumes that hospitals are either in or out of relevant geographic markets, which does not account for patients who travel outside of that geographic market. Smaller market areas might suggest that many hospitals are in an unconcentrated market, whereas larger market areas might mislead researchers and policy makers to believe that most hospitals are in concentrated markets. Furthermore, actual patient flows or shared beds in a hospital are typically used as a measurement of hospital concentration index; however, this may actually be due to hospital competition. In addition to these concerns, the market share might depend on unobserved characteristics of patients

[15] Dranove and Ody's study examines and compares different concentration measures used in the literature.

or hospitals. Estimates of the effect of hospital competition on any outcome or variable will likely reflect the true effect, as well as the effect of unobservable hospital and patient factors. Kessler and McClellan (KM hereafter) introduced an approach to overcome the use of geographic boundaries (Kessler & McClellan, 2000). KM estimated the predicted market share of hospitals, by accounting for predicted probabilities of each patient admission to every hospital in his or her associated geographic market.

In addition to those approaches, structural methods have been used to measure market concentrations, gaining popularity in the literature as these methods help to overcome measurement issues and potential biases (as mentioned above). One of those structural approaches is willingness to pay (WTP). WTP was developed by Capps et al. and has since been used extensively compared to other structural approaches in the literature (C. Capps et al., 2003) [16]. The approach is derived from an economic theory which uses structural models to account for the value of a hospital being in the managed care network. The value reflects the price that a hospital is able to receive through negotiations with payers, and differs considerably from the formula used to compute a hospital-specific HHI. Patient level data such as claims data, or discharge data enables a researcher to calculate market shares of hospitals for HHI. When using a structural approach, a price variable is needed along with those datasets.

For this current study, the previously mentioned approach by KM will be used to predict market shares of hospitals, instead of actual market shares based on predicted patient flows. The actual market shares of hospitals might suffer endogeneity bias, as these shares can be correlated with unobserved heterogeneity of both patient and hospital characteristics. The KM approach calculates the probabilities of every hospital admission for each patient, and then finds the expected number of patients for each hospital by summing up the probabilities. This approach calculates predicted market shares of hospitals based solely on observable hospital and individual characteristics. Also, to overcome issues with defining

[16] Martin Gaynor et al calls WTP approach as semi-structural approach since one step of analysis includes reduced-form estimates for the effect of hospital competition on the interest of outcome. Please see (Gaynor & Town, 2011).

discrete geographic boundaries, this study will calculate travel (driving by car) distance to use as a maximum amount of time that each patient drives from their zip code census-tract centroid, to the hospital's zip code census-tract centroid. This helps to create each patient's hospital choice sets. Also, similarly to the KM approach, this study will also assume that travel cost increases with driving distances, which is an important assumption for hospital choice.

The insurer market competition measure also suffers from potential endogeneity issues. The actual market share of the insurer could be biased, since a plan with an unobserved quality attribute or a plan benefit may affect the negotiated price; however, it may also increase a given insurance carrier's market share. In addition, unobservable variables that might be correlated with higher service prices are likely to deter insurance carriers from entering the market. The latter effect will bias the insurance carrier HHI coefficient upward — higher quality plans are likely to have a higher market share; however, it is likely that more market health insurers will have higher costs upon entering, resulting in fewer insurers being drawn into the market. In addition, population variables used in the study by Dunn et al. might be ideal instruments for this, as they are correlated with insurers, but do not have interest (Dunn & Shapiro, 2014). In this study, population estimates and demographics will be used as an instrument for insurer HHI.

2.3 Data

The data for this study comes from several sources: Healthcare Cost Report Information System (HCRIS) database, IRS Form 990, Decision Resource Groups (DRG), Managed Market Surveyor File, Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) by The Agency for Healthcare Research and Quality (AHRQ). This data was supplemented with data from American Hospital Association (AHA), Area Health Resource File (AHRF), and American Community Survey (ACS). The AHA asks all hospitals

in the US to fill out an annual non-mandatory survey for that year. The publicly available AHA annual survey provides the most complete data regarding hospital information such as: utilizations, affiliations, and finance for more than 6000 hospitals and 500 health systems. This data is available from 2012 to 2016.

The IRS Form 990 was utilized as it covers financial information of NP hospitals and Schedule H. Every tax-exempt NP hospital must return annual information to the IRS along with its charitable activities. IRS Form 990 includes a variety of organizational information, from financial information of NP hospitals such as revenues and expenses, to a list of key officers and employees. On Form 990, Part IV, Question 20 organizations are asked whether they operate one or more hospital facilities. If tax-exempt organizations answer 'yes' they must report information regarding their financial assistance and certain other CB activities during that tax year on Schedule H, which is attached to Form 990. Schedule H provides the key source for the dependent variable of this study: CB expense. Schedule H also provides additional information about community needs. The Affordable Care Act enacted new requirements under section 501(r)(3) for tax-exempt hospitals to qualify for tax exemptions.

The IRS considers eight categories of CB in Schedule H, which are as follows:

1. Charity Care or Financial Assistance which includes free or discounted health care services to patients in need, and eligible to the criteria of hospital's financial assistance program.

2. Unreimbursed Medicaid which takes the difference between the cost of treating Medicaid patients and the payment received for those treated by Medicaid.

3. Unreimbursed Costs which includes other means-tested programs such as the State of Children's Health Insurance Program and other state and local programs. This involves the same process as the second category mentioned above.

4. Community Health Improvement Services and Community Benefit Operations which includes programs and activities operated or subsidized by the health organization for

the purpose of community health improvement.

5. Health Professions Education which means educational programs that cover not only education of the organization's employees, but also health professionals in the community.

6. Subsidized Health Services which includes the costs that organizations provide to clinical services, even though it causes financial loss to the organization. This does not include bad debts, or means-tested programs costs, so there is no double accounting in the report.

7. Research which includes any research that aims to increase the generalized knowledge of the public, this includes knowledge about behavioral or sociological studies, related to health or diseases.

8. Cast and In-kind Contributions for Community Groups which includes any report where cash contributions or any other types of donation are given to other organizations. These donations can then provide other categories describe above.

In addition to these eight categories, Schedule H also covers community-building activities spending, which is reported in the second part of the form; however, this spending is not included as a CB by the IRS (Rosenbaum, 2016). Spending on 'physical improvements and housing' such as providing housing for a vulnerable population and spending money on 'community support' such as childcare for vulnerable residents are covered as community-building activities.

The difference between CB spending and community-building activity spending can be vague. For clarity, the IRS considers any community-building activity spending as CB spending, if that community-building activity spending meets the health needs of the community. Hence, community-building activities and use only CB expenses were excluded from 2012 to 2016. Table 2.1 displays the percentage of total spending of each category along with the total CB.

Table 2.1: Total Community Benefits Provision by 8 Categories for All Nonprofit Hospitals in the US

Year	2012	2013	2014	2015	2016
Charity Care(%)	24.2	24.8	20.5	18.0	17.6
Cash-in-kind Contributions(%)	2.6	2.8	3.2	2.8	2.8
Community Health Services(%)	4.3	4.2	4.3	4.3	4.1
Health Professions Education(%)	14.8	16.2	16.5	16.8	16.2
Unreimbursed Medicaid(%)	30.4	35.6	39.0	42.2	43.5
Unreimbursed Costs(%)	2.2	2.1	1.7	1.6	1.7
Subsidized Health Services(%)	8.4	9.1	9.5	9.1	9.2
Research(%)	13.1	5.2	5.3	5.2	5.0
Total Community Benefits($) *	68.3	63.3	63.6	68.2	73.3

1. * billion dollars

2. The data comes from IRS data for a period between 2012 and 2016 for all NP hospitals that submitted IRS 990 tax form

The next data source I utilize for the study comes from Decision Resource Groups (DRG) Managed Market Surveyor File. The DRG data includes both public and commercial insurance enrollment for each health plan in the health insurance marketplace from 2012 to 2016. Table 2.2 and 2.3 shows that the number of total populations with coverage increased over the years while the uninsured rate decreases. The rate of uninsured population decreased by 15% in 2015 after the expansion in Medicaid. The Medicaid expansion effect on the enrollment rate can be clearly seen in the table as well. The percentage of insurance coverage population by state is presented in the Figure D.1 in Appendix D.

Table 2.2: Summary Statistics of Enrollment Population-1

Year	Commercial (FI + SI)	Commercial FI	Commercial SI(Est)	Medicare	Medicare FFS (Parts A/B)
2012	162,470,052	79,775,622	82,694,430	49,277,779	35,961,999
2013	163,635,835	77,006,380	86,629,455	51,091,803	36,515,716
2014	170,825,067	81,669,453	89,155,614	52,631,495	36,713,426
2015	169,000,545	82,975,858	86,024,687	54,327,934	37,389,808
2016	169,660,179	79,855,237	89,804,942	55,314,316	37,378,892

Table 2.3: Summary Statistics of Enrollment Population-2

Year	Medicare Adv. (Part C)	Medicaid	Payer Managed Medicaid	State Managed Medicaid	Dual Eligible	Uninsured
2012	13,315,780	60,034,774	33,157,653	26,877,121	6,763,301	50,438,661
2013	14,576,087	60,778,403	34,768,763	26,009,640	7,028,187	49,262,628
2014	15,918,069	62,503,467	37,356,258	25,147,209	7,203,655	41,146,909
2015	16,938,126	71,699,963	46,713,235	24,986,728	7,396,745	34,938,880
2016	17,935,424	74,944,624	52,833,995	22,110,629	7,509,747	32,651,130

FI: "Fully Insured", SI: "Self-insured". Column with bold title (Commercial, Medicare and, Medicaid) is aggregate of two columns next to the right. For the total population with coverage: Commercial (FI + SI) +Medicare + Medicaid – Dual Eligible.

The other data source that was used in this study was the HCRIS database. Each Medicare-certified provider must submit an annual report to the Center for Medicare and Medicaid Services (CMS). It is a very comprehensive database which includes provider information such as facility characteristics, utilization data, cost, and charges by cost center (in total and for Medicare); as well as Medicare settlement data, and financial statement data. HCRIS data allows for the construction of a hospital average price per discharge using the same approach used in the article by Dafny [17], and examine how hospital average price per discharge varies based on competitiveness of health care market (L. Dafny, 2009).

The last data source, HCUP SID, provides all inpatient discharge records, all-payer in 48 states and District of Columbia. This data source was used to calculate hospital competition for a more robust identification. It was also used to supplement the final data with AHRF and ACS to obtain health care supply and demographics of the market. After merging the data sources at hospital level, a few non-federal, general short-term hospitals were selected from Florida, New York, Vermont, Massachusetts, Arizona, and Utah. Data was used from 2012 to 2016.

[17]Please see Appendix for the average hospital price calculation.

Competition Measure

Hospital market concentration was calculated using the KM approach. Firstly, all non-federal, general medical and surgical hospitals with non-rural Medicare patients were selected. A discrete-choice model of hospitals was estimated as a function of exogenous characteristics (e.g. travel distance) of hospitals and patients. The hospital choice of patient was modelled to account for driving distance by car from the patient's zipcode census tract centroid to the hospital's location [18]. Patient characteristics were allowed to affect his or her hospital choice. The hospital patient choice sets were created by limiting the travel distance up to 80 minutes by car. Every hospital within an 80 minute drive from the patient's location to their hospital of choice was included. Applying discrete-choice models of hospital demand, predicted probabilities of each discharge were obtained to estimate the expected number of admissions for every hospital in each patient's hospital choice set. After this, the expected number of admissions was used to calculate the predicted market concentration index at zip code level (Please see Appendix B for details of the model).

$$HHI_{it} = \sum_{i=1}^{N} s_{it}^2 \tag{2.1}$$

For insurers, the HHI was calculated by summing the square of market shares of the commercial health plan in the Metropolitan Services Area (MSA), including both fully- and self-insured enrollments. The index ranged from 1 (perfect competition) to 10000 (a monopoly).

$$s_{it} = \frac{q_{it}}{\sum_{j=1}^{N} q_{jt}} \tag{2.2}$$

i represents the unit of insurer while s indicates the market share of i at time t. The

[18] Driving distance was calculated by using OpenStreetMaps data. For that a local OSRM server was built and then the driving distance between two points with the latitude and longitude of census tract centroid of each 5 digit zipcode was calculated. HCUP data provided 5 digit zipcodes for each patient and hospital

market share s was calculated as in Equation (2.2) and q represents total enrollment in the health plan [19].

2.3.1 Descriptive Statistics

Table 2.4: Summary Statistics

	Mean	SD	Min	Max
A.Outcome of Interest				
Total CB Expense($)*	44.8	82.6	0.21	791.6
CB Expense / Total Exp.(%)	9.3	4.5	0.9	24.7
CB Expense by Bed($)	103,166.85	78,360.95	4,614.83	499,027.03
B.Competition Index				
Hospital HHI	3826	2167	874.74	9985
Insurance Market (MSA) HHI	1405.3	629.38	658	4011.8
C.Hospital Characteristics				
Bed Size	331.7	303.12	14	2829
Teaching Status	0.1	0.3	0	1
Average Hospital Price($)	4756	3011.1	798	24902.6
Total Operating Expense*	282.12	278.1	12.1	1,674.9
D.Market Characteristics				
Uninsured(%)	14.30	4.63	4.30	24.10
Privately Insured(%)	64.72	6.80	52.40	81.10
Poverty Rate(%)	11.22	2.08	6.20	19.60
Median Income($)	55,337	9,860.4	35,093	93,144
For Profit Hospitals(#)	3.63	4.02	0	15
Public Hospitals(#)	2.73	4.36	0	13
Nonprofit Hospitals(#)	11.66	14.42	0	46

1. * million dollars

2. All summary statistics are calculated for 2012-2016 time period.

3. Outcome of Interests are derived from IRS Form 990 data, Hospital HHI is derived from HCUP data. Hospital price is calculated using variables from HCRIS data. Other hospital characteristics are from AHA survey, and market characteristics are from ACS and Health Services Area Files.

[19]The hospital HHI was calculated based on hospital staffed beds to examine how it varies throughout the US, as AHA data provides national level data on hospital characteristics and size.

Table 2.4 shows the descriptive statistics for NP hospitals in the analytic sample [20]. The average CB expense of NP hospitals in the total data sample was $44.8 million, while the percentage of CB expense, as a ratio of total operating expense, was 9.3%; which is similar to the national average.

Table 2.5: Summary Statistics of Insurer Market and Hospital HHIs by Year

Year	Mean	Median	SD	Min	Max
Hospital HHI					
2012	3807.8	3550.6	2194.7	925.5	9984.9
2013	3814.8	3583.6	2181.0	902.4	9976.3
2014	3869.6	3624.2	2173.5	912.4	9982.9
2015	3851.9	3696.3	2165.1	921.3	9690.3
2016	3783.9	3657.7	2134.2	874.7	9909.6
Insurance Market HHI*					
2012	1431.5	1298.2	665.1	727.5	3274.9
2013	1324.8	1189.4	563.4	675.4	3227.2
2014	1360.6	1204.6	584.4	684.6	3677.5
2015	1449.9	1290.5	708.8	658.0	4011.8
2016	1462.9	1282.0	608.1	834.1	3531.4

*MSA level

Table 2.5 below shows the concentration level of both hospitals and insurers at MSA level from 2012 to 2016 for six US states. The insurer's HHI was generally more competitive than the hospital HHI. The summary statistics for both the hospitals and insurers showed that hospitals are highly concentrated, while insurance markets in MSA are moderately concentrated, following the Department of Justice (DOJ) definition [21].

[20]In the IRS 990 Schedule H, hospitals reported total CB expenses, which included any expenses related to a CB category, as well as any revenue from particular activities in that category. On the same line of the IRS form, hospitals subtract those revenues from total CB expenses and report it under the net CB expense column. The IRS form's instruction specifically states that hospitals should not report any negative numbers under that column; however, a researcher can quickly notice that there are negative numbers reported in the IRS data. Additionally, some hospitals reported their total CB expenses as astronomically higher, compared to total operating expenses. These data points were considered as outliers and errors. For that reason, winsorization of the data was preferable. CB covariates were winsorized above 97.5 percentile with the value at 97.5 percentile, and below 2.5 percentile with the value at 2.5 percentile to remove the outliers.

[21]Unconcentrated if HHI ¡ 1500, moderately concentrated if 1,500 ¡ HHI ¡ 2,500, and concentrated if HHI

The limitation with the DOJ market delineation is that it has a strong assumption about the market concentration level, and it is not specifically designed for health care market. Instead, both hospital and insurer market concentration was categorized into three groups based on the cut off of the 40th and 60th percentile of their distributions, rather than relying on the DOJ market delineation [22] The reason behind this hypothetical categorization of concentration, was to examine how hospital average prices and CB provision were correlated with different market concentrations.

Table 2.6: Tabulation of Hospital and Insurer Competition Level with Uncompensated Care*(%)

Insurer Market	Hospital Market			
	<40th	40th-60th	60th <	Total
<40th	8.11	7.98	4.31	6.94
40th-60th	6.62	6.45	5.61	6.12
60th <	4.45	4.65	4.23	4.48
Total	6.1	6.04	4.83	5.61

*As in Table 2.4 Uncompensated Care is defined as ratio of total operating expense. Uncompensated Care is only one category of community benefits.

The same analysis with quantile cutoffs is shown in Table 2.14

The data covers from 2012 to 2016 for VT, MS, AR, FL, NY, UT.

Firstly, variation in UC provision for each hospital in the data sample was examined in relation to hospital-insurer concentration indexes. UC provision was related to hospital prices when compared to other CB categories. Table 2.6 shows that the percentage of UC provision, as a ratio of total operating expenses, decreases substantially in unconcentrated hospital markets once insurer markets become more concentrated. The same trend applies to the situation in which hospital markets get more concentrated in unconcentrated insurer markets. It is plausible that insurers may not exploit enough bargaining power over hospital prices in more competitive markets. When there is more insurer competition in the health care market, hospitals provide less UC as hospitals get more concentrated. However, the

¿ 2,500

[22]I conduct the same analysis with quantile cutoffs(25th, 50th, 75th).

table shows that when insurer markets were more concentrated, hospitals did not tend to provide more UC to those in need.

2.3.2 The Cross-Sectional Estimation of Hospital Average Price

The purpose of the price analysis was to analyze how hospital prices vary between unconcentrated and concentrated health care markets. For that reason, the variation in average hospital price in the insurer-hospital concentration matrix was examined. Then this was analyzed using a cross-sectional variation of hospital and insurer market concentration, by exploiting hospital average price differences in those hypothetical groups, for descriptive purposes.

Table 2.7: Tabulation of Hospital and Insurer Competition Level with log of Average Hospital Price ($)

Insurer Market	Hospital Market			
	<40th	40th-60th	60th <	Total
<40th	8.6	8.4	8.24	8.4
40th-60th	8.4	8.2	8.1	8.2
60th <	8.2	8.3	8.4	8.3
Total	8.4	8.3	8.2	8.3

The same analysis with quantile cutoffs is shown in Table 2.15

The data covers from 2012 to 2016 for VT, MS, AR, FL, NY, UT.

Table 2.7 presents the two-way summary statistics of average hospital prices in the hospital-insurer matrix. In an unconcentrated hospital market, average hospital prices decrease when insurer market concentration increases. Also, in concentrated insurer markets, the average hospital price follows an upward trend towards a more concentrated hospital market.

For descriptive purposes, the first simple specification was run without interaction terms of different concentration groups. This takes the following function:

$$\ln(P_{it}) = \Phi_t + \gamma \ln(HHI^i_{mt}) + \vartheta \ln(HHI^S_{mt}) + \vartheta_1 D^l_{zt} \times HHI^S_{mt} + \beta x_{it} + \mu_{it} \quad (2.3)$$

where $\ln(P_{it})$ represents the logarithm of average hospital price for hospital i at time t. γ captures the effect of hospital market concentration at zip code z at time t. ϑ represents the effect of insurer market concentration in MSA level at time t. HHI^i_{mt} is hospital-specific HHI, while HHI^S_{mt} is insurer HHI at MSA level. D represents the interaction terms for hospital-specific concentration. The interaction of instrumental variables (IV) with interaction terms of market concentration in the IV estimates were included.

Table 2.8: Price Regression Results

	(OLS) log(price) b/se	(IV) log(price) b/se
Hospital HHI(log)	-1.153***	-0.775***
	(0.18)	(0.22)
Insurer HHI(log)(base)	-0.290***	-0.322*
	(0.04)	(0.15)
Hospital Market (40th-60th) x Insurer HHI(log)	0.044***	0.231
	(0.01)	(0.17)
Hospital Market (60th <) x Insurer HHI(log)	0.077***	0.108
	(0.01)	(0.20)
constant	20.157***	17.316***
	(1.63)	(2.16)
N	1161	1161
R2	0.152	0.035

Table 2.8 shows the result of the cross-sectional analysis. OLS estimates show that average hospital prices tend to be lower in the concentrated insurer markets compared to the unconcentrated markets; whereas, prices tend to be higher with increased hospital market concentration. However, this trend disappears in IV estimates, even though both estimates indicate a statistically significant association between market concentration and

average hospital price. As a detailed hospital price analysis is beyond the scope of this study, the next section of this paper will focus on the econometric analysis of the main subject of this study.

2.4 Econometric Specification

2.4.1 Cross-Sectional Estimation

NP hospitals were used in the IRS data sample with only CB expenses reported in IRS Form 990. This allowed for examination of NP hospitals with more community benefit(CB) categories. In the robustness check, UC expenses for the CB provision variable were used, which covered only one category of CBs. HCRIS data was utilized in order to add FP hospitals to the analysis. As stated above, HCRIS includes one category of CBs for both NP and FP hospitals, while the IRS data provides a more comprehensive CB provision for NP hospitals only.

The Pooled OLS was used for this analysis, and then fixed-effects were added to the model, in order to estimate the effect of hospital and insurer concentration on the CB provision (controlling for market-level and hospital characteristics). The following function defines the specification:

$$\ln(P_{it}) = \Phi_t + \gamma \ln(HHI^i_{mt}) + \vartheta \ln(HHI^S_{mt}) + \beta x_{it} + \alpha_{it} + \mu_{it} \tag{2.4}$$

in where Υ_{itm} defines the log of CB provision by hospital i in time t and metropolitan statistical area m. β represents the effect of control variables x such as hospital and market characteristics. α_i is hospital fixed effects. Hospital characteristics include ownership type as dummy variable to denote whether hospital is FP, NP or government hospitals [23] and teaching status which is a dummy variable indicating whether hospital is teaching hospital or not. To control for the market characteristics, a percentage of the uninsured and privately insured population, and logarithm of median income, poverty level, and number of primary

[23]It is included to the model in robustness checks

care physicians at MSA level were included.

Table 2.9: Cross-Sectional Regression Results for NP Hospitals

	(OLS) Total CB b/se	(IV) Total CB b/se	(OLS) CB by Bed b/se	(IV) CB by Bed b/se
Insurer HHI(log)	-0.472***	-0.535**	-0.550***	-0.763***
	(0.13)	(0.19)	(0.15)	(0.23)
Hospital HHI(log)	-0.011	-0.014	0.015	0.005
	(0.18)	(0.18)	(0.20)	(0.20)
Constant	-5.223	-4.497	7.090	9.543*
	(4.58)	(3.89)	(4.52)	(4.30)
N	586	586	586	586
R-sqr	0.720	0.719	0.266	0.262

(1)*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

(2)All regressions control for market and hospital characteristics. Standard errors are clustered by hospital.

The IRS data which only includes NP hospitals with a broad CB provision was examined. Table 2.9 shows estimates from a specification which accounts for cross-sectional variation. Two dependent variables: dollar value of CB expense in logarithm form, and CB expense by bed in logarithm form, were used to estimate dependent variable were estimated. The standard errors are clustered by MSA, which takes any correlation for unobserved components at MSA level into account. Any correlation in negotiation between health providers and insurers might be correlated within the MSA.

The result from the OLS indicated that the association between insurer market concentration and CB provision by hospitals is statistically significant and negative for both dependent variables. It shows that a 1% change in insurer concentration decreases CB provision of NP hospitals by 0.47% and 0.55% respectively. It also indicates that there is no positive and statistically significant association between hospital market concentration and CB provision. Even though the relationship is not statistically significant, the magnitude of the coefficient on hospital market concentration is far smaller than insurer

Table 2.10: Panel Data Estimation for NP Hospitals

	(FE) Total CB b/se	(FE-IV) Total CB b/se	(CRE) Total CB b/se	(FE) CB by Bed b/se	(FE-IV) CB by Bed b/se	(CRE) CB by Bed b/se
Insurer HHI(log)	-0.240	0.271	0.309	-0.272	0.091	0.229
	(0.13)	(0.40)	(0.35)	(0.14)	(0.45)	(0.33)
Hospital HHI(log)	0.065	0.127	-0.161	0.094	0.138	-0.138
	(0.13)	(0.17)	(0.23)	(0.15)	(0.39)	(0.20)
Constant	-22.357***	-36.847**	-4.135	-13.527*	-23.836	1.339
	(6.00)	(13.41)	(10.67)	(6.77)	(21.41)	(16.31)
N	586	586	585	586	586	585
R-sqr	0.726	0.09	0.863	0.290	0.074	0.97

(1)*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

(2)All regressions control for market and hospital characteristics. Standard errors are clustered by hospital.

market concentration. Both coefficients on insurer HHI in IV estimates show negative and statistically meaningful relationships between insurer concentration and CB provision. The result suggests that IV estimates of insurer concentration are slightly higher than OLS estimates, ranging from -0.54% to -0.76%. It also appears that the dollar value of CB provision in logarithm form has higher R2 values in both OLS and IV estimates, compared to the logarithm of dollar value of CB provision by bed.

2.4.2 Panel Data Estimation

The final analysis estimated the impact of hospital and insurer concentration on CB expense, using hospital fixed-effect estimations. This analysis isolated time variation within hospitals by forgoing the between-hospital variation. This helped to remove unobserved factors that may have been correlated with hospitals, and to examine how CB provision is affected over time by changes in market concentration. Table 2.10 presents the results from panel estimates for both dependent variables. It shows that there is no statistically significant effect of market structure on CB provision in OLS and IV estimates.

The opportunity to use both time-invariant factors and between-hospitals variation over time and states, by using time-series variation was forgoed.The fixed-effects models assume that the unobserved heterogeneity is correlated with explanatory variables and does not estimate the time-invariant variables. The concern is that a study that does not control for omitted time-invariant variables, such as hospital characteristics or the unobserved heterogeneity to the researcher, could produce biased results in the model estimation. For that reason, the correlated random effects (CRE) approach was employed, due to its ability to estimate both the within-clusters effect and between-clusters effect for the association of healthcare market concentration and CB provision.

The CRE regression method proposed by Wooldridge was followed to account for both within-group variation and time-invariant variables, which allowed for the inclusion of the Mudlak specification. The following model was estimated:

$$\ln(P_{it}) = \Phi_t + \gamma \ln(HHI^{i}_{mt}) + \vartheta \ln(HHI^{S}_{mt}) + \beta x_{it} + \delta \overline{x}_i + \theta z_i + \alpha_i + \mu_{it} \quad (2.5)$$

where the indexes are hospital, time, and MSA level. The first dependent variable Υ used in the estimation is dollar value of CB expense in logarithm form for hospital i at time t. Later, it is then changed to CB expense by bed in logarithm form. γ and ϑ represent respectively the marginal effect of hospital concentration on the CB provision, and insurer concentration on the CB provision. β captures the effect of control variables that vary over time while δ is the coefficient of each time average of time-varying variables. θ represents the effect of the time-invariant variables. α_i is the individual-specific unobserved heterogeneity from the sample data, and μ_{it} is the idiosyncratic error term. The assumption was maintained that both unobserved heterogeneity and idiosyncratic term are normally distributed and there is no serial correlation in idiosyncratic errors.

One drawback of the CRE approach stated in the literature, is that this approach is inappropriate for balanced panels. FE and RE models do not require further modification for unbalanced panels; however, CRE approaches do. Wooldridge proposes a CRE approach for

unbalanced panels which fits the type of panel data used in this study; however, it lacks some hospitals over the years due to closures, mergers and acquisition, and ones that are newly opened. The heterogeneity was modelled as a function of the number of complete cases available for each hospital and therefore dropped any missing observations (Wooldridge, 2019).

Column 3 and 6 in Table 2.10 show the result of the CRE model for each dependent variable. Similar to the previous estimates, no meaningful relationships were found between market concentration and CB provision for NP hospitals.

2.4.3 Robustness Checks

Table 2.11: Cross-Sectional Estimates for All-type Hospitals

	(OLS) Uncomp. Care b/se	(OLS) Uncomp. Care b/se	(IV) Uncomp. Care b/se	(IV) Uncomp. Care b/se	(OLS) U. Care by Bed b/se	(OLS) U. Care by Bed b/se	(IV) U. Care by Bed b/se	(IV) U. Care by Bed b/se
Insurer HHI(log)	-0.309**	-0.224	-0.475*	-0.454	-0.275*	-0.179	-0.427	-0.271
	(0.11)	(0.12)	(0.22)	(0.25)	(0.12)	(0.14)	(0.30)	(0.35)
Hospital HHI(log)	-0.004	-0.133	-0.028	-0.166	0.075	0.184	0.054	0.171
	(0.18)	(0.11)	(0.18)	(0.10)	(0.19)	(0.12)	(0.18)	(0.12)
For-Profit	1.282		1.105		-1.682		-1.871	
	(2.67)		(2.65)		(2.77)		(2.69)	
Government	8.180*		8.656*		4.958		5.569	
	(3.52)		(3.48)		(3.53)		(3.67)	
Hospital HHI x For-Profit Hospitals	-0.152		-0.132		0.160		0.182	
	(0.30)		(0.30)		(0.31)		(0.30)	
Hospital HHI x Government Hospitals	-0.847*		-0.900*		-0.493		-0.560	
	(0.39)		(0.39)		(0.39)		(0.40)	
Constant	-15.100*	-16.008*	-10.757	-9.937	-3.305	-6.004	0.627	-3.633
	(6.53)	(7.37)	(6.21)	(5.97)	(7.25)	(8.51)	(7.66)	(9.05)
N	1169	1169	1169	1169	1169	1169	1169	1169
R-sqr	0.785	0.749	0.784	0.747	0.348	0.243	0.346	0.243

(1)*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

(2)All regressions control for market and hospital characteristics. Standard errors are clustered by hospital.

In the second part of the analysis, the UC expenses variable, only one category of

CB provision, was calculated. HCRIS data was used in order to add FP hospitals and government hospitals to the analysis. As stated above, HCRIS includes only one category of CB for both NP, FP and government hospitals, while the IRS provides a more comprehensive CB provision, but it is solely for NP hospitals. Similarly to the IRS data sample, two dependent variables were used: dollar value of UC expense in logarithm form and UC expense by bed in logarithm form. As FP and government hospitals were analyzed in addition to NP hospitals, interaction terms of hospital ownership were used with hospital market concentration.

Table 2.12: Panel Data Estimation for All-type Hospitals-1

	(FE) b/se	(FE) b/se	(FE-IV) b/se	(FE-IV) b/se	(CRE) b/se	(CRE) b/se
Outcome of Interest: Uncompensated Care (log)						
Insurer HHI(log)	-0.321***	-0.244**	-0.463	-0.440	-0.061	-0.105
	(0.07)	(0.08)	(0.31)	(0.25)	(0.20)	(0.18)
Hospital HHI(log)	0.009	-0.140	-0.012	-0.167	0.273	0.135
	(0.10)	(0.08)	(0.20)	(0.16)	(0.35)	(0.28)
For-Profit	1.574		1.412		0.469	
	(1.44)		(3.18)		(3.42)	
Government	8.605***		8.983***		8.399***	
	(2.05)		(1.25)		(1.39)	
Hospital HHI x For-Profit Hospitals	-0.185		-0.167		-0.057	
	(0.16)		(0.36)		(0.38)	
Hospital HHI x Government Hospitals	-0.895***		-0.937***		-0.875***	
	(0.23)		(0.15)		(0.17)	
Constant	-11.176**	-11.643**	-7.273	-6.357	4.960	-0.732
	(3.59)	(3.67)	(9.38)	(7.08)	(4.48)	(1.99)
N	1169	1169	1169	1169	1169	1169
R-sqr	0.778	0.742	0.130	0.202	0.979	0.922

(1)*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

(2)All regressions control for market and hospital characteristics. Standard errors are clustered by hospital.

Table 2.11 shows these estimates along with interaction terms separately, to show how

ownership affects the UC provision in each hospital. The first four columns show the results of the OLS and IV estimates for UC expense in logarithm form; while the last four columns show UC expense by bed in logarithm form. From this table, it appears that the coefficient of insurer market concentration in the specification, alongside interaction term is statistically significant for UC expense in logarithm form. The OLS estimates show that a 10% increase in insurer concentration is associated with a decrease in UC expense by 3.1%. However, the OLS model without interaction terms does not show a statistically significant result for market concentration of both insurers and hospitals.

Table 2.13: Panel Data Estimation for All-type Hospitals-2

	(FE) b/se	(FE) b/se	(FE-IV) b/se	(FE-IV) b/se	(CRE) b/se	(CRE) b/se
Outcome of Interest: Uncompensated Care by Bed (log)						
Insurer HHI(log)	-0.284***	-0.191*	-0.409	-0.253	-0.023	-0.040
	(0.08)	(0.08)	(0.44)	(0.34)	(0.20)	(0.20)
Hospital HHI(log)	0.095	0.181*	0.077	0.172	0.300	0.286
	(0.11)	(0.09)	(0.28)	(0.16)	(0.34)	(0.28)
For-Profit	-1.346		-1.511		-1.821	
	(1.54)		(3.49)		(3.65)	
Government	5.530*		6.009*		5.746*	
	(2.27)		(2.37)		(2.33)	
Hospital HHI x For-Profit Hospitals	0.122		0.141		0.179	
	(0.17)		(0.39)		(0.40)	
Hospital HHI x Government Hospitals	-0.557*		-0.610*		-0.583*	
	(0.25)		(0.27)		(0.27)	
constant	-0.554	-2.722	2.790	-1.080	7.591	0.073
	(3.84)	(3.91)	(11.25)	(6.24)	(6.83)	(4.53)
N	1129	1129	1129	1129	1128	1128
R-sqr	0.330	0.225				

(1)*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

(2)All regressions control for market and hospital characteristics. Standard errors are clustered by hospital.

As a second and last step in panel-type estimates, an identical panel-type specification which was used for the previous cross-sectional estimates, was used here for the HCRIS data sample. These estimates are reported in Table 2.12 and 2.13. Both OLS estimates for the two dependent variables showed statistically significant relationships with insurer concentration. Furthermore, although the relationship between hospital concentration and UC provision was overall not statistically significant, this does not appear to be the case for government hospitals. Compared to NP hospitals, government hospitals tend to provide less UC provision when insurer concentration increases. OLS estimates indicate that for every 1% increase in insurer market concentration results, there is an increase in UC provision of -0.19% to -0.32%, which are a similar magnitude to the previous analysis. However, estimates using IVs for each model show that the magnitude of the coefficient on insurer concentration does not reflect downward bias as there is no statistically significant association with UC provision.

For both OLS and IV estimates, models with the dollar value of UC provision in logarithmic form have shown higher R2 values, compared to models analyzing UC provision by staffed beds, which have the log of dollar value.

As a final exercise in the second step, more variations were exploited by using CRE models. Similarly to the OLS and IV estimates, government hospitals were found to provide less UC provision when there was an increase in insurer market concentration, relative to the NP hospitals; however, both hospital and insurer market concentrations did not have statistically significant relationships with UC provision.

2.5 Conclusion

This paper studied how hospital and insurer competition are related to the CB provision of NP hospitals. The theoretical approach in the literature showed that NP hospitals may provide more socially valuable services once they have more market power; however, it depends on their objective. In addition, this approach posited that NP hospitals may behave similarly to FP hospitals by reducing consumer welfare. Although this approach

appeared logical, empirical findings have shown no statistical evidence for the association between hospital market power and charity care; while some early studies have shown that increased competition (reduced concentration) decreases the UC provision of hospitals. At present there is no current theoretical modelling which directly examines the impact of hospital and insurer competition on socially valuable services in hospitals. Therefore to address the gap, the current paper empirically examined this question, with the result that there is no statistically significant evidence of an effect of hospital and insurer competition on CB provision of NP hospitals.

Due to the lack of data available in the selected states, the analysis conducted in this paper could not provide enough empirical evidence to explain the possible inconsistency between the approach taken by the IRS concerning NP hospitals, and the current treatment of NP hospitals by antitrust law. Therefore, neither of those approaches can be justified regarding current legal rationale of tax exemption for NP hospitals. However, this paper's result that NP hospitals do not provide more CB provision once they ac quire more market power, may emphasize the importance of understanding the determinant of NP hospitals' decision on the level of CB provision, with implications for tax and health policy.

Despite the numerous downfalls that this study addressed, there were also several limitations. Data was only used for selected states such that the results may not be representative of all hospitals in the US. Additionally, due to data limitations, only one category of CB provision could be added — UC provision for FP hospitals. Next, the dependent variable, dollar value of CB provision, did not enable observation of variation in the quantity of UC in different market structures. In addition, this study did not examine the quality of UC at the patient level. Further study into this variable would be valuable. Lastly, instead of using a regression analysis, future research would benefit from using a theoretical model of hospital-insurer bargaining with socially valuable services, as this would provide an estimate of the impact of market structure on charity care and, more generally, CB activities of NP hospitals.

2.6 Tables

Table 2.14: Tabulation of Hospital and Insurer Competition Level with log of Uncompensated Care ($)

Insurer Market	Hospital Market				
	<25th	25th-50th	50th -75th	75th <	Total
<25th	8.432	7.666	6.8	3.352	6.938
25th-50th	6.541	6.951	5.976	5.477	6.088
50th -75th	5.205	5.675	6.473	5.331	5.602
75th <	4.017	4.781	3.231	2.859	3.752
Total	6.13	6.27	5.5	4.48	5.61

Table 2.15: Tabulation of Hospital and Insurer Competition Level with log of Average Hospital Price ($)

Insurer Market	Hospital Market				
	<25th	25th-50th	50th -75th	75th <	Total
<25th	8.53	8.5	8.33	8.14	8.41
25th-50th	8.44	8.31	8.11	8.13	8.21
50th -75th	8.43	8.4	8.5	8.36	8.42
75th <	8.12	8.22	8.09	8.23	8.17
Total	8.41	8.37	8.24	8.21	8.31

Chapter 3: The Implication of Health Care Market Concentration on Community Benefits and Health Outcomes

3.1 Introduction

The Internal Revenue Service (IRS) grants tax-exempt status to nonprofit (NP) hospitals, with the expectation that NP hospitals are providing community benefits (CBs) which promote their communities' health (IRS, 2020). The legal justification of tax-exempt status, known as the community benefit (CB) standard, has evolved several times since 1969. From 1956 to 1969, a narrow definition of the CB standard was a requirement for tax exemption. In 1956, the IRS created 'the charity care standard' which required NP hospitals to provide health care for free, or at a rate below-cost to those who were unable to pay (IRS, 1956). During 1965, the need for charity care was reduced due to the enactment of Medicaid and Medicare — national public health insurance . In 1969, a broader definition of CB replaced the previous definition and since then the definition of 'community benefit' has been considered a legal standard for qualification of tax-exempt status (IRS, 1969).

As of 2008, the IRS significantly changed the requirements such that NP hospitals had to disclose CB expenditures in dollar value, on IRS Form 990 Schedule H. The IRS categorized CB based on the activity types, aiming to set a standardized method for reporting those activities; however, this new categorization did not mandate a certain amount of dollar value that tax-exempt hospitals must follow in their CB activities; nor did it set any measures on how to serve the promotion of health. Due to these new measures, neither the IRS nor the hospitals were observing whether the CB activities promoted the communities' health.

At present, federal tax law no longer requires NP hospitals to solely provide charity care to receive tax exemption. To specify CB standards, the IRS designed CB categories

in Schedule H which not only include charity care, but also the following categories: unreimbursed costs of means-tested programs; community health improvement services; health professions education and research; and contributions to community groups. An additional section of Schedule H is dedicated to community-building activities, which encompass any type of activity that promotes the communities' health outside of the clinic. Even though this requirement of reporting CB activities appeared to bring a CB standard, the policy still requires NP hospitals to report their activities in monetary value. As previously mentioned, lack of observation of CB activities by the IRS and NP hospitals mean that the benefits are uncertain. It is also unclear as to whether charity care or uncompensated care (UC) of NP hospitals improves the health of the communities and/or the hospital quality for uninsured patients compared to insured patients.

In the previous chapter, competition in the health care market was examined to test whether it affected the CB provision in NP hospitals. In this chapter, the quality of CB activities, rather than the monetary value of CBs provision, will be analyzed. Previous research has shown that increased market power may raise the hospital's ability to provide more CB; subsequently improving the health of communities. A theoretical model by Capps et al. shows that some degree of market power is a necessary condition for NP hospitals to provide charity care or unprofitable services (C. S. Capps et al., 2020). Whether NP hospitals do more provide more community benefits with more market power is indeed empirical question. The results of the previous chapter showed no meaningful relationship between the competition level and CB activities.

A large body of evidence has revealed that the hospital quality level is compromised in concentrated markets. In their seminal paper, Kessler and McClellan (2000; KM hereafter) examined the relationship between hospital competition and patient health outcomes, finding that competition in hospital markets was welfare-improving (Kessler & McClellan, 2000). Their results showed that mortality rate among Medicare patients was higher in concentrated markets, compared to those in less concentrated markets. A growing body of empirical evidence has supported this result, such that competition in health care markets

generally improves the quality of care (Lewis & Pflum, 2017; Kessler & McClellan, 2000; Gaynor et al., 2015; Bloom, Propper, Seiler, & Van Reenen, 2015). If the same applies for the CB provision, then it is possible that NP hospitals may provide better quality care in competitive markets; however, it is not theoretically clear whether the quality of CB is improved with increased competition [1]

Setting a standard for these CB activities is a challenging task. Even more so, is the burdensome assessment involved in setting a standard for hospital quality measures, as it has to be comparable across hospitals and communities (Joseph J. Doyle, Graves, & Gruber, 2017). One such measure was launched by the Agency for Health Care Research and Quality (AHRQ), which assessed health care quality and developed quality indicators for various types of health care services. The AHRQ developed prevention quality indicators (PQIs) that identified admissions with ambulatory care sensitive conditions. These conditions could have been prevented if patients had access to better quality care or received high-quality care from the outset. The PQIs also act as population health indicators, used with the aim to help policymakers and hospitals evaluate the health care needs of their communities.

Hospital quality is multi-dimensional, and as a result the majority of studies have used mortality and readmission measures to test it. In this paper, PQIs were used as a hospital quality measure, in order to analyze the impact of health care market competition on the quality of CB provision. Due to the fact that CB categories do not solely include hospital services, only charity care was examined. This care falls into the financial assistance category of CB provision.

To understand the impact of competition on preventable admissions using hospital-level data, an empirical analysis was performed (discussed further in the Data section). Two ratios were created to measure the preventable admissions share of both uninsured patients and all patients out of total discharges per hospital. Following the KM approach, a form of the Herfindahl Hirschman Index (HHI) was used to calculate the predicted market shares of hospitals as an instrument for hospital competition level. For insurers, the sum of the

[1] better quality rate in CB does not mean that it is welfare-increasing.

squared market shares was calculated out of total enrollment plans and supplemented by using demographics. The results showed that hospital market competition did not have a meaningful impact on the PQIs, but that insurer competition did significantly improve the PQIs. Several robustness checks also supported this result.

This study contributes to several strands of literature. The first strand is focused on examining the outcome of tax-exempt status given to NP hospitals. Extensive research has shown that NP hospitals provide more CB activities than for-profit(FP) hospitals. The Congressional Budget Office (CBO) published an analysis before the IRS change in 2008, which examined the association between tax exemption and CB provision. They found that the distribution of CB provision in NP hospitals varied widely (Congressional Budget Office, 2006). An important result from this analysis was that NP hospitals did not provide as many CB provisions as government hospitals did, especially once the hospitals' operation expenses were considered. Even though FP hospitals are not required to provide any CB activities, there was no significant difference between the share of charity care operating expenses in NP hospitals and FP hospitals.

The CBO report also highlighted that there was no consensus as to what is considered a CB. The IRS requirement, in accordance with Schedule H Form 990, aimed to standardize reporting; however, it still considers input-based resource allocation as the sole requirement, rather than the valuable allocations that result from CB expenditures. The Affordable Care Act (ACA) requires NP hospitals to conduct a health needs assessment of their communities every three years. This is good progress as the content of the assessment shows whether NP hospitals' CB provisions have any community improvements; however, it does not have any legal impact on the hospitals' tax exemption. After these acts had been passed, Rubin et al. examined the legal process of tax exemption, and proposed an outcome-based approach for the CB provision of NP hospitals (Rubin, Singh, & Young, 2015). To contribute to this strand of literature, this current study aims to understand whether NP hospitals' CB activities affect the promotion of the communities' health.

The second strand of literature examined the effect of hospital and insurer competition

on hospital prices and quality (L. S. Dafny, 2010; Brekke, Siciliani, & Straume, 2011; Colla, Bynum, Austin, & Skinner, 2016; Ho & Lee, 2017; Pauly, 2019). The mechanism of hospital and insurer relationships and its impact on patient outcomes includes several layers of interactions. While each hospital and insurer compete with rivals in the health care market, they are also negotiating with each other to set prices that health plans pay to hospitals for each patient. Each side has its own impact on hospital quality and preventable admissions (Kolstad & Kowalski, 2012).

Within the literature, there is empirical evidence to suggest that lower hospital quality is associated with increased market concentration. Some empirical studies have shown that health maintenance organizations (HMO) penetration, decreases the preventable admission rates. In addition, Zhan et al. (2004) and a growing body of empirical studies, have shown that concentrated markets are associated with lower quality of health services (as discussed above) (Zhan, Miller, Wong, & Meyer, 2004). This current study contributes to this literature by analyzing how the preventable admission rates vary with competition level of the market; in addition to providing empirical evidence on the NP hospitals' promotion of CBs with increased market power.

3.2 Data

The HCUP State Inpatient Database (SID) files from 2012 and 2016 were used for this analysis, as they contain patient discharges for the following states: Arkansas, Florida, Mississippi, New York, Utah, and Vermont. The HCUP SID data includes patient characteristics and clinical information, such as diagnosis and procedures, for each hospital discharge in the participating states. Each discharge also contains payer information and the source of admissions. The data is provided by the AHRQ, along with SAS software that identifies PQIs based on diagnosis and procedure codes. The same algorithm used in the SAS software, was utilized to obtain PQIs for hospitals in the data sample which acted as dependent variables for this analysis.

The next data source which was utilized for this study came from Decision Resource Groups (DRG) Managed Market Surveyor File. The DRG data includes both public and commercial insurance enrollment for each health plan in the health insurance marketplace, from 2012 to 2016. The American Hospital Association's Annual Survey of Hospitals (AHA) was also used to obtain hospital characteristics. HCUP SID was merged with AHA data using AHA hospital identifier. This data was then supplemented with data from Area Health Resource File (AHRF), and the American Community Survey (ACS) to obtain market-level characteristics. Only general short-term hospitals were included in order to obtain potentially preventable hospital admissions, also known as ambulatory care sensitive conditions (ACSC), at the hospital level.

The data sample for the analysis contained more than 6 million discharges per year for 6 states. Following the AHRQ approach, patients who were younger than 18, had MDC 14 (Pregnancy, Childbirth, and the Puerperium, or transferred from another institution were excluded. Then discharges whose principal diagnosis was ACSC were identified, these included discharges with diabetes, short-term complications, or health failure [2]. The outcome variable at the hospital level, derived from the HCUP data, was PQI rate for uninsured patients. This was calculated by taking the ratio of the sum of uninsured patients with PQI given hospital divided by the total uninsured numbers in the service population. As part of the robustness checks, the analysis with PQI rate for all patients was reexamined.

AHRQ calculates the PQI as a population indicator, which means that each indicator is considered as a fraction of the population where each patient resides. While the numerator is the related discharges with multiple exclusions, the denominator is the population in the defined geographic area (metropolitan or county). The unit level of this analysis was hospital-level, rather than population-level, which would have been ideal for the study. To modify the ratio to create a hospital-level variable, the geographic population (denominator) was changed to the population of the hospital service area. In the first step, the county-level PQIs were calculated following the AHRQ approach, then the share of hospital patients from

[2]See Appendix A for more details on AHRQ quality measures

each county was calculated. In the second step, the hospital-level PQI ratio was calculated as the weighted sum of hospital-specific PQI rate, where the weight is the share of patients from that county. This method does not impose any geographic boundaries, instead it defines the community that a hospital serves. Then the final ratio was multiplied by 10000 to show how many patients with PQI per 100,000 population that hospital served in its defined service area in that fiscal quarter.

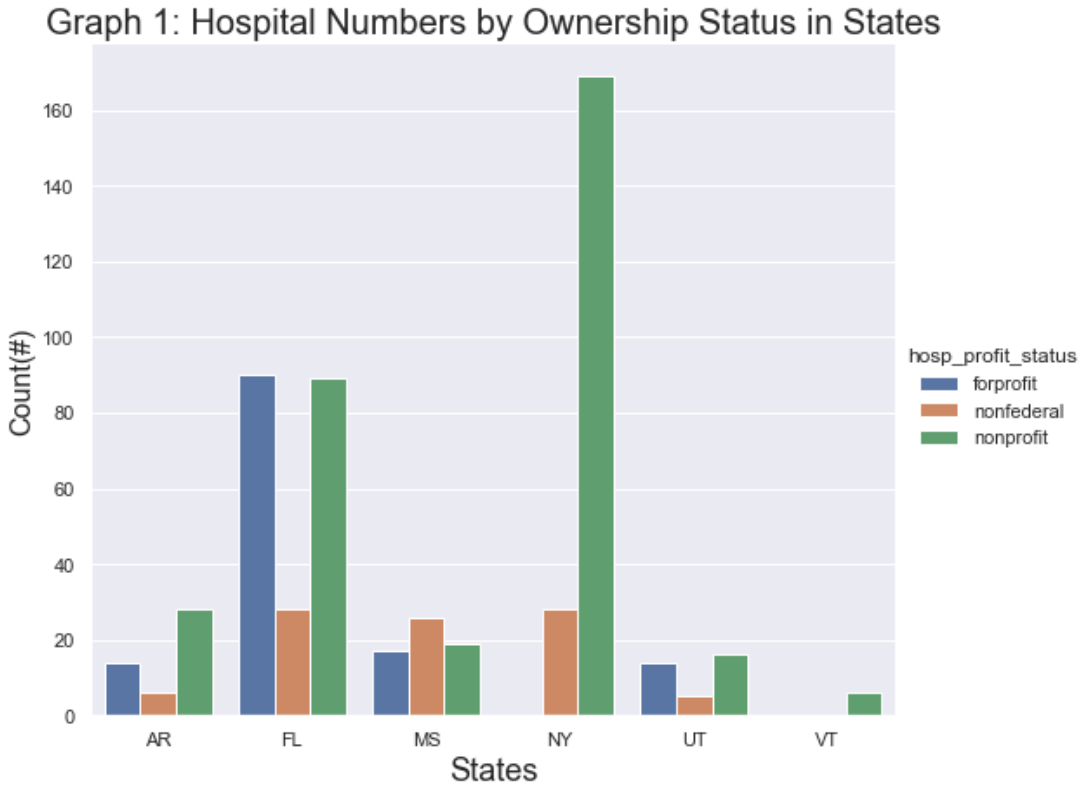


Figure 3.1: Number of Hospitals by Ownership Status in Six States

Table 3.1 the mean values of each dependent variable along with all variables.The final data, which is at the hospital-level, includes 417 hospitals from 6 states. The time used was the fiscal quarter in order to be consistent with the time frame of the HCUP SID data. Table 3.1 presents a summary of the data sample statistics, showing that the average PQI rate for uninsured patients is nearly 15% of the total uninsured discharges, which is lower

Table 3.1: Summary Statistics

	Mean	SD	Min	Max
A.Outcome of Interest				
PQI Rate for Uninsured (per 100,000)	137.66	147.70	0	2,496.18
PQI Rate for All (per 100,000)	484.53	389.73	0	5,480.34
B.Competition Index				
Hospital HHI	0.38	0.22	0.09	1.00
Insurer HHI	0.14	0.06	0.07	0.40
C.Hospital Characteristics				
Quarterly Total Discharge	2978.61	2195.57	1.00	13040
Quarterly Uninsured Discharge	154.81	189.36	1.00	1546
Casemix IndeX	1.56	0.24	0.74	2.42
Bed Size	444.75	481.14	14	2829
For-profit Hospital	0.27	0.44	0	1
Government Hospital	0.14	0.35	0	1
D.Market Characteristics				
Private Insured Pop.(percent)	64.53	6.68	52.40	81.10
Uninsured Pop.(percent)	14.44	4.68	4.30	24.10
138 Poverty Rate(percent)	19.62	3.44	12.55	30.06
Total Medicare Pop. (percent)	18.87	4.83	7.72	37.82
Population 65+ (percent)	16.91	5.79	6.88	38.84
Unemployment Rate(percent)	0.03	0.03	0.01	0.28
Active MDs	4093.73	9854.71	131	83738
Food SNAP Recipient	210584.74	339964.24	8106	2709045
Median Income	55213.61	9844.67	35093	93144

All summary statistics are calculated for 2012-2016 time period.

Outcome of Interests, Hospital HHI and Discharges are derived from HCUP data; other hospital characteristics are from AHA survey, and market characteristics are from ACS and Health Services Area Files.

than the PQI rate for all patients. Of the 6 states, more hospitals are located in Florida and New York State (Graph 3.1); and 60% of the total hospitals in those 6 states have NP status, while 25% are FP hospitals.

It is worth noting that ICD9 codes were the national diagnosis coding system in the US before The Department of Health and Human Services (HHS) required hospitals to use ICD10 diagnostic coding as of October 1, 2015. The transition to ICD10 occurred in the last quarter of 2015 and as of 2015 q4,all discharges were coded in ICD10. Compared to ICD9,

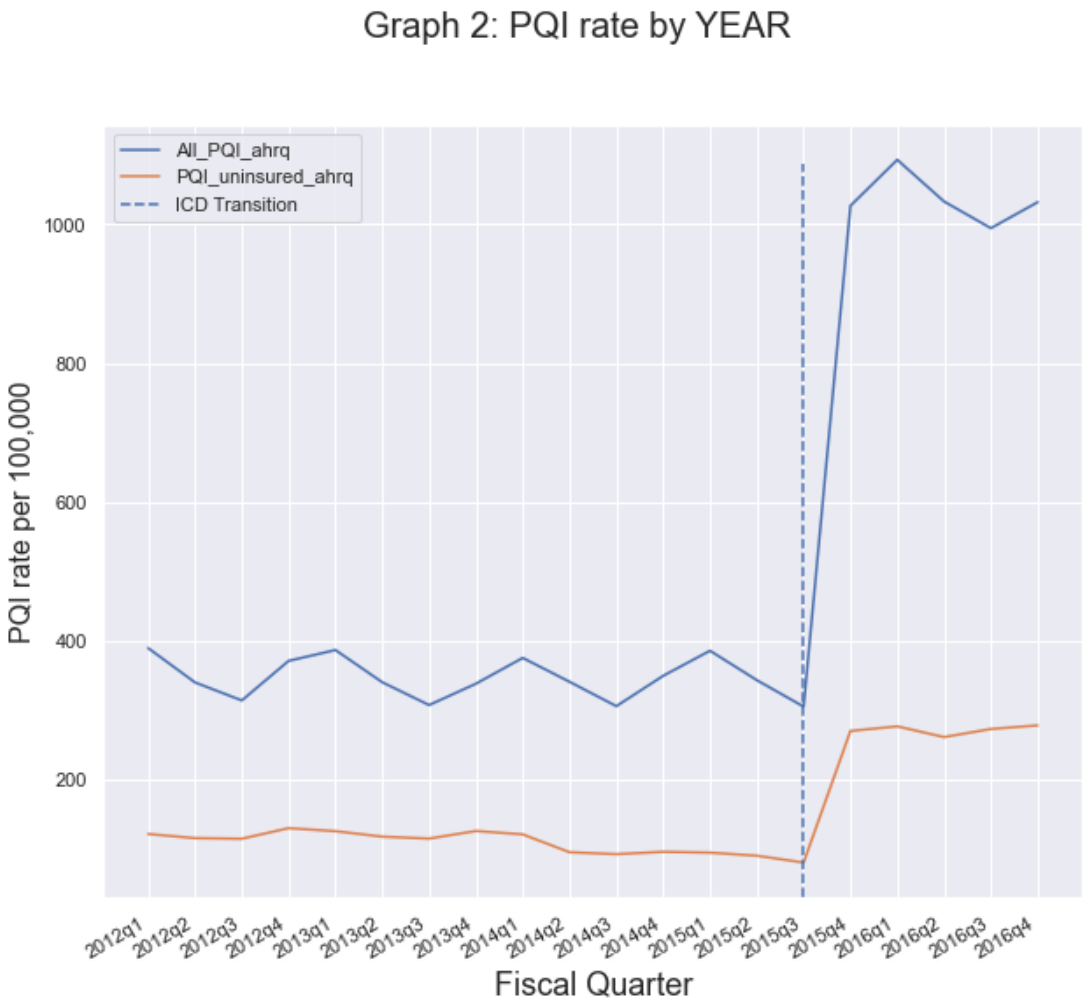


Figure 3.2: PQI Rate by Year

the ICD10 coding system includes a higher level of detail and incorporates new codes into the health care system. Graph 2 shows how the trend for each PQI rate increases dramatically in the last financial quarter of 2015, when the transition requirement was applied to all hospitals. This change was controlled in the analysis, instead of constructing an adjusted PQI rate for each hospital. In the sensitivity analysis, the data sample was limited to observations with ICD9.

Graph 3.3 below shows how the PQI rate for each group of patients was distributed, as well as the relationship between two groups of patients by ownership status of the hospitals.

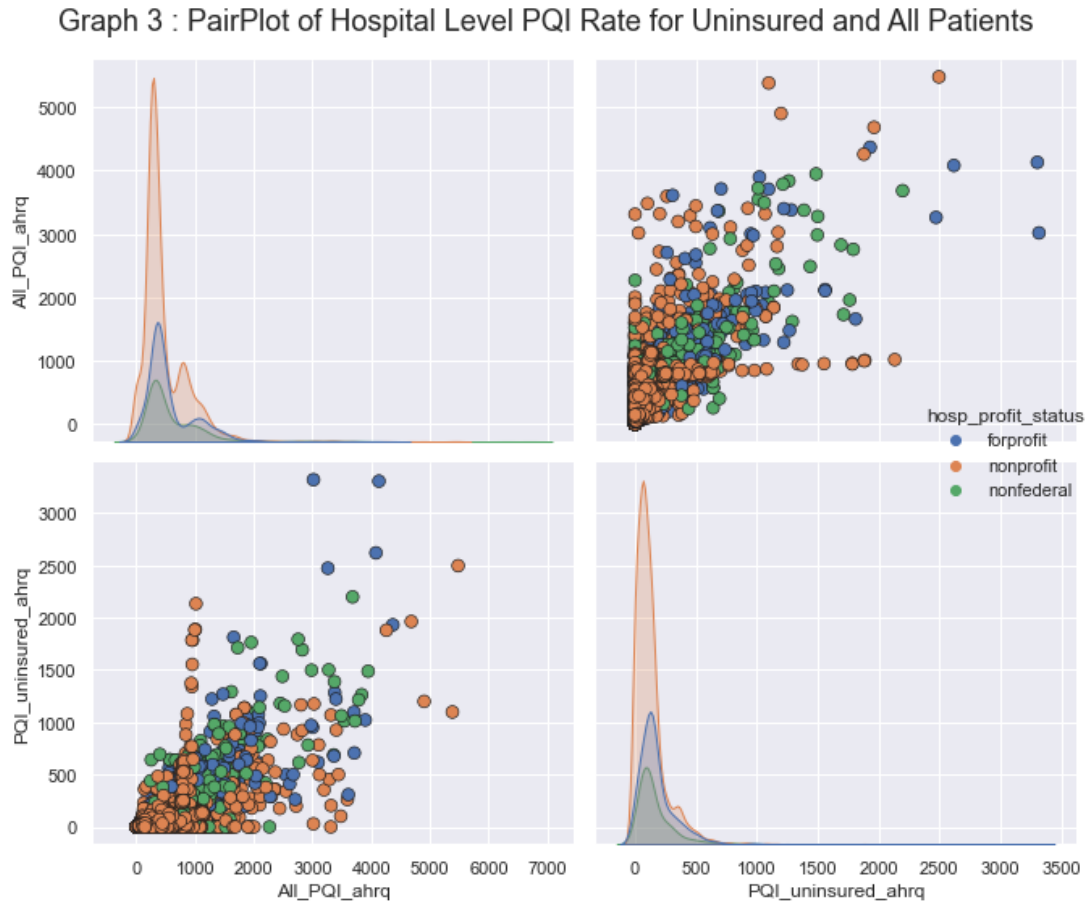
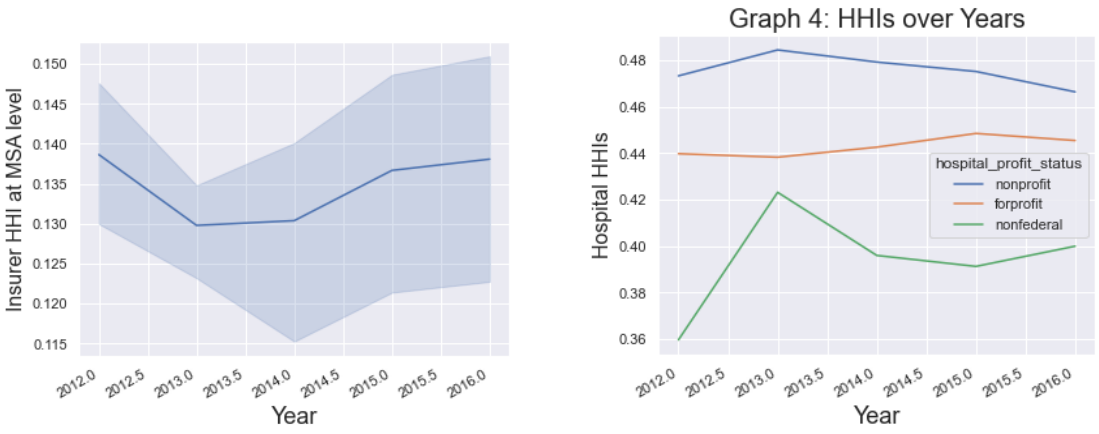


Figure 3.3: PairPlot of Hospital Level PQI Rate for Uninsured and All Patients

Both PQI rates for uninsured and all patients are distributed skew right. The rate for uninsured patients is higher in NP hospitals compared to other types of hospitals. As the sample size for NP hospitals accounts for 60% of the total hospital discharges from 2012 to 2016 in 6 states, it is highly probable that uninsured patients visit NP hospitals more, compared to other types of hospitals.

3.2.1 Competition Measure

Using the HCUP SID data and the KM approach, the predicted HHI for each hospital was estimated from predicted market shares. As discussed in Appendix A (attach it to the latex document later), due to the endogeneity of HHIs, the health care market was not defined



(a) Insurer HHI

(b) Hospital HHI

Figure 3.4: Insurer and Hospital HHI between 2012 and 2016

based on geographical area for competition measure, but by estimating a demand model based on relative travel distances of hospital visits. For the demand model, all non-federal, general medical and surgical hospitals with non-rural Medicare patients within 80 minutes driving distance from the patient's chosen hospital were selected. The HHI is estimated between 0-1, with a higher value considering less competitive hospitals.

For insurers, the HHI with shares of commercial health plan in the defined market were calculated, including both fully and self-insured enrollments at metropolitan market areas per year. Each patient's insurance type for either discharge data or at the population level were not observed. The index ranges from 1 (perfect competition) to 10000 (a monopoly); however, for the purpose of this analysis, the index was divided by 10000 to be consistent with the insurer HHI calculation.

Graph 3.4 shows how hospital HHIs and insurer HHIs, at the MSA level, vary over time and across hospital ownership types. There is a noticeable increase in non-federal and NP hospital HHIs in 2013; however, it decreases for these types of hospitals over time. In contrast, the trend for insurer HHIs is antithetical to the hospital HHIs trend over time. Graph 3.5 also shows the correlation between insurer and hospital HHIs, and how each hospital ownership type is located in a different market concentration. As the graph shows,

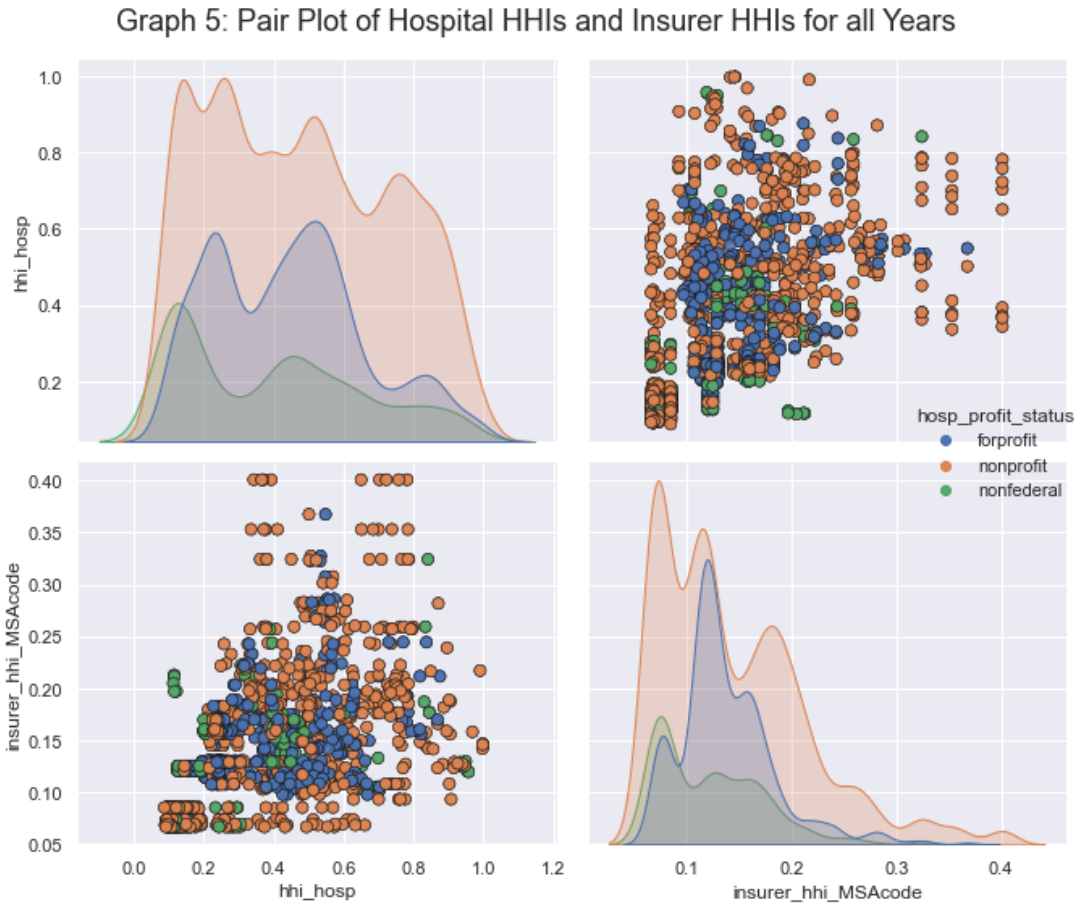


Figure 3.5: PairPlot of Insurer and Hospital HHI over Years

FP hospitals are more competitive and are mostly located in moderately competitive insurer markets. Hospital ownership types are more normally distributed in terms of hospital HHIs (slightly right-skewed); however, the distribution of the location of different hospitals based on insurer competitiveness is highly right-skewed. This means that the majority of hospitals are located in either relatively moderate or unconcentrated insurer markets.

3.3 Econometric Specification

One of the main focuses of this study was to examine preventable admission rates for uninsured patients given the market power of hospital and insurer concentration. To analyze

this, a basic regression framework was used in which PQI rate (R) was a function of hospital and insurer HHIs, along with both hospital and market-level characteristics.

$$R_{ht}^{m} = \Phi_h t + \alpha_h + \beta HHI_{ht} + \Gamma HHI_{it} + \theta X_{ht} + \zeta Z_t + \varepsilon_h^m t$$

R_{ht}^{m} defines the type of PQI rate, R^m, at hospital h in time t and Φ_{ht} is the constant that is specific to each hospital h at time t while α_h is hospital fixed effects. β coefficient presents the hospital-specific competition index which I use predicted market shares of the hospital for HHI. X includes the hospital characteristics such as ownership and teaching status while Z is for market-level characteristics such as poverty, income level, and employment rate. The ICD10 version was also added as a dummy variable to control for the ICD transition.

Hospitals may provide differing levels of quality and typically charge patients based on their insurance status and type (reference). Given that the PQI rates are indeed a measure of hospital quality, it can be assumed that hospitals provide the same level of quality for all admitted patients. Due to the fact that hospitals set the quality level, there is a potential endogeneity issue of quality indicators — some hospitals attract more patients and provide higher quality due to market size/higher market share. Since hospital market structure is endogenous, the predicted market share of hospitals was used to mitigate the endogeneity bias. β and Γ capture to what extent the PQI rate changes with market power of the hospital and insurer market concentration. As a risk-adjustment, all-payer case-mixes were included in the model to control for hospital performance. Then hospital fixed-effects were added to the model and the results were compared with the OLS regression results.

The OLS model allows for exploitation of the variation in PQI rates for hospitals in different locations, in order to observe how rates change with market concentration. The within and between standard deviation for the outcome of interest is nearly equal. Although the standard deviation is relatively small for within-hospitals, it is high enough to examine the model with fixed-effects. It could be argued that adding hospital fixed-effects into the model allows for isolation of unobservable hospital characteristics which might affect the

quality level of uninsured patients from differences in hospitals with similar characteristics. For instance, simply adding case-mix into the model would not be enough to account for patient differences among uninsured patients in separate hospitals.

It may be discerned that unobserved factors, such as health plan coverage, could be correlated with both the preventable admission rates and insurance concentration. Despite the validity of this concern for insured patients, the main interest of this analysis was uninsured populations. In addition, the model may not suffer from endogeneity bias if the actual share of insurer concentration is controlled. Although there is growing evidence for a positive impact of hospital concentration on quality of health care, there is not yet enough empirical evidence to understand the impact of hospital-insurer bargaining on hospital quality. Bargaining between hospitals and insurers might affect the hospital quality in a positive or negative way through the price mechanism and the health care production cost (Kolstad & Kowalski, 2012; Gaynor et al., 2015). To account for that, the insurer HHI was instrumented with demographic estimates, which are strong with 63.3 Cragg-Donald Wald F Statistics, following Berry et al. and Dun et al. (Dunn & Shapiro, 2014). Instruments such as population size and employment rate in the market are factors that more directly affect the both hospital and insurance investment decisions than the hospital quality or health plans.

3.4 Empirical Results

Table 3.2 reports the regression results of PQI rates for uninsured patients. Column(1) displays the results from the OLS model without the insurer concentration index; while the model in Column(2) adds the insurer concentration index; Column(3) and Column(4) shows the fixed-effect regression result for the model with no insurer concentration and both concentration indexes; finally, Column(5) reports the results for the model with IV and fixed-effects. Column 1 and Column 3 are displayed for comparison purposes.

The columns in Table 3.2 clearly show that hospital HHI is statistically insignificant when insurer concentration is added to the model. It is preferential to use the specification

Table 3.2: Regression Results for Uninsured PQI Rate

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE-IV
log(PQI Rate for Uninsured)					
Hospital HHI	-0.236	-0.085	0.292	0.412	-0.381
	(0.18)	(0.20)	(0.71)	(0.72)	(0.91)
Insurer HHI		2.623***		-0.858	-11.030**
		(0.69)		(0.79)	(3.80)
for-profit	-0.005	0.019	-0.068	-0.048	-0.099
	(0.06)	(0.06)	(0.11)	(0.14)	(0.28)
Government	-0.030	0.015	-0.141	-0.136	-0.454
	(0.06)	(0.06)	(0.16)	(0.19)	(0.42)
constant	13.851**	3.856	-1.103	-4.839	9.369
	(4.42)	(6.54)	(5.43)	(5.48)	(9.43)
N	3575	3214	3575	3214	3214.000
R2	0.64	0.67	0.58	0.58	0.46

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Notes: (1) The dependent variable is the log of PQI rate for uninsured patients. Column 1 and 2 are displayed for only comparison purpose. Hospital and Insurer HHI are the key explanatory variable of interest.

(2)All regressions control for time effects market and hospital characteristics. Columns 3, 4 and 5 includes also hospital-fixed effects.Standard errors are clustered by hospital.

with hospital fixed-effects and IV to mitigate bias (as discussed above); although, Column (4) and (5) show that this result does not change once IV is added in the model. The specification was also performed without accounting for hospital fixed-effects. The 95% confidence interval suggests that hospital HHI is not statistically significant and the result does not change.

According to the columns in Table 3.2, the outcome of interest is negatively associated with insurer HHI. This means that more market concentration in insurer market was associated with an improvement in the quality of preventable admissions. The same effect can be seen in Column(4) and Column(5). Even though the magnitude of insurer HHI coefficient is not close in Column (4) and Column (5), the only difference between the two models is IV. For the purpose of clear interpretation and as an illustration, consider the result in terms of elasticity. The elasticity of the coefficient shows that a 10% increase in insurer

HHI decreases PQI rate (improves quality) by 0.3% (FE) and 4.3% (IV-FE). It is expected that the coefficient of the endogenous variable may increase once it is estimated with IV. Controlling for the endogeneity of insurer HHI increases the impact of insurer HHI on PQI rate.

Both Column(4) and Column(5) in Table 3.2 show that none of the different types of ownership are associated with the quality level of PQIs. As was expected, NP hospitals are supposed to promote the community health as a return to tax-exemption status; however, the type of ownership and hospital concentration level does not impact community health through PQI rate of the service area. The results showed that after increasing the insured population through Medicaid expansion in 2014, Medicaid expansion decreased the PQI rate among uninsured patients.

Unlike insurer HHI, the hospital HHI does not produce different estimates across the columns. After adding hospital FE and IV to control for omitted variable bias, the results showed that there was no significant relationship between hospital HHI and PQI rate for uninsured patients. The 95% confidence interval around the estimate in the IV model was bounded between a 0.22% decrease and 0.15% increase in the PQI rate for uninsured patients, with a 1% increase in hospital HHI. This is consistent with the FE model (Column 4) in which the confidence interval around the estimate is between 0.04% decrease and 0.12% increase for every 1% increase in hospital HHI.

This shows that the impact of insurer HHI on PQI rate of a hospitals' service area is more effective than hospital HHI. Considering the outcome of interest is only PQI rate, it seems that the relationship between insurer HHI and hospital HHI may play a crucial role in explaining the improvement of PQIs among uninsured patients. Insurers' demand of better quality of care from hospitals with a bargaining leverage of selective contracting, might explain how insurer HHI positively affects the PQI rate for uninsured patients (Lewis & Pflum, 2017).

The hospital being not effective on the prevention quality indicator, in other words, not improving the community health has several plausible interpretations. The elasticity of the

health care service affects hospitals' decisions on treatment, price, and quality. Although out-of-pocket costs of uninsured patients were not observed, it is commonly known that providing CB services to uninsured patients is inherently unprofitable. An uninsured patient's ability to compensate the health care cost improves with insurance coverage.

There is also growing evidence in the literature which indicates that increasing health coverage among populations improves self-assessed health, decreases the hospitalization of preventable admissions and mortality rate, and increases preventive care utilization (Kolstad & Kowalski, 2012; Courtemanche & Zapata, 2014; Borgschulte & Vogler, 2020). Adequate and proper treatment for preventable admissions may be distorted by hospital decisions considering the compensation of treatment and the elasticity of health care services. Inelastic treatment, such as acute mycardial infarction (AMI) or stroke, might be less affected by hospital decisions. Finally, some studies which have investigated the impact of hospital competition on quality, show that a decrease in concentration increases non-clinical quality of hospitals, rather than clinical qualities.

3.4.1 Robustness Checks

Several robustness tests were conducted for this study to address concerns. The first concern was that the ICD10 transition might affect the estimation of the PQI rate. The ICD10 transition was a mandatory transition for all hospitals; however, for the purpose of this analysis, only the ICD9 period was calculated, without concern for the upward bias of the coefficient on covariates. Omitting discharges with the ICD10 code, over 5 fiscal quarters from 2015 Q4 to 2016 Q4, substantially reduced the variation in the outcome of interest; however, the results in Table 3.3 are close to the main result.

The second concern was that uninsured patients do not represent the total patient population, such that selecting uninsured patients as only one target of hospitals may not be enough to analyze hospital behavior towards preventable admissions. 3.4 presents the result of the specification with all patients. The preferred specification with FE and IV shows similar results to the main analysis (no statistically significant relationship between

Table 3.3: Robustness Check for ICD-9 Only

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE-IV
log(PQI Rate for Uninsured)					
Hospital HHI	-0.288	-0.071	-0.573	-0.878	-1.026
	(0.20)	(0.23)	(0.79)	(0.90)	(0.86)
Insurer HHI		2.272**		-1.413*	-4.522*
		(0.74)		(0.61)	(1.77)
For-profit	-0.010	0.015	-0.166*	-0.158	-0.212
	(0.06)	(0.06)	(0.08)	(0.12)	(0.17)
Government	-0.002	0.030	-0.126	-0.166	-0.350
	(0.07)	(0.07)	(0.14)	(0.18)	(0.27)
constant	12.312**	2.170	3.905	6.593	7.796
	(4.61)	(7.34)	(5.16)	(6.27)	(6.74)
N	2630	2389	2630	2389	2389
R2	0.51	0.56	0.22	0.23	0.21

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent. Standard errors are displayed in parenthesis.

Notes: (1) The dependent variable is the log of PQI rate for uninsured patients. Column 1 and 2 are displayed for only comparison purpose. Hospital and Insurer HHI are the key explanatory variable of interest. Sample includes only discharges before ICD10 transition.

(2)All regressions control for time effects market and hospital characteristics. Columns 3, 4 and 5 includes also hospital-fixed effects.Standard errors are clustered by hospital.

Table 3.4: Robustness Check for All Patients PQI Rate

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE-IV
log(PQI Rate for All)					
Hospital HHI	-0.150	-0.020	0.158	0.164	-0.072
	(0.14)	(0.15)	(0.17)	(0.20)	(0.28)
Insurer HHI		0.168		-0.074	-3.830***
		(0.36)		(0.14)	(0.94)
For-profit	-0.081	-0.070	-0.010	-0.008	-0.022
	(0.05)	(0.05)	(0.02)	(0.02)	(0.07)
Government	-0.028	-0.022	-0.036	-0.039	-0.132
	(0.06)	(0.06)	(0.03)	(0.03)	(0.11)
constant	5.994	4.616	8.913***	9.210***	16.259***
	(3.43)	(3.64)	(1.29)	(1.53)	(2.57)
N	3845	3463	3845	3463	3463
R2	0.83	0.84	0.94	0.93	0.92

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent.Standard errors are displayed in parenthesis.

Notes: (1) The dependent variable is the log of PQI rate for all patients. Column 1 and 2 are displayed for only comparison purpose. Hospital and Insurer HHI are the key explanatory variable of interest.

(2)All regressions control for time effects market and hospital characteristics. Columns 3, 4 and 5 includes also hospital-fixed effects.Standard errors are clustered by hospital.

PQI rate and hospital HHI; but a significant negative relationship between PQI rate and insurer HHI).

Table 3.5: Robustness Check for Uncompensated Care

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE-IV
log(Uncompensated Care)					
Hospital HHI	0.029	0.019	0.391	0.514	0.402
	(0.22)	(0.24)	(0.54)	(0.58)	(0.61)
Insurer HHI		0.017		0.894	0.539
		(0.93)		(0.69)	(3.18)
	(0.22)	(0.24)	(0.54)	(0.58)	(0.61)
constant	10.037	6.524	13.381	2.528	-2.224
	(7.51)	(7.92)	(8.56)	(9.28)	(10.17)
N	920	827	920	827	827
R2	0.658	0.657	0.151	0.149	0.136

*** indicates significance level at 1 percent, ** 5 percent, * 10 percent.Standard errors are displayed in parenthesis.

Notes: (1) The dependent variable is the uncompensated care provision. Column 1 and 2 are displayed for only comparison purpose. Hospital and Insurer HHI are the key explanatory variable of interest.

(2)All regressions control for time effects market and hospital characteristics. Columns 3, 4 and 5 includes also hospital-fixed effects.Standard errors are clustered by hospital.

The final concern was that that the sample used in Chapter 2 is slightly different than the sample used in this chapter might affect the conclusion. UC variable was regressed on the same model to test whether the result of this chapter would be different than the previous chapter's. Table 3.5 supports the result that the association between market power of hospitals and CB provision is not statistically significant.

3.5 Conclusion

This paper tested the impact of hospital and insurer competition on the health outcome of UC, which NP hospitals provide under the CB provision as a requirement for tax exemption. At present, the IRS does not require tax-exempt NP hospitals to provide a certain amount

of CB, and further, it does not set a target for hospital outcomes or quality of services for UC in NP hospitals. Within the literature, there is still little understanding as to whether NP hospitals promote their communities' health, while taking advantage of their tax-exempt status. Due to the legal justification of the CB standard, any advancement on NP hospitals' ability to compensate CB expenses would help achieve the rationale of tax-exempt status. NP hospitals are expected to benefit their communities more once they acquire more market power or financial ability. If competition level in health care markets restricts the CB provision level for NP hospitals, then it is salient to understand how competition in the health care market affects both the level and quality of CB provision.

The findings of this study may show no empirical evidence that NP hospitals promote the health of their communities in more concentrated markets (by improving PQI). Our analysis also showed that the PQI rate decreases in concentrated insurer markets. From this, it is plausible to argue that the impact of insurer concentration might be more effective on the health outcomes of UC in NP hospitals, rather than in hospital concentrations. This study concludes that the behavior of NP hospitals towards CB activities does not justify the rationale for tax-exempt status, given the estimates of the analysis.

Despite the numerous strengths of this study, it also has several limitations. Firstly, the impact of insurer concentration and hospital concentration on one another was not directly examined. Secondly, this study employed reduced form models rather than structural models. This prevents the study from analyzing how the health outcomes of UC would have altered after exogenous changes. Thirdly, the study period only covers 5 years of data. Considering the social determinants of health, a longer period would provide more variation in market characteristics, resulting in better estimates for the panel data analysis. Future analysis would benefit from adding more quality indicators, such as mortality and readmission rates, to better understand the communities' health improvements.

Appendix A: Appendix A

A.1 Community Benefit Calculation

Centers for Medicare and Medicaid (CMS) defines uncompensated care in the instruction document as follows: Uncompensated care consists of charity care, non-Medicare bad debt, and non-reimbursable Medicare bad debt. Uncompensated care does not include courtesy allowances, discounts given to patients that do not meet the hospital's charity care policy, or discounts given to uninsured patients that do not meet the hospital's FAP, or bad debt reimbursed by Medicare. CostReportData.com was used to obtain documents for HCRIS data. To have comparable data across the hospitals, uncompensated care costs will be used as a percentage of total operating expenses. Based on the definition of CMS three parts were used from the cost reports to calculate uncompensated care cost

1. Charity Care Costs
2. Non-Medicare Bad Debt
3. Non-reimbursable Medicare Bad Debt.

The lines used:

- Charity Care Cost: Worksheet S-10, Line 20, Column 3
- Charity Care Cost: Worksheet S-10, Line 22, Column 3
- Charity Care Cost: Worksheet S-10, Line 23, Column 3
- Total bad debt expense: Worksheet S-10, Line 26, Column 1
- Non-reimbursable Medicare Bad Debt: Worksheet S-10, Line 27, Column 1
- Medicare allowable bad debts: Worksheet S-10, Line 27.01, Column 1
- Non-Medicare Bad Debt: Worksheet S-10, Line 28, Column 1

- Total Operating Expense: Worksheet G-3, Line 4, Column 1

One important note here is that beginning October 1, 2013 hospitals calculate non-Medicare bad debt expense (Line 28) by subtracting Medicare allowable bad debts (Line 27.01) from total bad debt expense for the entire hospital complex (Line 26). However, Line 27 was used instead of Line 27.01 before October 1, 2013. For that it is better to adjust the data to have consistent calculation for each year. Line 29 is the sum of the non-Medicare bad debt expense (Line 28) and the non-reimbursable Medicare bad debt expense (Line 27.01 - Line 27).

Here is the Uncompensated Care calculation:

$$UC = CharityCareCosts + Non-MedicareBadDebt + Non-reimbursableMedicareBadDebt \tag{A.1}$$

$$UC = (Line20 - Line22) + (Line28) + (Line27.01 - Line27) \tag{A.2}$$

Then UC will be divided by total operating expense to obtain the percentage.

Calculation the Cost of Uncompensated Care in HCRIS

Thanks to the detail instruction of CMS, it is easy to figure out how uncompensated care is calculated in CMS. The regular calculation of uncompensated care in the literature is simply the sum of bad debt and charity care. The Cost report data provides Worksheet S-10 that includes data regarding uncompensated care. Here is the definition of uncompensated care (UC) stated in the instruction:

Uncompensated care consists of charity care, non-Medicare bad debt, and non-reimbursable Medicare bad debt. Uncompensated care does not include courtesy allowances, discounts given to patients that do not meet the hospital's charity care policy, or discounts given to uninsured patients that do not meet the hospital's FAP, or bad debt reimbursed by

Medicare.

As we see in the Worksheet S-10, Line 20 to Line 31 are related to uncompensated care. Based on the definition and UC calculation in the literature, here is how UC is calculated in Equation A.1.

It looks like the info we need is in the line 30 which gives us the cost of uncompensated care; however there is one thing that we need to consider. CMS changed the format of HCRIS and also made some minor but important changes in the calculation of some line. For that reason, it is better to see how each line in UC section in the form is calculated. The instruction gives a detailed explanation how hospital/provider needs to put some figures/numbers in each line. Here is the explanation for Line 30:

"Calculate the cost of uncompensated care by entering the sum of lines 23, column 3, and line 29".

line 23 says it is cost of charity care (Line 21 minus Line 22) and Line 29 says it is the cost of non-Medicare and non-reimbursable Medicare bad debt expense. So far what we have for the calculation is Line 21, Line 22, Line 29. We started from very last line and so let's keep going up.

For line 29 which is the cost of non-Medicare and non-reimbursable Medicare bad debt expense, the instruction says:

For cost reporting periods beginning before October 1, 2013, the cost of non-Medicare and non- reimbursable Medicare bad debt expense is calculated by multiplying line 28 by the CCR on line 1. For cost reporting periods beginning on or after October 1, 2013, the cost of non-Medicare bad debt expense is calculated by multiplying line 28 by the CCR on line 1. The cost of non- reimbursable Medicare bad debt expense is calculated by subtracting line 27 from line 27.01 (this amount is not multiplied by the CCR on line 1).

So we have three extra lines to consider for the UC calculation: Line 28, Line 27.01, Line 27.

Let's make it more visible:

UC = Charity Care Costs + Non-Medicare Bad Debt + Non-reimbursable Medicare

Bad Debt = Line 30

UC = Charity Care Costs + Line 29

UC = Charity Care Costs + (Line 28 + Line 27.01 - Line 27)

Now it is time to look at Line 28 which is about Non-Medicare Bad Debt to see if it is calculated with other line(s).

Line 28–Effective for cost reporting periods beginning before October 1, 2013, calculate the non- Medicare bad debt expense by subtracting line 27 from line 26. Effective for cost reporting periods beginning on or after October 1, 2013, calculate the non-Medicare bad debt expense by subtracting line 27.01 from line 26.

Two more lines for the calculation: Line 27.01 and Line 26.

UC = Charity Care Costs + (Line 26 - Line 27.01) + Line 27.01 - Line 27

The instruction shows that there is no need to consider other line for Line 27.01 and Line 26. The last component that we need to look at is charity care cost. The instruction and form shows that we need to look at line 20-23 to calculate charity cost. My understanding of what costs can be considered as charity care leads me to take Line 23 and use it as charity care cost. What Line 23 does is to subtract "payments received from patients for amounts previously written off as charity care" (line 22) from "cost of patients approved for charity care and uninsured discounts" (line 21).

Let's finalized our little formula with two extra lines.

UC = Line 21 - Line 22 + (Line 26 - Line 27.01) + Line 27.01 - Line 27

UC = (Line 21 - Line 22) + (Line 26 - Line 27)

UC = Charity Care Costs + Bad Debt Costs

The line 26 is the total bad debt expense for the entire hospital complex and the line 27 is Medicare reimbursable bad debts for the entire hospital complex. To subtract Line 27 from Line 26 gives us bad debt expense. Here is the simply trick to eliminate the change occurred on October 1, 2013. Instead of adjusting the data across the year, this simple solution can be used to calculate UC for each year after 2010.

Here is an example how uncompensated care (charity care and bad debt) is calculated

in Worksheet S-10. A hospital has a charity care policy which determines charity care on a "sliding scale" basis and may forgive anywhere from 25% to 100% of the patient's liability. An uninsured patient owes the hospital 1000 dollars for an allowable hospital service. The patient applies for charity care, and the hospital determines that the uninsured patient qualifies for charity care at 60%. The hospital records the entire 1000 dollars charge as charity care on line 20, column 1. The remaining 400 dollars is the patient's liability and must be recorded on line 22 as this is a patient liability for which the hospital expects to receive payment. The uninsured patient pays 100 dollars toward their 400 dollars liability. The 100 dollars patient payment does not get recorded on Worksheet S-10, because the 400 dollars full patient liability was already recorded as an expected payment on line 22. If the 300 dollars balance remains unpaid and the hospital determines it to be a bad debt, it can be recorded as a hospital bad debt on line 26.

UC = (Line 20 - Line 22) + Line 26 UC = (1000 - 400) + 300 = 900 dollars

So, the total uncompensated care recorded for that patient in the hospital report is 900 dollars.

IRS Calculation

In Schedule H, the community benefit expense calculation is shown in Worksheet 1 at the Schedule H instruction. For example, here is the "Financial Assistance at Cost" category of community benefits calculation:

1. Calculate amount of gross patient charges written off under financial assistance policies
2. Identify ratio of patient care cost to charges which is asked in the form (cost-to-charge ratio)
3. Estimate cost (multiply gross patient charges by ratio)
4. Calculate Medicaid provider taxes, fees, and assessments
5. Add the estimate cost (3) to (4) and find Total community benefit expense

6. Calculate revenue from uncompensated care pools or programs
7. Identify other direct offsetting revenue
8. Add (6) to (7) and find Total direct offsetting revenue
9. Subtract Total community benefit expense from Total direct offsetting revenue and find Net community benefit expense
10. Calculate percentage of total expense. The numerator is Net community benefit expense and the denominator comes from Form 990, Part IX, line 25, column (A) total functional expense.

How does the IRS define the calculation of patient care cost-to-charges ratio (CCR)?

How does the IRS define the calculation of patient care cost-to-charges ratio (CCR)? The worksheet 2 (page 15) in the Schedule H instruction guides hospitals on how to calculate the CCR, unless hospitals choose to use another cost accounting method or system.

- CCR = Adjust Patient Care Cost / Adjusted Gross Patient Charges
- Adjusted Patient Care Cost = Total operation expense - Nonpatient expense
- Adjusted Gross Patient Charges = Gross Patient Charges - Gross charges for community benefit programs

IRS 990 Form includes 8 categories of community benefits, while the cost report data only includes bad debt and charity care. In order to have comparable data, uncompensated care costs were calculated as a percentage of total expense for each hospital.

Appendix B: Appendix B

B.1 Price Calculation

This appendix explains the calculation of the average price per discharge for a given year which follows the approach by Dafny and Lewis et al. The formula to calculate the price is obtained from the paper by (Lewis & Pflum, 2017) and is as follows:

$$Price = \frac{[[\text{Gross Inpatient Rev.} * \text{discount}] - \text{Medicare Payments}]}{Non - Medicare\ Discharges} \tag{B.1}$$

$$Discount = 1 - \frac{\text{Total Contractual Adjustment}}{Gross\ Inpatient\ Rev. + Gross\ Outpatient\ Rev.} \tag{B.2}$$

Each element of formula is obtained from HCRIS data and the list of lines as follows:

1. Gross Inpatient Revenue comes from Worksheet G, line 28 from Form CMS-2552-10 and Worksheet G, line 25 from Form CMS-2552-96.

2. Medicare Payment comes from Worksheet E, Part A line 59, column 1 from Form CMS-2552-10 and Worksheet E, Part A, line 16 from Form CMS-2552-96.

3. Non-Medicare Discharges is the difference between Worksheet S-3 line 7, column 8 and Worksheet S-3 line 7, column 7, Worksheet S-3 line 7, column 6, Worksheet S-3 line 7, column 5.

4. Total Contractual adjustments come from Worksheet G-3, line 2, column 1 from both Form CMS-2552-10 and CMS-2552-96.

5. Total Gross Revenue comes from Worksheet G-2, line 28, column 3 from Form CMS-2552-10 and from Worksheet G-2, line 25, column 3 from Form CMS-2552-96.

Appendix C: Appendix C

C.1 The Model of Hospital Competition Measure

I model that indirect utility that a patient receives by selecting a hospital over alternatives in a hospital choice set is a function of travel cost which increases with driving distance, hospital, and patient characteristics. It is given by:

$$\mu_{ij} = \alpha D_{ij} + \Gamma X_i + \beta Z_j + \varepsilon_{ij} \tag{C.1}$$

where D_{ij} is the driving distance to hospital j's location from patient i's location, X_i and Z_j are hospital and patient observable characteristics, and ε_{ij} is independently and identically distributed with Weibull distribution and captures unobservable characteristics of hospital and patient. The probability of patient i selecting hospital j over the alternative choice set is given by:

$$\rho_{ij} = \frac{e^{(f_{ij}+g_{ij})}}{\sum_{l=1}^{J} e^{(f_{il}+g_{il})}} \tag{C.2}$$

I estimate the parameters of this model using multinomial maximum likelihood and then obtain predicted probabilities, $\hat{\rho}_{ij}$, of admission of each patient to hospital. For every zip code of patient location, I calculate predicted share of patients from zip code k to hospital j which is shown as:

$$\hat{\rho}_{jk} = \frac{\sum i \ living \ in \ zip \ k \ \hat{\rho}_{ij}}{\sum_{j=1}^{J} \sum i \ living \ in \ zip \ k \ \hat{\rho}_{ij}} \tag{C.3}$$

Due to possibility that each hospital may have different demand function from each zip code surrounding its location, it is possible that hospital might differentiate among patients from different zip code. To account for that possibility, $\hat{\rho}_{jk}$ is translated to zip code level

for patients living in that zip code:

$$HHI_k = \sum_{j=1}^{J} \hat{\rho}_{jk}^2 \tag{C.4}$$

The next step is to calculate the hospital-level share of competition by creating a weighted average share of zip code that a hospital is predicted to serve.

$$\hat{\theta}_{kj} = \frac{\sum i \ living \ in \ zip \ k \ \hat{\rho}_{ij}}{\sum_{i=1}^{N} \hat{\rho}_{ij}} \tag{C.5}$$

$$HHI_j = \sum_{k=1}^{K} \hat{\theta}_{kj}.HHI_k \tag{C.6}$$

The $\hat{\theta}_{kj}$ is the predicted share of patients from zip code k and then HHI_j represents the weighted average of competition accounting for all zip codes a hospital serves. The concern is that unobserved factors of hospital choice might be correlated with patient health. To account for that concern, KM approach assigns hospital-level share of predicted HHI to patients depend on $\hat{\rho}_{jk}$.

$$HHI'_k = \sum_{j=1}^{J} \hat{\rho}_{jk}.HHI_j \tag{C.7}$$

Compared to HHI_k, HHI'_k accounts for weighted expected share of hospitals. HHI'_k in a panel data set includes variations of over time in the market such as mergers and closure, and individual preferences of hospital choice. Table X and Y shows the summary statistics of demand function and HHI'_k.

Table C.1: Summary Statistics of HCUP Data

State	AR	MS	UT	VT	FL	NY
	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd
Age (year)	77.88	77.45	77.46	78.58	78.29	79.01
	8.2	8.2	8.0	8.4	8.3	8.5
Female (%)	59%	59%	57%	55%	55%	57%
	0.5	0.5	0.5	0.5	0.5	0.5
Distance (minute)	25.93	25.04	16.09	21.72	16.16	14.65
	20.5	19.4	14.1	17.9	13.3	13.7
Choice Set	14.57	14.53	28.11	4.35	35.30	49.96
	9.5	6.4	13.5	1.3	17.2	30.5
Preferred Closest Hospital (%)	41%	35%	43%	80%	44%	46%
	0.5	0.5	0.5	0.4	0.5	0.5
Discharge	81359.64	86992.75	38942.05	11356.69	700763.75	479058.71
	3787.4	5743.6	4386.4	446.2	10654.0	19207.9
N	405893	433046	192068	56696	3503002	2391404

Appendix D:

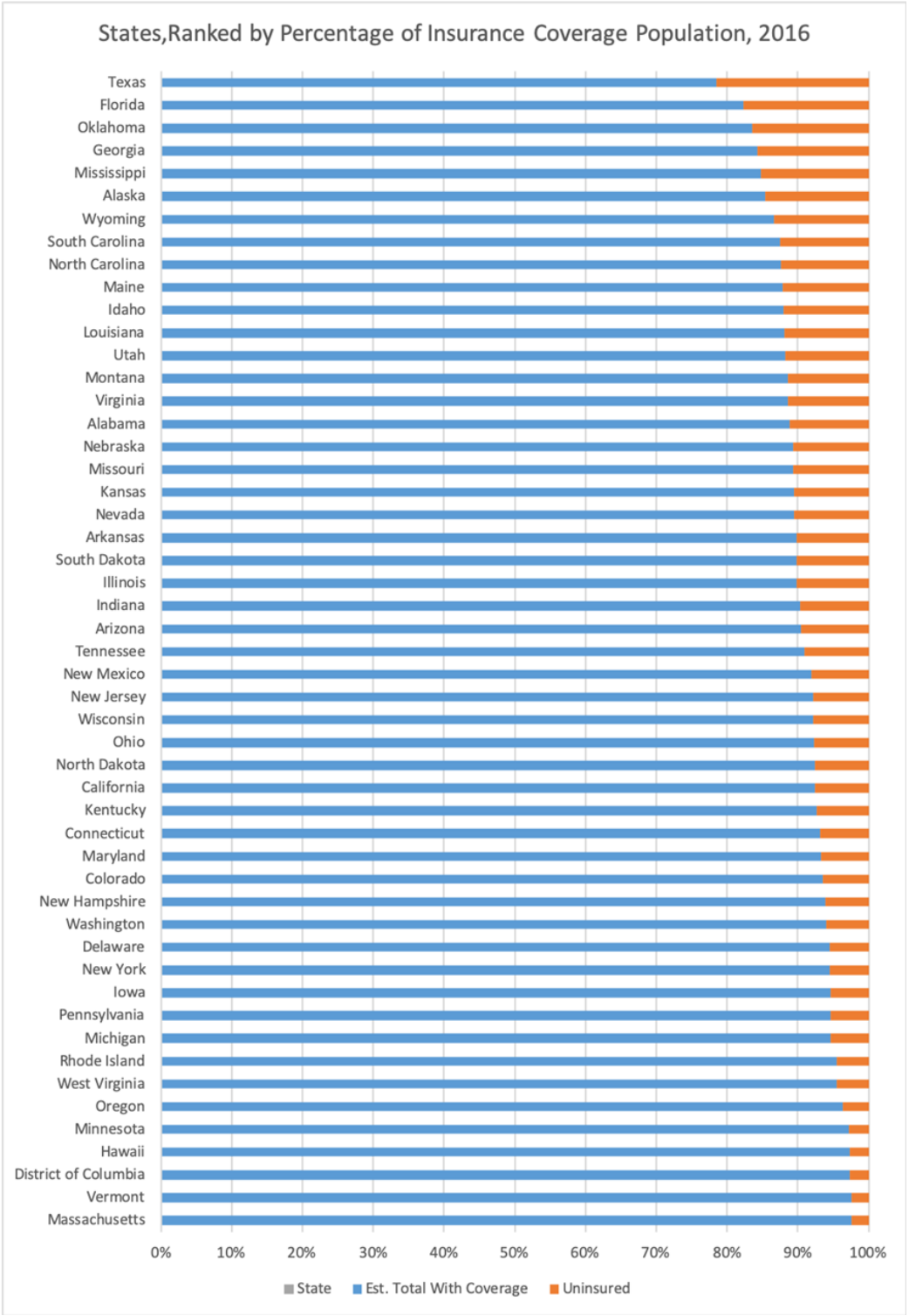


Figure D.1: Insurance Coverage

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Curriculum Vitae

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