The Impact of Hospital Concentration on Municipal Finances

Jarrett Bell

Follow this and additional works at: https://elischolar.library.yale.edu/yurj

Recommended Citation
Bell, Jarrett (2020) "The Impact of Hospital Concentration on Municipal Finances," The Yale Undergraduate Research Journal: Vol. 1 : Iss. 1 , Article 46. Available at: https://elischolar.library.yale.edu/yurj/vol1/iss1/46

This Article is brought to you for free and open access by EliScholar – A Digital Platform for Scholarly Publishing at Yale. It has been accepted for inclusion in The Yale Undergraduate Research Journal by an authorized editor of EliScholar – A Digital Platform for Scholarly Publishing at Yale. For more information, please contact elischolar@yale.edu.
The Impact of Hospital Concentration on Municipal Finances

Jarrett Bell¹

¹Yale University

Abstract

Since adoption of the Affordable Care Act, hospital concentration has increased across the country, with alarming implications for healthcare affordability. This paper finds evidence that hospital concentration is associated with increases in tax revenue and property tax revenue per capita within a city. The relationship between hospital concentration and taxes is strongest in cities with higher tax revenues, with higher nonprofit ownership shares, and that financially support their hospitals. This paper investigates two potential mechanisms through which hospital concentration may increase tax revenues within a city—specifically, the effect of concentration on changes in nonprofit or for-profit hospital ownership and the effect of concentration on capital investments—failing to find strong supporting evidence for either. Beyond hospital concentration’s role in healthcare price growth across the country, this paper may provide a starting point for further investigation into the impact of hospital mergers and concentration on city governments and other actors.

1. INTRODUCTION

Hospitals, according to Gaynor, Ho, and Town (2015), make up 5.6% of U.S. GDP. Since the passage of the Affordable Care Act, Schmitt (2017) reports, “there has been a sharp uptick in hospital mergers, with the number of deals essentially doubling within three years.” According to Cooper, Craig, Gaynor, and van Reenen (2019), merging hospitals are mostly large, well-respected nonprofits and “tend to be located in less concentrated markets” where they are less likely to draw antitrust scrutiny. Increased concentration likely strengthens hospitals’ negotiating power with insurers, resulting in higher rates.

The impact of hospital concentration on municipal finances is not well understood. Given that hospital concentration increases prices for patients and hospitals receive substantial tax incentives, the question of whether hospitals earn their government assistance is a pressing one. When tax revenues decrease, cities must cut public services, including education, food assistance, and public safety. With Jonas (2012) calculating that city property tax revenues fell by 3.2% on average and by up to 25% during the Great Recession and with cities taking a financial hit from coronavirus-related shutdowns, understanding the role of one of the largest industries in the country and in many cities, hospitals, on municipal finances is important. If hospital concentration contributes to this trend, policymakers need to know.

In this paper, I use a city fixed effects model to study the relationship between hospital concentration and taxes. I identify this model based on changes in hospital concentration within a city over time, as opposed to differences across cities. Utilizing panel data on hospital size from 2001 to 2014, I construct a measure of hospital concentration and system concentration within each city. With the Lincoln Institute’s fiscally standardized dataset on municipal finances, I measure the effect
of changes in hospital concentration on tax revenue within a city. I then split cities above and below median tax revenues and median for-profit and nonprofit hospital ownership shares to gauge which types of cities are powering the relationship between hospital concentration and taxes. Finally, utilizing a RAND dataset containing hospital ownership shares and capital expenditures across markets, I explore two mechanisms through which hospital concentration could affect municipal finances: changes in ownership status after mergers and capital construction.

I find evidence that growth in hospital concentration as measured by the Herfindahl-Hirschmann Index (HHI) within a city increases municipal taxes and property taxes per capita. A 10% increase in hospital concentration is associated with a moderately significant increase in taxes per capita of 1.6% within a city. Though statistically insignificant, a 10% increase in HHI corresponds to an approximately 2% increase in property tax revenue per capita within a city. That the property tax result is larger than that for all tax revenues combined suggests that changes in property taxes may be driving the relationship between hospital concentration and taxes. System concentration also appears to increase municipal finances. My heterogeneity analysis reveals that the relationship between hospital concentration and municipal finances is largest in cities with high taxes and high nonprofit ownership shares.

Turning to mechanisms, my analyses fail to support the hypothesis that changes in the for-profit or nonprofit hospital share are responsible for the positive relationship between HHI and tax revenue per capita within a city. Instead, I find that only growth in the government-run hospital share increases tax revenue, which may be a case of reverse causality. Because cities can tax for-profit hospitals, I anticipated a positive relationship between the for-profit ownership share and property taxes per capita. Surprisingly, I find that a 10% increase in the share of for-profit hospitals corresponds to a 2.3% decrease in property tax revenue, whereas the share of nonprofit hospitals had next to no effect on property taxes. Next, I analyze whether hospital construction and expansion explain changes in capital construction and, through construction, the increase in taxes per capita within cities. While my results show that increases in HHI statistically significantly reduce various measures of capital construction within cities, I identify no relationship between capital expenditures and tax revenue.

My paper contributes to the literature by establishing a relationship, whether causal or not, between hospital concentration and city tax revenue. By investigating the repercussions of hospital concentration on city governments as opposed to healthcare prices, costs, and outcomes, I am contributing novel research to the existing literature and providing a starting point for future investigation.

One limitation of my research is that because including fixed effects limits my analysis to variation within cities, the city fixed effects cannot account for time-varying characteristics within cities. For example, my city fixed effects model would not control for a shock, such as Hurricane Katrina, that affects one city’s taxes and economic growth and not others’. Similarly, city fixed effects cannot account for differences in regional economic development. Without supporting evidence for a causal pathway through which hospital concentration might increase tax revenue, I cannot verify causation. Another limitation of my study is that the RAND dataset on hospital capital and ownership status does not encompass all the cities in the Lincoln Institute data and the city definitions differ slightly, making comparisons across the two datasets imperfect.

2. Literature Review

Research shows that hospital consolidation raises prices on consumers. Applying difference-in-differences to health insurance claims data, Cooper et al. (2019) discovered that “prices increased by over 6% when the merging hospitals were geographically close (e.g., 5 miles or less apart), but not when
the hospitals were geographically distant (e.g., over 25 miles apart).” Alarmingly, Dafny (2009) found that non-merging hospitals respond to the merger of their rivals by increasing their own prices by up to 40%. Comparing insurer and hospital concentration, Melnick, Shen, and Wu (2011) determined that hospital concentration raises prices for consumers while insurer concentration lowers prices. Unfortunately for consumers, 90% of hospitals operate in markets wherein hospital concentration exceeds insurance plan concentration. Hospitals get away with price increases because consumers “choose hospitals largely ignoring the hospital’s price,” according to Garmon (2013).

Hospitals, especially nonprofit ones, receive substantial government support. By exempting nonprofit hospitals from “federal income tax, state income tax, state and local sales taxes, and local property tax,” nonprofit hospitals received a subsidy of $24.6 billion in 2011, Rosenbaum et al. (2015) estimated. In response to calls to increase their community benefit spending, nonprofit hospitals, which make up 47% of all US hospitals, according to the American Hospital Association, raised their community benefit spending from 7.6% of operating expenses in 2010 to 8.1% in 2014, Young et al. (2018) calculated. Herring et al. (2018) found that “incremental community benefit spending”—how much more nonprofit hospitals spend on charity care and community benefit programs than for-profit hospitals—exceeded the tax exemption for only 62% of nonprofit hospitals.

As nonprofit hospitals consolidate and raise prices, they continue to receive substantial tax breaks. With many municipalities in financial trouble thanks to coronavirus and critics questioning hospitals’ community benefit spending, understanding the effect of hospital concentration on municipal finances is an important policy concern.

### 3. DATA DESCRIPTION

#### 3.1) Hospital Merger Data

Cooper et al.’s “The Price Ain’t Right” (2019) contains a hospital merger dataset with the ownership status of 2,358 out of 3,272 hospitals in the American Hospital Association (AHA) from 2001 to 2014. These publicly-available data include system affiliation, latitude and longitude, and hospital bed count. The authors’ unique location and system identifiers made possible the calculation of market concentration using HHI.

#### 3.2) Lincoln Institute Data

Founded in 1946, the Lincoln Institute of Land Policy maintains a dataset, “Fiscally Standardized Cities,” on the finances of 150 American cities from 1977 to 2016, including tax revenues and expenditures. I have limited my analysis to the 147 cities with at least one hospital in the Cooper et al. (2019) dataset and the period 2001-2014 to match Cooper et al.’s (2019).

For the purposes of this paper, I use only 20 measures encompassing taxes, revenues, and spending. All values are per capita, enabling straightforward comparisons across cities. Because some city jurisdictions may overlap with county governments, the Lincoln Institute created fiscally standardized (FiSC) indicators by “adding together revenues and expenditures for the city government plus an appropriate share from overlying counties, school districts, and special districts…based on a city’s share of county population, the percentage of students in each school district that live in the central city, and the city’s share of the estimated population served by each special district,” according to Langley (2016). I will be restricting my analysis to FiSC variables to sidestep complications with overlapping government jurisdictions. This
is a widely-accepted practice for research across cities with variable governmental structures. The IMF’s Jiri Jonas (2012) used a similar “constructed cities” method to estimate the costs of the Great Recession on local governments and other researchers, including Chernick and Reschovsky (2017), have used the Lincoln Institute’s dataset for papers in the Journal of Urban Affairs, for the Pew Charitable Trust, and for the Federal Reserve.

3.3) RAND Market-Level Hospital Data

Using CMS Medicare cost reports, the RAND Corporation compiled metrics on hospital profits, costs, ownership status, and more. RAND aggregates the data at hospital, county, market, and state levels. To facilitate comparisons across Lincoln Institute and RAND measures, I have opted for market-level indicators. 115 markets in the RAND dataset match, imperfectly, cities in the Lincoln data. Unlike the Lincoln Institute data, RAND market indicators may not be confined to city limits. However, as an approximation, RAND markets and Lincoln cities are useful. Because the Lincoln Institute compiles its data on a per-capita basis, I calculated population-weighted averages for Lincoln Institute cities to create matching, aggregated “markets” in cases where RAND lists several cities under one market name, such as “Los Angeles-Long Beach-Anaheim, CA.”

4. RESEARCH DESIGN

4.1) Creating Measures of HHI and System HHI

HHI is a measure of market concentration used in the academic literature and by the Department of Justice (DOJ) in antitrust cases. The DOJ considers markets with HHI scores between 0 and 1,500 un-concentrated, between 1,500 and 2,500 moderately concentrated, and between 2,500 and 10,000 highly concentrated. This paper uses hospital beds, as compiled in Cooper et al. (2019), as a proxy for market share. For a given market with \( n \) hospitals, its HHI is the sum of each hospital’s market share, \( s_i \), squared:

\[
HHI = \sum_{i=1}^{n} s_i^2 = x_1^2 + x_2^2 + \cdots + x_{n-1}^2 + x_n^2 = \frac{\text{Hospital Bed Count}_i}{\sum_{i} \text{Hospital Bed Count}_i} * 100 .
\]

Any measure of hospital concentration that ignores hospital systems is likely to understate market concentration. Thus, within each city, I grouped hospitals by system to calculate system market share. For a market with \( N \) systems,

\[
S_i = \frac{\text{Hospital System Bed Count}_i}{\sum_{i} \text{Hospital System Bed Count}_i} * 100 .
\]

Using hospital market share, I calculated system HHI

\[
HHI: \quad \text{System HHI} = S_1^2 + S_2^2 + \cdots + S_{n-1}^2 + S_n^2 = \sum_{i=1}^{n} S_i^2 .
\]

4.2) City Fixed Effects Model

To estimate the effect of hospital concentration on taxes and property taxes per capita, I employed a city fixed effects model with standard errors clustered by city and year controls. Fixed effects isolate the impact of a change in one indicator on another within a city over time, holding all other time-invariant, city characteristics equal:

\[
\tilde{Y}_i = \beta_1 * \tilde{X}_i + \text{City Effects} + \text{Time Fixed Effects} + \tilde{\epsilon}_i .
\]

The coefficient of interest, 1, captures the effect of the independent variable \( X \)—the logarithm of HHI, system HHI, or another variable—on the dependent variable \( Y \)—the logarithm of a measure of municipal finances such as tax revenue per capita. I scaled my estimates such that the coefficient represents the effect of an approximately 10% change in HHI. Year fixed effects control for trends across time, such as overall changes in tax revenues across time resulting from macroeconomic events unrelated to hospital concentration. All standard errors are clustered at the city level to account for serial correlation in the estimates of a city over time. Results are weighted by city population because city populations vary from a low of 16,000...
to more than 8,000,000 and small cities tend to have highly concentrated hospital sectors, distorting the results in one direction.

A city fixed effects model does not inherently demonstrate causality but is usually more accurate than simple regressions across cities because it discards cross-city variation in financial structure. Small cities tend to have more concentrated hospital sectors than large cities and tax residents less. Taking an ordinary least squares (OLS) regression across small and large cities, therefore, is likely to find that taxes and hospital sectors are negatively correlated. A city fixed effects regression, by contrast, isolates the impact of hospital concentration on taxes within a city over time.

5. RESULTS

Table 1 reports my summary statistics.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>N</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHI</td>
<td>2,058</td>
<td>4,660.8</td>
<td>2,771.1</td>
<td>291.1</td>
<td>10,000.0</td>
</tr>
<tr>
<td>System HHI</td>
<td>2,058</td>
<td>5,306.2</td>
<td>2,602.1</td>
<td>666.7</td>
<td>10,000.0</td>
</tr>
<tr>
<td>Taxes per capita</td>
<td>2,058</td>
<td>1,937.6</td>
<td>878.1</td>
<td>639.2</td>
<td>10,535.9</td>
</tr>
<tr>
<td>Property Taxes per capita</td>
<td>2,058</td>
<td>1,270.6</td>
<td>485.3</td>
<td>269.2</td>
<td>3,455.2</td>
</tr>
<tr>
<td>City Population</td>
<td>2,058</td>
<td>432,977.9</td>
<td>788,349.4</td>
<td>14,064</td>
<td>8,458,642</td>
</tr>
<tr>
<td>CPI</td>
<td>2,058</td>
<td>1.2</td>
<td>0.1</td>
<td>1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Total Revenue per capita</td>
<td>2,058</td>
<td>6,059.4</td>
<td>2,176.8</td>
<td>2,293.3</td>
<td>20,939.9</td>
</tr>
<tr>
<td>General Revenue per capita</td>
<td>2,058</td>
<td>5,283.0</td>
<td>1,843.5</td>
<td>2,083.8</td>
<td>19,520.8</td>
</tr>
<tr>
<td>General Sales Tax per capita</td>
<td>2,058</td>
<td>279.1</td>
<td>289.6</td>
<td>0.0</td>
<td>1,872.9</td>
</tr>
<tr>
<td>Gross Receipts Sales Tax per capita</td>
<td>2,058</td>
<td>420.2</td>
<td>352.2</td>
<td>0.0</td>
<td>2,977.7</td>
</tr>
<tr>
<td>Direct Spending per capita</td>
<td>2,058</td>
<td>6,149.7</td>
<td>2,171.7</td>
<td>2,301.3</td>
<td>21,923.7</td>
</tr>
<tr>
<td>General Spending per capita</td>
<td>2,058</td>
<td>5,224.6</td>
<td>1,804.9</td>
<td>1,987.4</td>
<td>20,999.4</td>
</tr>
<tr>
<td>Education Spending per capita</td>
<td>2,058</td>
<td>1,790.5</td>
<td>553.3</td>
<td>0.0</td>
<td>4,711.2</td>
</tr>
<tr>
<td>Health Spending per capita</td>
<td>2,058</td>
<td>152.7</td>
<td>167.9</td>
<td>0.0</td>
<td>1,214.0</td>
</tr>
<tr>
<td>Social Services Spending per capita</td>
<td>2,058</td>
<td>583.8</td>
<td>816.1</td>
<td>0.0</td>
<td>6,278.2</td>
</tr>
<tr>
<td>Public Welfare Spending per capita</td>
<td>2,058</td>
<td>181.9</td>
<td>396.1</td>
<td>0.0</td>
<td>5,174.0</td>
</tr>
<tr>
<td>Hospital Spending per capita</td>
<td>2,058</td>
<td>249.2</td>
<td>607.3</td>
<td>0.0</td>
<td>5,564.4</td>
</tr>
<tr>
<td>Corporate Income Tax Revenue per capita</td>
<td>2,058</td>
<td>12.4</td>
<td>81.9</td>
<td>0.0</td>
<td>1,013</td>
</tr>
<tr>
<td>Individual Income Tax Revenue per capita</td>
<td>2,058</td>
<td>109.3</td>
<td>310.5</td>
<td>0.0</td>
<td>2,663.4</td>
</tr>
</tbody>
</table>

Notes: Means not population-weighted

Most cities have highly concentrated hospital sectors, with a mean HHI and mean system HHI of 4,661 and 5,306, respectively—well above the DOJ threshold of 2,500. Because systems own multiple hospitals, system HHI logically exceeds HHI.

5.2) Hospital Concentration and Taxes

Table 2 displays my primary estimates of the relationship between HHI and taxes.

<table>
<thead>
<tr>
<th></th>
<th>Pooled OLS</th>
<th>Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(Taxes Per Capita)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Log(System HHI)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Log(Property Taxes Per Capita)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Log(System HHI)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
<tr>
<td>HHI</td>
<td>-0.242***</td>
<td>0.163***</td>
</tr>
<tr>
<td>System HHI</td>
<td>-0.090</td>
<td>0.084</td>
</tr>
<tr>
<td>Fixed Effects?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2,058</td>
<td>2,058</td>
</tr>
<tr>
<td>R²</td>
<td>0.338</td>
<td>0.968</td>
</tr>
</tbody>
</table>

Note: *p<0.10; **p<0.05; ***p<0.01

The estimates in column 1 come from an OLS regression between HHI and taxes per capita across cities. Column 2 adds the results of a fixed effects regression between HHI and tax revenues per capita. Column 3 displays the estimates of the OLS regression between system HHI and taxes. Column 4 exhibits the fixed effects results of system HHI and taxes. Columns 5 through 8 do the same for HHI and property taxes per capita.

Although the OLS regression across cities suggests a negative relationship between hospital concentration (HHI) and taxes per capita, the fixed effects model, which examines variation within a city and accounts for time effects, shows a positive and moderately significant relationship between HHI...
and taxes per capita: a 10% increase in HHI is associated with an approximately 1.6% increase in taxes per capita. Whereas the OLS regression captures that small cities tend to have concentrated hospital sectors and low rates of taxation, fixed effects indicate that an increase in hospital concentration within a city is associated with a decrease in taxes per capita. Similarly, the movement from across-city variation to within-city variation flips the direction of the impact of system HHI on taxes per capita from negative to positive.

Though far from conclusive, the property tax results imply that HHI and property taxes per capita are positively correlated, with a 10% increase in HHI associated with a roughly 2% increase in property tax revenues. The correlation between system HHI and property taxes is slightly positive and statistically insignificant.

5.3) Heterogeneous Treatment Effects

In this section, I examine which types of cities are driving the relationship between hospital concentration and tax revenues. I find that cities with higher taxes, with higher nonprofit ownership shares, and that support their hospitals financially exhibit more substantial relationships between hospital concentration and taxes.

The relationship between HHI, on the one hand, and taxes and property taxes, on the other, is the most positive and most statistically significant in cities with the highest tax revenues. To determine which cities account for the relationship between HHI and taxes per capita, I take each city’s average tax revenue over the study period and then organize cities above and below the median average tax revenue over the study period. In Table 3, I test HHI’s relationship with taxes and property taxes above and below the median.

Columns 1 and 2 of Table 3 display the results of my fixed effects regression of HHI and taxes per capita in below-median and above-median taxed cities, respectively. Columns 3 and 4 do the same for HHI and property taxes. In high-taxed cities, a 10% increase in HHI corresponds to a statistically significant 2% increase in taxes per capita. In cities with below-median taxation, the effect of HHI on taxes is slightly negative and statistically insignificant. Likewise, Table 3 shows that above-median taxed cities are powering the positive relationship between HHI and property taxes I observe in Table 3. In high-taxed cities, a 10% increase in HHI is associated with an approximately 2.6% increase in property taxes per capita. In less-taxed cities, HHI has no effect on taxes or property taxes. Treating taxes as an imperfect indicator of a city’s wealth or tax base—since cities with higher per capita incomes can afford to tax their residents more—Table 3 illustrates that hospital concentration has a larger impact on tax revenue in prosperous cities.

In the following analyses, I investigate whether a city’s share of nonprofit hospitals affects my treatment effects. In Table 4, I start by calculating the average of each city’s nonprofit ownership share over the study period and then divide cities into subsets depending on whether they are above or below the median city’s for-profit share, allowing me to discern whether cities with higher or lower nonprofit ownership account for the relationship between HHI and taxes.

<table>
<thead>
<tr>
<th>Table 4 – Effect of HHI on Taxes by Whether Above or Below Median Nonprofit Ownership Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Log(Taxes Per Capita)</td>
</tr>
<tr>
<td>Below (1)</td>
</tr>
<tr>
<td>0.021 (0.082)</td>
</tr>
<tr>
<td>Fixed Effects?</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>Log(HHI)</td>
</tr>
<tr>
<td>0.012 (0.128)</td>
</tr>
<tr>
<td>Fixed Effects?</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>R²</td>
</tr>
</tbody>
</table>

Note: Results weighted by population and standard errors clustered by city

Though the share of nonprofit hospitals is not the inverse of the share of for-profit hospitals thanks to the existence of government-run hospitals, the results for nonprofit and for-profit hospitals mirror each other. Cities with a higher share of nonprofit hospitals exhibit a larger association between hospital
concentration and taxes. In Table 4, the relationship between hospital concentration and taxes is statistically insignificant above and below the median nonprofit ownership share. However, the coefficient for HHI and taxes is seemingly more positive in cities with above-median nonprofit ownership shares, with a 10% increase in HHI corresponding to a 1.5% increase in above-median nonprofit cities. Likewise, HHI and property tax revenue per capita are more positively related in cities with above-median nonprofit ownership shares: a 10% increase in HHI is associated with a roughly 3% increase in property tax revenue in cities with above-median nonprofit ownership.

Given that cities with higher tax revenues exhibit a larger association between hospital concentration and taxes, the extent to which cities direct revenue to hospitals may reinforce the relationship between city finances and hospital concentration. To explore whether city government spending patterns affect this relationship, I split cities in Table 5 by whether or not they have ever supported their hospitals financially through direct hospital payments.

| Table 5 – Effect of HHI on Taxes by Whether Cities Financially Support Their Hospitals |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                                | Log(Taxes Per Capita)           | Log(Taxes Per Capita)           | Log(Property Taxes Per Capita)  | Log(Property Taxes Per Capita)  |
|                                | Support (1)                    | Don’t Support (2)               | Support (3)                    | Don’t Support (4)               |
| Log(HHI)                       | 0.170†                        | 0.098                         | 0.205                         | 0.114†                         |
|                                | (0.095)                        | (0.067)                       | (0.142)                       | (0.065)                        |
| Fixed Effects§                 | Yes                            | Yes                           | Yes                           | Yes                            |
| Observations                   | 1,274                          | 784                           | 1,274                         | 784                            |
| R²                             | 0.969                          | 0.940                         | 0.919                         | 0.952                          |

Note: Standard errors clustered by city and results weighted by population

Columns 1 and 3 of Table 5 display my estimates for the relationship between HHI and measures of tax revenue for the 91 cities that financially supported their hospitals between 2001 and 2014. Columns 2 and 4 contain estimates for the 56 cities that never supported their hospitals. In cities that have supported their hospitals financially, a 10% increase in HHI is associated with a moderately significant 1.7% increase in taxes and a statistically insignificant 2% increase in property taxes. The relationship between HHI and taxes per capita in cities that have never supported their hospitals financially is both statistically insignificant and less positive, with a 10% increase in HHI resulting in a statistically insignificant 1% increase in taxes and a statistically significant 1.1% increase in property taxes. Thus, the relationship between HHI and tax revenues appears largest in cities that have supported their hospitals financially than within those that have not.

These results reveal that the effect of HHI on taxes and property taxes is stronger in some cities than in others. In cities with higher tax revenues per capita, my results point to a statistically significant, positive relationship between HHI, on one side, and taxes and property taxes, on the other. In cities with a higher nonprofit hospital share and lower for-profit hospital ownership share, HHI and tax revenues are more positively related. Finally, in cities that support their hospitals financially, the relationship between HHI and tax revenues is more positive.

These findings are likely interdependent since cities with lower for-profit shares also tend to have higher taxes, the OLS results in Tables 6 and 7 show. Cities with higher tax revenues are more likely to spend across a wide variety of items, including direct payments to hospitals. That the relationship between hospital concentration and municipal finances is strongest in cities with higher taxes, lower for-profit shares, and higher spending on hospitals may stem from these cities having more mechanisms through which hospital concentration can affect municipal finances. In a city with low tax revenues and low spending, it is possible that any change in the relative concentration of that city’s hospital sector is less likely to influence its finances because the city lacks the mechanisms, including direct hospital payments, to register such a change.
5.4) Mechanisms

In this section, I attempt to identify a mechanism through which hospital concentration impacts city taxes. The two mechanisms I explore are: (1) changes in the share of for-profit, nonprofit, or government hospitals and (2) changes in hospitals’ capital expenditures. For the first, it is possible that growth in the for-profit hospital share could increase tax revenues since cities can tax for-profit hospitals. For the second, growth in hospitals’ capital expenditures could signal that hospitals are purchasing land or building new facilities, which could alter a city’s property tax base. If a nonprofit hospital buys land, for example, a city’s property tax base would contract because it cannot tax land owned by nonprofits. Since 30% of cities’ tax revenues come from property taxes in 2017, according to the Tax Policy Center, any change, including hospital ownership status, that affects a city’s property tax base could have a measurable impact on its revenue generation. I fail to find supporting evidence for either mechanism. Only the government hospital share has a positive and statistically significant effect on taxes, while the shares of nonprofit and for-profit hospitals have negligible impacts. Instead of finding an association between capital expenditures and tax revenues, my estimates imply that capital expenditures correspond to a decrease in hospital concentration and are not significantly related to tax revenue.

Because nonprofit hospitals are exempt from property taxes, it is worth exploring whether growth in the nonprofit hospital sector impacts municipal finances. To do this, I run city fixed effects regressions of RAND’s measures of nonprofit, for-profit, and government ownership on tax data taken from the Lincoln Institute in Table 6.

Columns 1 and 2 of Table 6 present results from an OLS and a city fixed effects regression, respectively, of nonprofit ownership share on tax revenue per capita. Columns 3 and 4 do the same for the share of for-profit hospitals on taxes. Columns 5 and 6 add the results of the relationship between government-run hospitals and taxes. Growth in the nonprofit or for-profit market share has a negligible impact on tax revenue. Only the share of government-run hospitals is statistically significantly associated with tax revenue per capita: a 10% increase in the government share corresponds to an approximately 2.2% increase in tax revenues within a city. This may be a case of reverse causality, though: to operate government-run hospital systems, governments need more revenue.

Because nonprofit hospitals are exempt from property taxes, it is possible that nonprofit and for-profit consolidation have divergent effects on property tax revenue. Hence, the negative coefficient of for-profit hospital ownership on property taxes is surprising.

Table 6: Effect of Hospital Ownership on Taxes

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Pooled OLS</th>
<th>Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Log(Tax Revenue Per Capita)</td>
<td>Pooled OLS</td>
<td>Fixed Effects</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>Pooled OLS</td>
<td>Fixed Effects</td>
</tr>
<tr>
<td></td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Percent Nonprofit</td>
<td>0.306</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(0.334)</td>
<td>(0.064)</td>
</tr>
<tr>
<td>Percent For-Profit</td>
<td>-0.580</td>
<td>-0.081</td>
</tr>
<tr>
<td></td>
<td>(0.482)</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Percent Government</td>
<td>0.193</td>
<td>0.223*</td>
</tr>
<tr>
<td></td>
<td>(0.213)</td>
<td>(0.105)</td>
</tr>
<tr>
<td>Fixed Effects?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,610</td>
<td>1,610</td>
</tr>
<tr>
<td>R²</td>
<td>0.029</td>
<td>0.965</td>
</tr>
<tr>
<td></td>
<td>0.065</td>
<td>0.965</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.965</td>
</tr>
</tbody>
</table>

Note: *p<0.10 **p<0.05 ***p<0.01
As Table 7 illustrates, growth in the market share of for-profit hospitals within a city is associated with a statistically significant decrease in property taxes per capita. I found that a 10% increase in the for-profit share corresponds to a decrease in property taxes of roughly 2.3%. Because cities can tax land owned by for-profit hospitals, growth in the for-profit share may expand a city’s property tax base. With a broader tax base, a city’s tax burden may be spread more evenly across the population, possibly resulting in lower property taxes per capita. Growth in the nonprofit share of hospitals within a city has virtually no impact on property tax revenues. A 10% increase in the government ownership share, by contrast, increases property tax revenue by approximately 4.2%, a result that is statistically significant at the 1% level. This, too, is likely a case of reverse causality: to fund government hospital systems, cities need higher property taxes. It is worth noting that growth in the for-profit hospital share has a significantly more negative effect on property tax revenues than does an increase in the nonprofit hospital share.

Additionally, with the RAND dataset, I examined whether HHI affected capital expenditures, which could suggest that consolidation breeds construction. I next checked whether increases in capital expenditures within a city impacted tax revenues. If hospital concentration were expanding construction and construction were then raising tax revenues by increasing property values or incomes, then I could identify a possible causal mechanism.

On the first count, Table 8 shows that HHI is associated with reductions in hospital capital, a combination of capital-related buildings and fixtures, total fixed assets, and capital-related costs.

<table>
<thead>
<tr>
<th>Table 7 – Effect of Hospital Ownership on Property Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable:</td>
</tr>
<tr>
<td>Log(Property Tax Revenue Per Capita)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pooled OLS Fixed Effects</td>
</tr>
<tr>
<td>(1)          (2)</td>
</tr>
<tr>
<td>Percent Nonprofit</td>
</tr>
<tr>
<td>0.013        (0.219)</td>
</tr>
<tr>
<td>Percent For-Profit</td>
</tr>
<tr>
<td>-0.128       (0.294)</td>
</tr>
<tr>
<td>Percent Government</td>
</tr>
<tr>
<td>0.232        (0.272)</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>1,610        1,610</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>0.0001       0.924</td>
</tr>
</tbody>
</table>

Note: Standard errors clustered at the city level and results weighted by population.

As Table 7 illustrates, growth in the market share of for-profit hospitals within a city is associated with a statistically significant decrease in property taxes per capita. I found that a 10% increase in the for-profit share corresponds to a decrease in property taxes of roughly 2.3%. Because cities can tax land owned by for-profit hospitals, growth in the for-profit share may expand a city’s property tax base. With a broader tax base, a city’s tax burden may be spread more evenly across the population, possibly resulting in lower property taxes per capita. Growth in the nonprofit share of hospitals within a city has virtually no impact on property tax revenues. A 10% increase in the government ownership share, by contrast, increases property tax revenue by approximately 4.2%, a result that is statistically significant at the 1% level. This, too, is likely a case of reverse causality: to fund government hospital systems, cities need higher property taxes. It is worth noting that growth in the for-profit hospital share has a significantly more negative effect on property tax revenues than does an increase in the nonprofit hospital share.

Additionally, with the RAND dataset, I examined whether HHI affected capital expenditures, which could suggest that consolidation breeds construction. I next checked whether increases in capital expenditures within a city impacted tax revenues. If hospital concentration were expanding construction and construction were then raising tax revenues by increasing property values or incomes, then I could identify a possible causal mechanism.

On the first count, Table 8 shows that HHI is associated with reductions in hospital capital, a combination of capital-related buildings and fixtures, total fixed assets, and capital-related costs.

<table>
<thead>
<tr>
<th>Table 8 – Effect of HHI/System HHI on Measures of Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable:</td>
</tr>
<tr>
<td>Log(Capital-Related Buildings and Fixtures) + Log(Capital-Related Costs) + Log(Total Fixed Assets)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pooled OLS Fixed Effects</td>
</tr>
<tr>
<td>(1)          (2)</td>
</tr>
<tr>
<td>Log(HHI)      -3.888***</td>
</tr>
<tr>
<td>(0.233)</td>
</tr>
<tr>
<td>Log(System HHI)</td>
</tr>
<tr>
<td>-5.314***</td>
</tr>
<tr>
<td>(0.444)</td>
</tr>
<tr>
<td>Fixed Effects?</td>
</tr>
<tr>
<td>No           Yes</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>1,593        1,593</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>0.745        0.988</td>
</tr>
</tbody>
</table>

Note: Standard errors clustered at the city level and results weighted by population.

Additionally, with the RAND dataset, I examined whether HHI affected capital expenditures, which could suggest that consolidation breeds construction. I next checked whether increases in capital expenditures within a city impacted tax revenues. If hospital concentration were expanding construction and construction were then raising tax revenues by increasing property values or incomes, then I could identify a possible causal mechanism.

On the first count, Table 8 shows that HHI is associated with reductions in hospital capital, a combination of capital-related buildings and fixtures, total fixed assets, and capital-related costs.

Columns 1 and 2 of Table 8 feature OLS and fixed effects regression results of HHI on measures of hospital capital. Columns 3 and 4 do the same for system HHI and measures of capital. As the fixed effects results in Table 8 illustrate, a 10% increase in HHI within a city corresponds to a significant 8.3%
decrease in various measures of capital. Likewise, increases in system consolidation appear to be weakly associated with falling capital costs within a city.

When I separate these measures of capital in Table 9, I also find that HHI reduces capital costs and expenditures.

With a statistical significance of less than 1%, a 10% increase in HHI is associated with a 4% decrease in capital-related costs. Though statistically insignificant, growth in system HHI also appears to reduce capital-related costs.

Together, Tables 8 and 9 demonstrate that HHI has a significantly negative impact on capital expenditures and costs.

On the second count, however, Table 10 identifies no significant relationship between various measures of capital expenditures and taxes or property taxes.

Table 10 – Effect of Capital Asset Building Improvements Depreciated on Taxes & Property Taxes

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Log(Taxes Per Capita)</th>
<th>Log(Property Tax Per Capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled OLS</td>
<td>Fixed Effects</td>
</tr>
<tr>
<td>Log(capital-related buildings and fixtures)</td>
<td>-0.103</td>
<td>-0.028</td>
</tr>
<tr>
<td>(0.073)</td>
<td>(0.028)</td>
<td>(0.118)</td>
</tr>
<tr>
<td>Log(capital-related costs)</td>
<td>0.277***</td>
<td>0.004</td>
</tr>
<tr>
<td>(0.124)</td>
<td>(0.025)</td>
<td>(0.118)</td>
</tr>
<tr>
<td>Log(total fixed assets)</td>
<td>0.045</td>
<td>-0.018</td>
</tr>
<tr>
<td>(0.061)</td>
<td>(0.025)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Fixed Effects?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,593</td>
<td>1,593</td>
</tr>
<tr>
<td>R²</td>
<td>0.615</td>
<td>0.965</td>
</tr>
</tbody>
</table>

The estimates in columns 1 and 2 come from OLS and fixed effects regressions, respectively, of measures of capital costs and expenditures and taxes per capita. Columns 3 and 4 do the same for capital measures on property taxes. None of the estimates is large or statistically significant.

To further investigate whether changes in capital expenditures act as a causal mechanism for hospital concentration to affect taxes and property taxes, I add capital controls—the logarithms of capital-related buildings and fixtures, capital-related costs, and total fixed assets—to my fixed effects regression, in Table 11. Because only the RAND dataset contains measures of capital, the results in Table 11 are not directly comparable to those in Table 2 based on the Lincoln data.

Table 11 – Effect of HHI on Taxes/Property Taxes Without and With Controls

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Log(Taxes Per Capita)</th>
<th>Log(Property Tax Per Capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Controls</td>
<td>Controls</td>
</tr>
<tr>
<td>Log(HHI)</td>
<td>0.139</td>
<td>0.134</td>
</tr>
<tr>
<td>(0.108)</td>
<td>(0.104)</td>
<td>(0.159)</td>
</tr>
<tr>
<td>Capital Controls?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,610</td>
<td>1,593</td>
</tr>
<tr>
<td>R²</td>
<td>0.966</td>
<td>0.966</td>
</tr>
</tbody>
</table>

Columns 1 and 2 display the results of fixed effects regressions of HHI on taxes per capita without and with capital controls, respectively. Columns 3 and 4 add the results for property taxes without and with capital controls. Unlike Table 2, I find no statistically significant relationship between HHI and taxes or property taxes in Table 11. However, like my previous results, Table 11 highlights a positive, though statistically insignificant, relationship between HHI and the two measures of tax revenue. More importantly, adding capital controls hardly budges my fixed effects results and standard errors, signaling that changes in capital expenditures do not explain the positive association between hospital concentration and taxes.

Although I was unable to conclusively identify a mechanism to explain the positive relationship between HHI and taxes per capita, I can rule out two hypotheses. The first hypothesis which my analysis could not corroborate was that hospital ownership status was responsible for the positive relationship between hospital concentration and tax revenues within a city. The second hypothesis that we can discard is that,
as hospitals invested in making improvements and purchased more real estate, they drove up property values and thereby increased property tax revenues. Instead, I found no significant relationship between various measures of capital construction and tax revenues. Simultaneously, I found a significantly negative relationship between hospital concentration and capital costs, indicating that increases in HHI may stem from closing competitor hospitals, which would decrease the footprint of hospitals in a city, or that hospitals, contrary to industry claims, invest less on capital improvements in the wake of consolidation. Future research might untangle through which mechanism growth in HHI is connected to decreases in capital expenditures.

6. CONCLUSION

Using city fixed effects regressions on hospitals and municipal finances in 147 American cities from 2001 to 2014 and controlling for time effects, I found a statistically significant relationship between hospital concentration and tax revenues per capita within cities. A 10% increase in hospital concentration was associated with an approximately 1.6% increase in tax revenues per capita within a city. Although statistically insignificant, HHI and property tax revenue per capita appear to be positively correlated, with a 10% increase in HHI associated with a 2% increase in property tax revenue per capita.

Since adoption of the Affordable Care Act, hospital systems have driven the nationwide trend in hospital consolidation, according to Cooper et al. (2019). Nevertheless, compared to the relationship between HHI and taxes, that between system HHI and taxes within cities over time is weak. With a correlation of 0.93, HHI and system HHI are similar variables. Whereas HHI measures market concentration across individual hospitals within a city, system HHI measures market concentration across hospital systems within a city. That HHI has a stronger relationship with taxes than system HHI may be a sign that growth in hospital size as measured by beds, not hospital system consolidation, is responsible for the association between hospital concentration and municipal finances.

Through my heterogeneous treatment effects analysis, I determined that cities with higher tax bases and those that supported their hospitals financially exhibited stronger positive relationships between hospital concentration and tax revenues per capita, reinforcing the idea that cities with higher taxes and cities that spend on a broader scale are more likely to register changes in hospital concentration than those with low taxes and low spending.

My investigation of two possible mechanisms through which hospital concentration could impact municipal tax revenues—first, changes in ownership status and, second, changes in capital costs and expenditures—came up empty. Lacking concrete evidence of a mechanism, I am reluctant to declare that hospital concentration causes tax revenues per capita to increase within a city. However, my results suggest that changes in tax revenue are associated with changes in hospital consolidation within a city. Future research should investigate possible mechanisms for the relationship between hospital concentration and taxes, potentially confirming a causal relationship, and investigate why hospital concentration correlates to reductions in capital costs and expenditures.

7. BIBLIOGRAPHY

7.1) Data Sources


https://doi.org/10.7249/TL303

7.2) Literature Review Documents


https://doi.org/10.1016/j.jhealeco.2016.08.006.


https://doi.org/10.1016/j.surg.2016.05.027.


Reinhardt, Uwe E. “The Economics of For-Profit and Not-for-Profit Hospitals: Nonprofit Hospitals Owe Society Community Benefits in Exchange for their Tax Exemption, but What Is a Fair Amount?” *Health Affairs*, vol. 19, no. 6, November 2000.


https://doi.org/10.1016/j.jhealeco.2017.01.007.

