The ENH Effect:
Employer-Provided Health Insurance and Hospital Competition

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Abstract: In the United States, most commercial health insurance is provided as an employment benefit. This paper explores the effect of employer provision of health insurance on hospital competition. In particular, the paper models the location of the employer executives and investigates whether a merger of hospitals near executives will result in a larger price increase than a merger of competing hospitals elsewhere. This is found to be the case even when the executive has the same opportunity cost of travel as her employees and even when the executive is the sole owner of the firm, retaining all profits. This is consistent with the FTC’s findings in its recent challenge of Evanston Northwestern Healthcare’s acquisition of Highland Park Hospital. The model is further tested using hospital financial and discharge data from Florida and Texas and CEO location data from the Bureau of Labor Statistics.
1. Introduction

In January of 2000, Evanston Northwestern Healthcare (ENH)–a two hospital system located in Chicago’s north shore suburbs–purchased nearby Highland Park Hospital. At the time of the transaction, ENH’s flagship hospital, Evanston Hospital, was a relatively large hospital offering many tertiary services, such as open heart surgery and neonatal intensive care. Highland Park was a community hospital offering no tertiary services. Highland Park is located about 15 miles away from Evanston Hospital and about the same distance from ENH’s other hospital, Glenbrook Hospital (see the map in Appendix 1). Closer to Highland Park than is Evanston or Glenbrook is another community hospital, Lake Forest Hospital, roughly 6 miles northwest of Highland Park. Closer to Evanston than is Highland Park are a number of relatively large tertiary hospitals (Advocate Lutheran General Hospital, St. Francis Hospital, and Rush North Shore Medical Center).

One month later, in February of 2000, Provena St. Therese Medical Center and Victory Memorial Hospital–both located in Waukegan, Illinois–merged under the aegis of a newly formed joint venture called Vista Health. At the time of the transaction, St. Therese and Victory were both community hospitals offering roughly the same set of primary and secondary hospital services. St. Therese and Victory are the only hospitals in Waukegan and are located just 2 miles from each other. The nearest hospital outside of Waukegan is Condell Medical Center, located about 8 miles to the southwest of the Waukegan hospitals (see the map in Appendix 1).

Given this basic fact pattern, one would think that, of these two, the merger most likely to result in an increase in market power would be the merger of St. Therese and Victory. These two hospitals are geographically closer than Evanston and Highland Park and offered roughly the same services before the merger, whereas Evanston was a tertiary hospital and Highland Park only offered primary and secondary services before their merger. In addition, Evanston and Highland Park seem to have more competitors than the Waukegan hospitals and these competitors are relatively close to Evanston and Highland Park, with respect to geography and services offered. In fact, Capps, Dranove, Greenstein, and Satterthwaite (2002) cite the Waukegan merger as one that is potentially problematic, but they make no mention of the Evanston merger.
In 2002, the Federal Trade Commission opened investigations of both transactions as part of its Hospital Merger Retrospectives Project, which studied the effects of certain consummated hospital mergers. On July 1, 2004, the FTC closed its investigation of the Victory/St. Therese merger, citing a lack of evidence that the merger resulted in market power for the combined entity. However, on February 10, 2004, the FTC issued a complaint against ENH for violating antitrust laws through its merger with Highland Park, citing “significantly higher prices” after the merger.

What might explain this seemingly counterintuitive result: that, of two hospital mergers that occurred at roughly the same time and in roughly the same area of the country, the one that seemed less likely to be anticompetitive (at least based on a cursory examination of the basic facts) resulted in a significant post-merger price increase while the one that seemed more likely to be anticompetitive failed to produce a post-merger price increase? One clue to this mystery is provided by the trial testimony and memoranda of former and current Evanston and Highland Park executives. As paraphrased by FTC staff attorneys in their post trial reply brief, a former Highland Park executive testified that:

...the merged entity would have greater price ‘leverage’ because of the ‘geographical placement’ of the three ENH facilities. Within the geographic triangle live many executives who ‘make decisions about health benefits for their employers, employees,’ and have ‘immense influence and power with the health plans.’

The Court, in finding that the merger was anticompetitive, cited this testimony and a memo

2“Statement of the Federal Trade Commission, Victory Memorial Hospital/ Provena St. Therese Medical Center, File #0110225,” http://www.ftc.gov/os/caselist/0110225/040630ftcstatement0110225.htm, accessed on 10/17/05


written by a current ENH executive that made the same argument:

The inclusion of local hospitals in this particular geographic market is critical to hospital networks because, as ENH officials proclaimed, this is an area populated by ‘senior executives and decision-makers’ and it would be ‘real tough’ for any managed care organization and employer ‘whose CEOs either use [Evanston or Highland Park] to walk from [ENH] and 1700 of their doctors.’

From this evidence, it is clear that one factor contributing to ENH’s post-merger market power is the location of important healthcare decision-makers, the executives who decide which health plans will be offered to their employees. The area within the triangle formed by Evanston, Glenbrook, and Highland Park is the most affluent in the Chicago region and where many executives of Chicago-based companies reside. The executives’ proximity to Highland Park and the ENH hospitals likely make these hospitals their first and second choice if they ever need hospitalization for the most common primary and secondary services. While the Waukegan hospitals are likely closest substitutes for more potential hospital patients, ENH and Highland Park are closest substitutes for the potential patients who are also making health insurance decisions for their employees.

In the United States, most commercial health insurance is provided as an employment benefit. The employer decides which health benefit plans will be offered to employees and each employee enrolls in one of the plans or opts out of health insurance. For most large employers, third-party health insurance is not used. These employers design and “self-fund” the health benefits of their employees and bear all of the risk. These employers simply contract with managed care companies to administer their benefits and the payments to the providers associated with each plan. Although relatively uncommon, some employers even negotiate directly with providers for inclusion in their health plan.

Despite the important role of employers in the provision of health insurance, the existing models of hospital competition (Gaynor and Vogt (2003), Capps, Dranove, and Satterthwaite

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The model resembles that of Gal-Or (1999) in that hospital differentiation is represented with a circular city. However, unlike Gal-Or, the model incorporates the employer and its influence in health plan design. (2003), and Town and Vistnes (2001)) all abstract from the employer’s decision about the health benefits to offer employees. In other words, all of these models assume that the employer is a perfect agent for the employees when selecting health benefits and providers to include in its health plan. The demand for a particular hospital then becomes a function of its characteristics and the characteristics of the employees (e.g., location, demographics, diagnoses, etc.). The locations of the employees making decisions about health care for the company are not given special weight. For this reason, the existing models would most likely predict a larger price increase after the Waukegan merger than after the Evanston merger.

In this paper, I develop a model which illustrates the impact on hospital competition of employers making health care decisions for their employees. To isolate the role of employer-based health care decision-makers, the model simplifies the role of managed care companies instead of simplifying the role of employers as is standard in the current literature. The “CEO” of a company negotiates directly with hospitals for inclusion in the network that serves all of the company’s employees, including the CEO. The employees then each use the most preferred hospital in the network if hospitalization is required. In this “second stage” of competition, the employees base their decisions on non-price characteristics (e.g., location) since they pay the same coinsurance amount regardless of the network hospital they select. In this way, the model closely matches the many situations in which large employers are actively involved in designing, funding, and bearing the risk for their employees’ health insurance.

A number of important insights result from the model. First, even if the CEO has the same opportunity cost of travel as her employees, a merger of hospitals surrounding the CEO will result in a larger price increase than would result from a hospital merger occurring elsewhere. With the merger of any adjacent hospitals, the hospitals’ price will increase because, in the post-merger negotiations between the hospitals and the CEO, the CEO’s outside-option compensation from residual profits will fall since the CEO’s employees will require higher wages if the merged hospitals are not part of the health plan’s network. For a merger of hospitals surrounding the CEO, not only does the merger reduce her outside-option compensation from

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residual profits, but it also directly worsens the CEO’s outside option of expected
hospitalization. Thus, even if the CEO has the same opportunity cost of travel as her employees,
a merger of hospitals surrounding the CEO will worsen her outside option more than any other
merger of adjacent hospitals, leading to a larger price increase. This illustrates that the “Evanston
Effect” is not simply a function of the affluence—and possible higher opportunity costs of
travel—of the community between the hospitals, as some have speculated.\footnote{Ibid, page 140, in reference to Dr. Kenneth Elzinga’s testimony in the ENH trial.}

Second, the difference between the price increase from a merger of hospitals surrounding
the CEO and a price increase from another merger is inversely proportional to the share of
profits received by the CEO. As the CEO’s share of residual profit declines, the worsening of her
own outside option of expected hospitalization becomes more prominent compared to the
worsening of her compensation if an agreement cannot be reached with the merging hospitals. In
the extreme case in which the CEO receives only a fixed salary unrelated to the firm’s profits,
she will only care about the hospitals near her and these are the only hospitals that can worsen
her outside option by merging.

Third, even if the CEO receives all of the firm’s profits, the price increase from a merger
of hospitals surrounding the CEO will still be greater than a price increase from another merger.
This is because the CEO is harmed personally (through an increase in her expected travel costs if
hospitalization is necessary) in addition to the reduction in her compensation (the full employee
wage increase) that is necessary if an agreement cannot be reached.

The implications of the model are confirmed with hospital financial and discharge data
from Florida and Texas and CEO location data from the Bureau of Labor Statistics. In relatively
concentrated hospital markets in Florida and Texas, hospital prices are positively correlated with
the number of CEO’s per employee in the area, as the model predicts. This relationship exists
even after controlling for the median income of the area, again confirming that the “Evanston
Effect” is more than an income effect.

It is natural to ask why shareholders would allow this distortion which emanates from the
CEO’s influence in constructing the health plan’s provider network. Couldn’t the shareholders
offer the CEO a separate health insurance plan (say, a very generous indemnity plan which

\footnote{Ibid, page 140, in reference to Dr. Kenneth Elzinga’s testimony in the ENH trial.}
includes all hospitals) in addition to profit-sharing to better align the CEO’s incentives with that of the shareholders and employees? That is certainly possible, but it may not be likely given the relatively small benefit to the shareholders from doing so. The distortion described below only affects the post-merger prices of the hospitals surrounding the CEO. It does not affect the prices that result when other hospitals merge. Whether the CEO has her own health insurance or shares the employees’ health insurance, she will have the correct incentives to negotiate with merging hospitals not located near her if she shares some of the company’s profit. Thus, giving the CEO her own health insurance would only reduce health care costs associated with employee admissions to hospitals near the CEO which, in the inclusive health plan networks currently favored by employers, would be a very small percentage of the plan’s overall costs. In any event, recent empirical research suggests that CEOs are often not compensated in a manner that would solve all agency problems (see Bertrand and Mullainathan (2001)).

The results described in this paper have important implications for hospital merger enforcement. Obviously, patient and hospital characteristics–the factors that are used to calibrate existing models of hospital competition–are important for assessing the likely effects of hospital mergers. However, when estimating the likely effect of a hospital merger, antitrust investigators should also consider the locations of executives who choose their company’s health benefit options and the form of the executives’ compensation. The merger of ENH and Highland Park Hospital illustrates that these factors can have a non-trivial effect on post-merger hospital prices.

The following section describes the model and characterizes the pre-merger equilibrium. Section 3 describes the equilibrium that results when two hospitals merge if the hospitals do not surround the healthcare decision-maker of the firm. Section 4 characterizes the equilibrium that results when the two hospitals surrounding the healthcare decision-maker merge and juxtaposes this price with the price found in Section 3. Section 5 describes the data and methods used to test some of the implications of this model and the results of the data analysis. Section 6 concludes.

2. Model

One of the most important factors in a patient’s decision to be treated at a hospital is the hospital’s proximity to the patient. However, unlike most markets with geographic differentiation, insured patients largely ignore price when making decisions about the hospital to
Most HMO plans offer no coverage outside of the network. PPO plans usually offer some coverage outside of the network, but the amount that is the patient’s responsibility is much larger for out-of-network hospitals than for in-network hospitals, giving the patients a strong incentive to only use in-network hospitals.

This is not to say that price is irrelevant for hospital competition. The choice of which providers to include in a health plan’s network—what is often referred to as the first stage of hospital competition—is largely a function of price. This first stage of competition involves often simultaneous negotiations between the health plan and the providers wishing to gain or retain access to the health plan’s insured members. Thus, a model of hospital competition should reflect the first-stage simultaneous negotiations that determine price as well as the second stage choices of insured patients that are largely based on non-price factors, such as location.

Consider a circular city with a circumference of one, similar to the circular city in Salop (1979). Evenly distributed around this circle are N hospitals and M+1 (>>N) employees/potential patients. The hospitals locations are fixed and no hospital entry is permitted, reflecting the hospital markets of many states (including Illinois) that are constrained by certificate of need regulations that severely restrict hospital movement, entry, or expansion. The M+1 potential patients consist of M insured employees and a CEO who represents the employees in the negotiations with the hospitals that result in the company’s health plan. Note that the role of the managed care company is deliberately minimized to focus attention on the employer and its decision-makers who have “immense influence” with the managed care companies.

Each employee has a travel cost of $c_i(t) = kt^\beta$, where $t$ is the distance traveled to hospital $i$, $k > 0$, and $\beta \geq 1$. Since the employee pays the same co-pay for any hospital in the network and pays a much larger co-pay for any hospital outside of the network, the employee will seek

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*Most HMO plans offer no coverage outside of the network. PPO plans usually offer some coverage outside of the network, but the amount that is the patient’s responsibility is much larger for out-of-network hospitals than for in-network hospitals, giving the patients a strong incentive to only use in-network hospitals.*
treatment, if needed, from the nearest network hospital. Let \( q \) be the probability that an employee (including the CEO) will need hospitalization. For simplicity, the employee’s in-network co-pay is normalized to zero.

If all \( N \) hospitals are included in the firm’s health care network, the firm’s expected variable profit (i.e., above the CEO’s fixed salary) is:

\[
\prod^F = R - Mw - \frac{q(M + 1)}{N} \sum_{i=1}^{N} p_i
\]

where \( R \) is the firm’s revenue, \( w \) is the average wage for each employee, and \( p_i \) is the price of an admission at hospital \( i \). The firm’s only costs are labor costs and direct healthcare costs. The firm does not employ outside insurance, but instead pays the hospital costs directly and bears all of the risk. It is assumed that the firm’s demand for labor is perfectly inelastic at \( M \).

Each employee is risk neutral with a reservation wage normalized to zero. Each employee is paid the wage that compensates him for his expected travel cost to the nearest hospital. If all \( N \) hospitals are in the health plan’s network, the average wage is:

\[
w = 2Nqk \int_0^{\frac{M}{2}} t^\beta dt = \frac{qk}{(\beta + 1)(2N)^\beta}
\]

Therefore, when all hospitals are in the network, the firm’s expected variable profit is:

\[
\prod = R - \frac{Mqk}{(\beta + 1)(2N)^\beta} - \frac{q(M + 1)}{N} \sum_{i=1}^{N} p_i
\]

The CEO, who is risk neutral, receives a fixed salary \( s \) and also receives a share \( \alpha \in (0,1] \) of the firm’s variable profits. The CEO’s travel cost to a hospital is \( k_\mu t^\beta \). The CEO lives halfway between hospitals \( \mu \) and \( \mu + 1 \) where \( \mu \in \{1, 2, ..., N\} \). The point halfway between \( \mu \) and \( \mu + 1 \) is chosen for the CEO’s location to isolate the effect of the merger of hospitals surrounding the CEO from other mergers. If, for instance, the CEO lived closer to \( \mu \) than \( \mu + 1 \), the pre-merger price of \( \mu \) would be higher than the price of other hospitals, reflecting the CEO’s preference for
μ. If μ and μ-1 merged, the price of the combined entity would be higher than the price of any other two merged hospitals, but only because of the CEO’s preference for μ, not because there is anything special about the merger. The CEO’s payoff, when all N hospitals are in the network, is then:

\[
V = \alpha \left[ R - \frac{Mqk}{(\beta + 1)(2N)^\beta} - \frac{q(M + 1)}{N} \sum_{i=1}^{N} p_i \right] + s - \frac{qk_c}{(2N)^\beta}
\]  

Since the N hospitals are evenly distributed around the city, each hospital can expect to treat \( q(M+1)/N \) patients if all of the hospitals are in the network. Each hospital has a constant marginal and average cost of treating patients and this is normalized to zero. The profit from treating patients outside of the health plan (e.g., Medicare, self-paying, etc.) is normalized to zero as well. Hospital \( i \)'s net profit, if \( i \) is in the health plan’s network, is:

\[
\Pi_i = \frac{q(M + 1)p_i}{N}
\]

If hospital \( i \) is not included in the health plan’s network, then the wages paid to the firm’s employees will increase on average because the employees who live closest to hospital \( i \) will require compensation for the higher expected travel cost of traveling to hospital \( i-1 \) or \( i+1 \). In this case, the additional amount of total wages necessary to compensate these employees near hospital \( i \) is:

\[
2Mqk \int_0^{\frac{1}{N}} \left[ \left( \frac{1}{N} - t \right)^\beta - t^\beta \right] dt = \frac{4Mqk(2^\beta - 1)}{(\beta + 1)(2M)^{\beta+1}}
\]

Thus, the net gain to the CEO from including hospital \( i \) in the network is:

\[
V - V_{-i} = \alpha \left[ \frac{4Mqk(2^\beta - 1)}{(\beta + 1)(2N)^{\beta+1}} + \frac{(M + 1)}{2N} (p_{i-1} + p_{i+1}) - \frac{(M + 1)p_i}{N} \right]
\]

The CEO and the hospitals engage in N simultaneous negotiations to determine the price
at which the hospital will be in the plan’s network. Each negotiation results in the Nash bargaining solution (i.e., an equal division of the net gains from reaching an agreement). In this sense, the model is similar to Stole and Zwiebel (1996) except that the negotiations are simultaneous and not sequential. There are two reasons for the choice of simultaneous negotiations. First, and most importantly, each health plan often negotiates simultaneously with multiple hospitals (and hospitals often negotiate simultaneously with multiple health plans). This is particularly true in areas where the convention is to negotiate annual contracts. But, even in areas where “evergreen” contracts are common, multiple negotiations can be occurring at the same time. Second, in Stole and Zwiebel (1996), in which a firm pair-wise negotiates with multiple workers, the workers are identical so the equilibrium is independent of the ordering of negotiations. In the context of pair-wise CEO/hospital negotiations, when two hospitals merge, hospitals are no longer identical; even non-merging hospitals are differentiated by their distance from the merging hospitals. In this case, the ordering of negotiations could affect the equilibrium and it is not clear what ordering would result post-merger. Any model with sequential negotiations would need to endogenize the ordering of negotiations and, given that many health plan/hospital negotiations occur simultaneously, this seems unnecessarily complex.

Each negotiation between the CEO and hospital i (for \( i = 1, \ldots, N \)) will solve:

\[
\max_{a_i} \prod_i [v_i - v_{-i}] = \frac{\alpha q^2 (M + 1) p_i}{N} \left[ \frac{4 Mk(2^\beta - 1)}{(\beta + 1)(2N)^{2\beta+1}} + \frac{(M + 1)\left(p_i - 1 + p_{i+1}\right)}{2N} - \frac{(M + 1)p_i}{N} \right]
\]

The solution to this maximization problem is:

\[
P_i = \frac{Mk(2^\beta - 1)}{(M + 1)(\beta + 1)(2N)^\beta} + \frac{(p_{i-1} + p_{i+1})}{4}
\]

By symmetry (since this is before any merger has occurred), we know that \( p_i = p_{i-1} = p_{i+1} \). Therefore, the equilibrium in which all of the CEO/hospital negotiations conform to the Nash bargaining solution is:

\[
P_i = \frac{2 Mk(2^\beta - 1)}{(M + 1)(\beta + 1)(2N)^\beta}
\]
It is assumed that hospital systems negotiate on an all-or-nothing basis (i.e., all of the hospitals are included in the contract or none are included), which is consistent with the negotiating practices of most hospital systems, included ENH. Obviously, merger effects can occur even when commonly owned hospitals negotiate separately.

\[ (11) \quad \Omega = \frac{1}{(M + 1)(\beta + 1)(2N)^\beta} \]

The pre-merger equilibrium then can be expressed as:

\[ (12) \quad p_i = 2\Omega M^\kappa (2^\beta - 1) \]

### 3. Post-Merger Equilibrium

Suppose hospitals \( i \) and \( i+1 \) merge (where \( i \neq \mu \)). In this case, if the CEO and the merged hospitals fail to reach an agreement, the increase in the firm’s total wage costs will be:

\[ (13) \quad 2Mqk \int_0^{\frac{1}{N}} \left[ \left( \frac{1}{N} - t \right)^\beta - t^\beta \right] dt + 2Mqk \int_0^{\frac{1}{N}} \left[ \left( \frac{1}{N} + t \right)^\beta - t^\beta \right] dt = \frac{6Mqk(3^\beta - 1)}{(\beta + 1)(2N)^{(\beta + 1)}} \]

because the employees located near \( i \) and \( i+1 \) will require compensation for the expected costs of traveling to hospital \( i-1 \) or \( i+2 \). The CEO’s payoff if all \( N \) hospitals are in the network (\( V \)) is the same as before, except that \( p_i = p_{i+1} \) since, within the merged entity, the hospital campuses are symmetric. Therefore, the CEO’s net gain from reaching an agreement with the merged hospitals is:

\[ (14) \quad V - V' = \alpha q \left[ \frac{6M^\kappa (3^\beta - 1)}{(\beta + 1)(2N)^{(\beta + 1)}} + \frac{(M + 1)}{N} (p_{i-1} + p_{i+2}) - \frac{2(M + 1)p_i}{N} \right] \]

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\(^9\) It is assumed that hospital systems negotiate on an all-or-nothing basis (i.e., all of the hospitals are included in the contract or none are included), which is consistent with the negotiating practices of most hospital systems, included ENH. Obviously, merger effects can occur even when commonly owned hospitals negotiate separately.
since the employees closest to i and i+1 would go to hospitals i-1 and i+2 without an agreement. The negotiation between the CEO and the merged hospital will maximize the Nash product as before:

\[
(15) \text{Max}_N \prod_i (V_i - V_{i-1}) = \frac{2 \alpha \eta^2 (M + 1)}{N} \left[ \frac{M \gamma (2^\gamma - 1)}{(2M)^\gamma} + \frac{(M + 1)}{N} (p_{i-1} + p_{i+2}) - \frac{2(M + 1)p_1}{N} \right]
\]

The \( p_i \) which “splits the pie” between the CEO and the merged hospital is:

\[
(16) \quad p_i = \frac{3\Omega M \gamma (3^\gamma - 1)}{4} + \frac{p_{i-1} + p_{i+2}}{4}
\]

In this post-merger world, it is no longer possible to use complete symmetry to solve for the equilibrium as was possible before the merger. The merged hospital, with two campuses, is different from all of the hospitals which have only one campus and even the one-campus hospitals are distinguished from each other by their distance from the merged hospitals. However, there is a limited symmetry that can be used to solve for the equilibrium. To see this, it is useful to consider an example. Suppose \( N = 12 \) and hospitals 6 and 7 merge. The merged hospital campuses are symmetric within the merged entity, so \( p_6 = p_7 \). Expanding out, \( p_6 = p_8 \) because hospitals 5 and 8 are the same distance from a merged campus. Likewise, \( p_4 = p_9, p_5 = p_{10}, p_2 = p_{11}, \) and \( p_1 = p_{12} \). Therefore, it is sufficient to only consider one “side” of the circular city when solving for the equilibrium.

Furthermore, the fact that \( p_1 = p_{12} \) can be used to derive an equation for the equilibrium value of \( p_1 \) as a function of \( p_2 \) using (9) above (which characterizes the equilibrium price for non-merging hospitals):

\[
(17) \quad p_1 = \Omega M \gamma (2^\gamma - 1) + \frac{p_{12} + p_2}{4} \Rightarrow p_1 = \frac{4\Omega M \gamma (2^\gamma - 1) + p_2}{3}
\]

Condition (9) also produces analogous equations for \( p_2, p_3, p_4, \) and \( p_5 \). Condition (16) above, which describes the merged hospitals’ equilibrium price, coupled with the fact that \( p_5 = p_8 \) produces an independent expression of \( p_6 \) as a function of \( p_5 \):
A similar result obtains when $N$ is odd.

Thus, the equilibrium when there are 12 hospitals and hospitals 6 and 7 merge is characterized by the following system of equations:

$$
\begin{bmatrix}
3 & -1 & 0 & 0 & 0 & 0 \\
-1 & 4 & -1 & 0 & 0 & 0 \\
0 & -1 & 4 & -1 & 0 & 0 \\
0 & 0 & -1 & 4 & -1 & 0 \\
0 & 0 & 0 & -1 & 4 & -1 \\
0 & 0 & 0 & 0 & -1 & 2
\end{bmatrix}
\begin{bmatrix}
p_1 \\
p_2 \\
p_3 \\
p_4 \\
p_5 \\
p_6
\end{bmatrix}
=
\begin{bmatrix}
4\Omega MK(2^\beta - 1) \\
4\Omega MK(2^\beta - 1) \\
4\Omega MK(2^\beta - 1) \\
4\Omega MK(2^\beta - 1) \\
4\Omega MK(2^\beta - 1) \\
3\Omega MK(3^\beta - 1)/2
\end{bmatrix}
$$

The coefficient matrix on the lefthand side is invertible with the equilibrium price of the merged hospital given by:

$$p_6 = \frac{\Omega MK[836(2^\beta - 1) + 856.5(3^\beta - 1)]}{989}$$

The previous result can be generalized to $N$ hospitals (where $N$ is even$^{10}$). Without loss of generality, assume that the merging hospitals are $i = N/2$ and $i+1 = (N/2)+1$. The system of equations that characterize the equilibrium is given by $Ap=b$ where $A$ is an $(N/2)\times(N/2)$ matrix:

$^{10}$A similar result obtains when $N$ is odd.
\[ \mathbf{b} = \begin{bmatrix} 4 \Omega \mathcal{M} \kappa (2^b - 1) \\ 4 \Omega \mathcal{M} \kappa (2^b - 1) \\ \vdots \\ 4 \Omega \mathcal{M} \kappa (2^b - 1) \\ 3 \Omega \mathcal{M} \kappa (3^b - 1)/2 \end{bmatrix} \]

Define \( \varphi_j \) as a second-order linear recurrence with initial values \( \varphi_1 = 1, \varphi_2 = 3 \), and \( \varphi_j = 4\varphi_{j-1} - \varphi_{j-2} \) for \( j > 2 \). The last row of \( \mathbf{A}^{-1} \) is:

\[ \begin{bmatrix} \phi_1 \\ 2\phi_1 - \phi_{-1} \\ \phi_2 \\ 2\phi_2 - \phi_{-1} \\ \phi_3 \\ \vdots \\ \phi_j \\ 2\phi_j - \phi_{-1} \end{bmatrix} \]

Therefore, the equilibrium price of the merged hospital is:
A few steps of algebra (contained in Appendix 2) confirm that the post-merger price of the merged firm given in (24) is strictly greater than the pre-merger price given in (12) for all $\beta \geq 1$. In other words, the merger of two adjacent hospitals leads to a price increase. This is due to a worsening of the CEO’s outside option after the merger since dropping two adjacent hospitals requires a disproportionately larger wage increase than dropping one.

4. Merger of Hospitals Surrounding the CEO

Now suppose that the hospitals surrounding the CEO merge; in other words, $i = \mu$. Again, without loss of generality, assume that $N$ is even and $i = \mu = N/2$. In this case, not only will the firm pay higher wages to its employees if an agreement with the merged hospitals cannot be reached, but the CEO will be harmed personally with an increased expected travel cost of her own since she too lives directly between the merging hospitals. In this case, the CEO’s net gain from reaching an agreement with the merged hospitals is:

\begin{equation}
V - V_{-i} = \alpha N \left[ \frac{6 M \phi_k (3 \beta - 1)}{(\beta + 1)(2N)^{\beta+1}} + \frac{(M + 1)}{N} (P_{i-1} + P_{i+2}) - \frac{2(M + 1)P_i}{N} \right] + \frac{\phi_k (3 \beta - 1)}{(2N)^{\beta}}
\end{equation}

since she would have to travel to $i-1$ or $i+2$ without an agreement with the merged hospitals. The negotiation between the CEO and the merged hospital solves:

\begin{equation}
\max_k \frac{\alpha^2}{N} \left[ \frac{(6 M \phi_k + 2N(\beta + 1)\phi_k)(3 \beta - 1)}{(\beta + 1)(2N)^{\beta+1}} + \frac{\alpha(M + 1)}{N} (P_{i-1} + P_{i+2}) - \frac{2\alpha(M + 1)P_i}{N} \right]
\end{equation}

The price which maximizes (26) is:
Again, the conditions which characterize the prices for the non-merging firms are given by (9), so the equilibrium in this case is given by $A p = b$ as it was in Section 3, except that $b$ is now:

\[
\begin{pmatrix}
4\Omega M k (2^\beta - 1) \\
4\Omega M k (2^\beta - 1) \\
\vdots \\
4\Omega M k (2^\beta - 1) \\
\Omega [3\alpha M k + N (\beta + 1) k_c] (3^\beta - 1) \\
\end{pmatrix}
\]

Comparing the merged hospital’s price when the merging campuses surround the CEO (given by (29)) and the price resulting from a merger elsewhere (given by (24)), we see that:

\[
p_i^c - p_i^m = \frac{\Omega N (\beta + 1) (3^\beta - 1) \phi_i}{4 \phi_i - 2 \phi_{i-1}} \left[ \frac{k_c}{\alpha} \right] > 0
\]

Condition (30) reveals a great deal about the effect of the CEO’s location on hospital competition and the price increase associated with the merger of adjacent hospitals. First, notice that $p_i^c - p_i^m > 0$ even if $k_c = k$. In other words, even if the CEO has the same travel cost as her
employees, a merger of hospitals surrounding the CEO will lead to a larger price increase than a merger of adjacent hospitals elsewhere. While a merger of hospitals in an affluent area may lead to a larger price increase than a merger of hospitals in a less prosperous area because of the higher opportunity cost of travel of the patient population, there is an additional price effect if the executives who choose health benefit plans for their employees also live in this area. The former effect can be captured by a model, such as Capps, Dranove, and Satterthwaite (2003), that differentiates travel patterns by income, but the latter effect cannot be since the locations of healthcare decision-makers are not given special weight.

Second, notice that $p_c - p_m$ is inversely proportional to $\alpha$. In other words, as the CEO’s share of the firm’s profit decreases, the difference between the price of merged hospitals surrounding the CEO and the price of merged hospitals elsewhere increases. This is because a merger of the hospitals near the CEO directly affects the CEO by increasing her expected travel cost if an agreement is not reached with the merged hospitals. A merger of hospitals elsewhere only affects the CEO by reducing her compensation from profits if an agreement cannot be reached. If she gets a relatively small share of the firm’s profit, this reduction in compensation will be relatively small. Thus, when the CEO receives a relatively small share of the firm’s profit, not reaching an agreement with hospitals near the CEO reduces her expected payoff much more than not reaching an agreement with hospitals elsewhere. In the extreme in which the CEO receives only a fixed salary unrelated to profit (i.e., as $\alpha$ approaches zero), a merger of hospitals not near the CEO will not affect her bargaining position at all. Only the merger of hospitals surrounding the CEO will lead to a worsening of her bargaining position and, thus, a price increase.

Third, notice that $p_c - p_m$ is positive even when $\alpha = 1$. In other words, even if the CEO is the sole owner of the firm, receiving all profits, a merger of hospitals surrounding the CEO will lead to a larger price increase than a merger of adjacent hospitals elsewhere. This is because failure to reach an agreement with the hospitals surrounding the CEO leads to an increase in the CEO’s expected travel costs and a reduction in profits because the employees must be paid more with the smaller hospital network. A merger of adjacent hospitals elsewhere only leads to a reduction in profits because the employees must be paid more with the smaller hospital network. A merger of adjacent hospitals elsewhere does not directly affect the CEO’s expected travel
costs. Therefore, the hospitals surrounding the CEO will gain more bargaining leverage with the CEO through a merger than adjacent hospitals elsewhere, even if the CEO receives all of her firm’s profit.

5. Empirical Analysis

Empirically testing the implications and predictions of the previous model is difficult because it requires knowledge of the CEO’s location. For obvious reasons, a CEO’s residential address is usually not public information. However, the Bureau of Labor Statistics’ Occupational Employment Statistics program provides estimates of the number of employees working in various occupations in each of the Metropolitan Statistical Areas in the U.S. One of the employee classifications for which BLS provides estimates is chief executive. Thus, using BLS data, it is possible to calculate the number of CEOs per employee in each MSA in the U.S. One testable implication of the previous model is that, in relatively concentrated hospital markets (e.g., those that have experienced mergers leading to relatively high levels of concentration), hospital prices should be higher when there are more CEOs per worker. Furthermore, this relationship should hold even after controlling for differences in income levels across areas.

To test this hypothesis, I use 2002 hospital financial and inpatient discharge data from the Florida Agency for Health Care Administration, the Texas Department of Health and the Texas Health Care Information Council. Florida and Texas both collect detailed financial information from each hospital in the state, including the net revenue (i.e., after contractual discounts) received from managed care patients. The dependent variable in the analysis below—the proxy for the price paid by managed care patients—is the net revenue per discharge for managed care patients at each hospital.

The hypothesis from the model is that this price is positively correlated with the number of CEOs per worker in relatively concentrated markets. In order to test this hypothesis, it is necessary to group hospitals by the level of competition they face. The most commonly used measure of market concentration is the Herfindahl-Hirschman Index (HHI): the sum of the squares of the market shares for the firms in the market. The primary problem with the HHI is that it is obviously very sensitive to market definition. Previous studies using the HHI have defined the market using political boundaries (e.g., counties and MSAs) or radii from the
hospital. While these market definitions are empirically convenient, they may be a poor proxy for the competition actually faced by a hospital, since they incorporate no information about patient preferences. For instance, hospitals within an MSA, particularly a large urban area, may face different levels of competition.

Given the problems of defining hospital markets, some researchers studying hospital competition have employed a variant of the HHI that does not require market definition, which I will denote as the System-Specific HHI (SSHHI). The SSHHI is calculated by first dividing patients into classes (e.g., zip codes) and calculating the HHI for each class. For each hospital system, the SSHHI is then the weighted average of all of the micro-HHIs, where the weights are based on the importance of each patient class to that hospital system. This measure correctly reflects the fact that hospital systems face different levels of competition depending on the competition they face for each of the groups of patients they serve. Capps and Dranove (2004) employ the SSHHI to show that mergers of competing hospitals often lead to higher managed care prices. A detailed description of how the SSHHI is calculated is attached in Appendix 3.

Hospitals are divided into two groups: those facing relatively little competition (i.e., those with an SSHHI greater than the median SSHHI) and those in relatively competitive environments (i.e., those with an SSHHI less than the median SSHHI). Within each group, the managed care price of the hospital is modeled as a function of the number of CEOs per 1000 employees (CW) in the hospital’s MSA, as well as cost shifters (X) and demand shifters (Y):

\[
\begin{align*}
    p_{mc}^h &= F(CW, X, Y) \\
           &= F(CW, X, Y)
\end{align*}
\]

The primary determinant of a hospital’s cost is the mix of diagnoses seen and procedures performed by the hospital. To measure the cost associated with each hospital’s managed care patient mix, I use the case mix index for the hospital’s managed care patients. The case mix index for a group of patients is the mean Diagnosis Related Group (DRG) weight. Each year, the Centers for Medicare and Medicaid Services calculates a weight for each DRG which reflects the

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\[^{11}\text{There is, of course, an endogeneity problem with this classification as the SSHHI is based on sub-market shares and a hospital could have large shares (and, thus, a large SSHHI) in part due to a low price. To correct this problem, instead of using 2002 market shares to calculate the SSHHI, I use the predicted market shares based on the 2002 hospital system configuration and 1999 market shares to calculate the SSHHI for each hospital system.}\]
average relative resource use associated with that diagnosis or procedure. For example, in 2002, the DRG weight for a liver transplant was 8.04 while the DRG weight for a cesarean section without complications was 0.68. Thus, the case mix index for a hospital’s managed care patients represents the average expected resource use for that group of patients.

As a proxy for costs shared across patients, I use the mean hourly wage for healthcare practitioners and technical occupations (e.g., nurses, lab technicians, etc.) in the hospital’s MSA from the BLS’s Occupational Employment Statistics. To capture the possibility of economies or diseconomies of scale, I also use the hospital’s number of staffed beds as an independent variable. It is generally assumed that hospitals with teaching programs have higher costs, so I also include a teaching dummy variable.

To capture shifts in hospital demand, I use the population and the median household income of the county in which the hospital resides from 2002 Census estimates. To test the model, it is particularly important to control for differences in income since one might expect that areas with a higher proportion of CEOs would also have higher median incomes. Some have speculated that the “ENH Effect” is due to the higher incomes in the area around the hospitals and not its concentration of chief executives.

Finally, I include a dummy for investor ownership (“Profit”) since past research has shown that for-profit hospitals charge higher prices than non-profit hospitals, all else equal. I also include a dummy for the hospital’s state (“Florida”). Only private, urban, short-term, general, acute-care hospitals that reported managed care inpatient net revenues and discharges are included in the analysis. There are 221 such hospitals in Florida and Texas. Table 1 below lists the summary statistics of the variables. All non-dummy variables were log transformed and the coefficient estimates were calculated using ordinary least squares.

---

12 The correlation coefficient between the two is 0.31.

13 A detailed description of the variables is included in Appendix 4.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managed Care Price</td>
<td>$11,110</td>
<td>$9,067</td>
<td>$1,079</td>
<td>$84,533</td>
</tr>
<tr>
<td>CEO/1000Employees</td>
<td>3.76</td>
<td>0.88</td>
<td>2.19</td>
<td>6.10</td>
</tr>
<tr>
<td>SSHHI</td>
<td>0.4048</td>
<td>0.0764</td>
<td>0.1878</td>
<td>0.8458</td>
</tr>
<tr>
<td>Case Mix Index</td>
<td>1.113</td>
<td>0.272</td>
<td>0.655</td>
<td>1.975</td>
</tr>
<tr>
<td>Median Income</td>
<td>$39,440</td>
<td>$7,866</td>
<td>$24,449</td>
<td>$75,866</td>
</tr>
<tr>
<td>Population</td>
<td>1,084,652</td>
<td>1,018,088</td>
<td>16,750</td>
<td>3,540,254</td>
</tr>
<tr>
<td>Health Wage</td>
<td>$25.40</td>
<td>$2.14</td>
<td>$19.57</td>
<td>$30.46</td>
</tr>
<tr>
<td>Staffed Beds</td>
<td>234</td>
<td>229</td>
<td>0</td>
<td>1,718</td>
</tr>
<tr>
<td>Profit</td>
<td>0.49</td>
<td>0.50</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Teach</td>
<td>0.17</td>
<td>0.37</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Florida</td>
<td>0.48</td>
<td>0.50</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 2 below lists the estimated coefficients and standard errors. As seen in Table 2, for hospitals facing relatively little competition (denoted as “Concentrated”), there is a statistically significant relationship between the number of CEOs per worker in the hospital’s area and the hospital’s managed care price. A ten percent increase in the number of CEOs per 1000 workers roughly corresponds to a 6.7 percent increase in price for these hospitals. Of particular note, this relationship exists even after controlling for the effects of income (which turn out not to be significant). However, the relationship does not exist for hospitals in competitive areas. Overall, the data provides confirmation for the predictions of the model: in concentrated hospital markets, hospitals located near large numbers of CEOs can negotiate higher managed care prices.
### Table 2
DV: Managed Care Price

<table>
<thead>
<tr>
<th>Variable</th>
<th>Concentrated</th>
<th>Unconcentrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEOs/1000Employees</td>
<td>0.669***</td>
<td>-0.181</td>
</tr>
<tr>
<td></td>
<td>(0.191)</td>
<td>(0.468)</td>
</tr>
<tr>
<td>Case Mix Index</td>
<td>0.953***</td>
<td>0.960***</td>
</tr>
<tr>
<td></td>
<td>(0.129)</td>
<td>(0.202)</td>
</tr>
<tr>
<td>Median Income</td>
<td>-0.177</td>
<td>-0.109</td>
</tr>
<tr>
<td></td>
<td>(0.211)</td>
<td>(0.229)</td>
</tr>
<tr>
<td>Population</td>
<td>-0.109***</td>
<td>-0.048</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Health Wage</td>
<td>-0.552</td>
<td>0.176</td>
</tr>
<tr>
<td></td>
<td>(0.336)</td>
<td>(0.699)</td>
</tr>
<tr>
<td>Staffed Beds</td>
<td>0.040</td>
<td>0.168*</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.098)</td>
</tr>
<tr>
<td>Profit</td>
<td>0.006</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.072)</td>
</tr>
<tr>
<td>Teach</td>
<td>-0.089</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>(0.078)</td>
<td>(0.155)</td>
</tr>
<tr>
<td>Florida</td>
<td>0.091</td>
<td>-0.459**</td>
</tr>
<tr>
<td></td>
<td>(0.139)</td>
<td>(0.194)</td>
</tr>
</tbody>
</table>

| N                          | 120          | 101            |
| F                          | 17.209       | 10.191         |
| R²                         | 0.490        | 0.399          |
| AdjR²                      | 0.448        | 0.340          |

Huber-White robust standard errors in parentheses
* p<.1; ** p<.05; *** p<.01
6. Conclusion

Hospital competition is unusual because the ultimate consumers of the hospital’s services—the patients—do not select a hospital based on price. Patients select hospitals from within their health plan’s network based on non-price factors, such as location and quality. Prices are set at the first stage of competition: the negotiations that determine whether the hospital will be included in the health plan’s network.

Another unusual aspect of hospital competition—an aspect not fully captured by previous models—is that the consumers at the first stage of competition are the managed care companies and their clients, the employers, who are choosing the health plans to offer their employees. As this paper illustrates, the locations of the decision-makers who are choosing the health plans (to which they and their employees will have access) will affect the negotiations between the employers/managed care companies and the hospitals. As in the case of ENH’s purchase of Highland Park Hospital, a merger of hospitals close to these employer-based healthcare decision-makers will lead to a larger price increase than a merger of competing hospitals elsewhere. This is confirmed with data from Florida and Texas showing that hospitals facing little competition in areas with a relatively large proportion of CEOs can charge higher prices than hospitals that simply face little competition.

This has important implications for hospital antitrust enforcement. One factor antitrust regulators and the courts should consider when assessing the likely effects of a hospital merger is the location and compensation arrangements of the executives who are choosing the health plans to offer their employees. All else equal, a merger of hospitals in the area where most executives live is more likely to lead to market power than mergers elsewhere, particularly if the executives’ compensation is not tied to company profits. This is true even if the executives have the same opportunity cost of travel as their employees.
References:
Appendix 1: Map of the North Shore of Chicago
Appendix 2: Post-Merger Price is Greater Than Pre-Merger Price

When $\beta = 1$, the coefficient of $\Omega_{Mk}$ in (24) is:

$$\frac{4\sum_{j=1}^{i-1} \phi_j + 3 \phi_i}{2 \phi_i - \phi_{i-1}} = \frac{4\sum_{j=1}^{i-1} \phi_j + \phi_i + 2 \phi_i - \phi_{i-1} + \phi_{i-1}}{2 \phi_i - \phi_{i-1}} + 1$$

Looking at the first part of this expression:

$$\frac{4\sum_{j=1}^{i-1} \phi_j + \phi_i + \phi_{i-1}}{2 \phi_i - \phi_{i-1}} = \frac{4\sum_{j=1}^{i-1} \phi_j + 4 \phi_{i-1} - \phi_{i-2} + \phi_{i-1}}{2(4 \phi_{i-1} - \phi_{i-2}) - \phi_{i-1}} = \frac{4\sum_{j=1}^{i-1} \phi_j + 3 \phi_{i-2} + 9 \phi_{i-1}}{7 \phi_{i-1} - \phi_{i-2}} > 1$$

Thus, for $\beta = 1$, the post-merger price given in (24) is strictly greater than $2\Omega_{Mk}$ (i.e., the pre-merger price given in (12)). It follows from (24) and (12) that the post-merger price is then greater than the pre-merger price for all $\beta \geq 1$. 
Appendix 3: Calculation of the SSHHI

Competition is measured using the system-specific Herfindahl-Hirschman Index (SSHHI). This measure avoids the problems associated with market definition by first dividing the patient population into groups and then calculating a competition index for each patient group. The level of competition faced by each hospital system is then the weighted average of the group competition indices where the weights reflect the importance of each group to that system.

I used patient groups based on zip codes and the classifications of Diagnosis Related Groups (DRGs) used in Town and Vistnes (2001) which reflect general categories of resource use. Zip code and diagnosis-based patient groups are used to reflect the importance of distance in a patient’s choice of hospital and the fact that patients are generally willing to travel farther for more complex diagnoses. The four Town and Vistnes (2001) DRG groups are used instead of the roughly 500 DRGs to insure a sufficient sample size in each patient group.

Suppose there are M zip codes in the state. Define patient group \( z_k \) as the managed care patients from zip code \( z \) with diagnosis in group \( k \). Each hospital system \( h \) serves a share \( s_{h,z_k} \) of the managed care patient’s in this group, equal to the patients in \( z_k \) who go to system \( h \) divided by the total number of managed care patients in \( z_k \). Of each hospital system’s managed care patients, the share \( \rho_{h,z_k} \) come from group \( z_k \). If there are \( N \) hospital systems in the state, the SSHHI for system \( h \) is:

\[
SSHHI_{h} = \sum_{x=1}^{M} \sum_{k=1}^{4} \rho_{h,z_k} \sum_{h=1}^{N} (s_{h,z_k})^2
\]

A hospital system that has a monopoly in all groups from which it takes patients would have a SSHHI of 1.

---

\(^{14}\)Group 1: DRGs with a weight \( \geq 2 \); Group 2: DRGs with a weight \( \geq 1.27 \) and \(< 2 \); Group 3: DRGs with a weight \( \geq 0.91 \) and \(< 1.27 \); Group 4: DRGs with a weight \(< 0.91 \). DRG weights are defined using the contemporaneous fiscal year definitions found in the Federal Register.
Appendix 4: Data and Variable Construction

**Florida:**

**Hospital Universe:**
All short-term general acute care (hospital type = A or D) hospitals in the state of Florida operating between 1999 and 2002, excluding the following:
1. Hospitals for which financial information is not available.
2. Hospitals that listed no revenue from managed care inpatients in 1999 or 2002 or listed a managed care price increase of over 2000% between 1999 and 2002.
3. Public hospitals
4. Hospitals in rural areas

Note: All short-term general acute care hospitals are included in the calculation of the competition measures, even if they do not satisfy 1-4.

**Variables:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>managed_care_price02</td>
<td>(insurance charge-based net inpatient revenue + other charged-based payers net inpatient revenue + commercial HMO net inpatient revenue + commercial PPO net inpatient revenue + other commercial discounted payers net inpatient revenue)/(\text{acute care insurance charge-based inpatient admissions + acute care other charge-based inpatient admissions + acute care commercial HMO/PPO inpatient admissions + acute care other discounted inpatient admissions})</td>
<td>Florida Hospital Financial Data, Florida Agency for Health Care Administration (AHCA)</td>
</tr>
<tr>
<td>ceo_pct1000</td>
<td>(\text{(number of chief executives/total employment)}*1000 \text{(unique to each MSA)})</td>
<td>Occupational Employment Statistics, Bureau of Labor Statistics</td>
</tr>
<tr>
<td>sshhi02 (SSHHI)</td>
<td>weighted average Herfindahl-Hirschman Index for insured patients based on 1999 discharges and system02 (unique to each hospital system)</td>
<td>Florida Hospital Inpatient Data, AHCA</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>system02</td>
<td>owner of the hospital</td>
<td>Florida Hospital Financial Data, AHCA and the AHA Guide to Hospitals, 1999-2000 and 2002-2003 editions</td>
</tr>
<tr>
<td>cmi02</td>
<td>Mean DRG weight for insured (Payer=E, F, or G) patients</td>
<td>Florida Hospital Inpatient Data, AHCA and the Federal Register</td>
</tr>
<tr>
<td>beds02</td>
<td>Total acute-care staffed beds</td>
<td>Florida Hospital Financial Data, AHCA</td>
</tr>
<tr>
<td>profit02</td>
<td>=1 if the hospital is investor-owned in 2002, else = 0</td>
<td>Florida Hospital Financial Data, AHCA</td>
</tr>
<tr>
<td>public</td>
<td>=1 if the hospital is government-owned in 2002, else = 0</td>
<td>Florida Hospital Financial Data, AHCA</td>
</tr>
<tr>
<td>teach</td>
<td>= 1 if the hospital is a teaching hospital in 2002, else = 0</td>
<td>Florida Hospital Financial Data, AHCA</td>
</tr>
<tr>
<td>medhhinc02</td>
<td>median household income (unique to each county)</td>
<td>Small Area Income and Poverty Estimates, U.S. Census Bureau</td>
</tr>
<tr>
<td>pop02</td>
<td>population (unique to each county)</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>wage02</td>
<td>mean hourly wage, healthcare practitioners and technical occupations (unique to each MSA) (For Ocala MSA, mean hourly wage of registered nurses used)</td>
<td>Occupational Employment Statistics, Bureau of Labor Statistics</td>
</tr>
<tr>
<td>rural</td>
<td>=1 if the hospital is not located in an MSA</td>
<td>Florida Hospital Financial Data, AHCA</td>
</tr>
</tbody>
</table>
Texas:
Hospital Universe:
All short-term general acute care hospitals in the state of Texas operating between 1999 and 2002, excluding the following:
1. Hospitals for which financial information is not available.
2. Hospitals that listed no revenue from managed care patients in 1999 or 2002 or listed a managed care price increase of over 2000% between 1999 and 2002.
3. Public hospitals
4. Hospitals in rural areas
Note: All short-term general acute care hospitals are included in the calculation of the competition measures, even if they do not satisfy 1-4.

Variables:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>managed_care_price02 (Managed Care Price)</td>
<td>[\frac{(HMO \text{ net revenue } + \text{ PPO net revenue} + \text{ other third party net revenue})(\text{inpatient gross revenue/total gross revenue})}{(HMO \text{ inpatient admissions } + \text{ PPO inpatient admissions } + \text{ other third party inpatient admissions})}]</td>
<td>Texas Department of Health, Annual Survey of Hospitals</td>
</tr>
<tr>
<td>ceo_pct1000 (CEOs/1000Employees)</td>
<td>((\text{number of chief executives/total employment})*1000 ) (unique to each MSA)</td>
<td>Occupational Employment Statistics, Bureau of Labor Statistics</td>
</tr>
<tr>
<td>sshhi02 (SSHHI)</td>
<td>weighted average Herfindahl-Hirschman Index for insured patients based on 1999 discharges and system02 (unique to each hospital system)</td>
<td>Texas Health Care Information Council, Hospital Inpatient Discharge Public Use Data File</td>
</tr>
<tr>
<td>cmi02 (Case Mix Index)</td>
<td>Mean DRG weight for managed care (payment source 1 = U or Y or source payment code 1 = F or G) patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Texas Health Care Information Council, Hospital Inpatient Discharge Public Use Data File and the Federal Register</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>beds02</td>
<td>General medical-surgical staffed beds</td>
<td>Texas Department of Health, Annual Survey of Hospitals</td>
</tr>
<tr>
<td>profit02</td>
<td>$=1$ if the hospital is investor-owned in 2002, else $=0$</td>
<td>Texas Department of Health, Annual Survey of Hospitals</td>
</tr>
<tr>
<td>public</td>
<td>$=1$ if the hospital is government-owned in 2002, else $=0$</td>
<td>Texas Department of Health, Annual Survey of Hospitals</td>
</tr>
<tr>
<td>teach</td>
<td>$=1$ if the hospital is a teaching hospital in 2002, else $=0$</td>
<td>AHA Guide to Hospitals, 2002-2003</td>
</tr>
<tr>
<td>medhhinc02</td>
<td>Median household income (unique to each county)</td>
<td>Small Area Income and Poverty Estimates, U.S. Census Bureau</td>
</tr>
<tr>
<td>pop02</td>
<td>Population (unique to each county)</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>wage02</td>
<td>Mean hourly wage, healthcare practitioners and technical occupations (unique to each MSA) (For Victoria MSA, mean hourly wage of registered nurses used; For Galveston PMSA, mean hourly wage for Houston used)</td>
<td>Occupational Employment Statistics, Bureau of Labor Statistics</td>
</tr>
<tr>
<td>rural</td>
<td>$=1$ if the hospital is not located in an MSA</td>
<td>Texas Department of Health, Annual Survey of Hospitals</td>
</tr>
</tbody>
</table>