Hospital Mergers and Their Price Effects: A Case Study

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Abstract

The FTC recently commissioned a number of retrospective studies to examine how well merger policy has worked in the past and what changes, if any, should be made to the *Horizontal Merger Guidelines*. This paper adds to that literature by examining whether the *Sutter-Summit* hospital merger that took place in the San Francisco Bay Area in 1999 caused prices to increase above competitive levels. Although Tenn (2008) has previously evaluated this merger, I use an improved methodology based on publicly available data. In contrast to Tenn (2008), my empirical results show that the merger did not result in increased prices.

JEL classification: D21; I11; L13; L31; L41; L44

Keywords: Hospital Mergers · Monopoly Pricing · Merger Retrospective Analysis · Antitrust · Nonprofit Hospitals

I. Introduction

Proposed mergers typically face a great deal of scrutiny. The only exceptions occur if the transactions fall under a certain dollar size in which case the parties do not have to report the mergers. Regulators, such as the Federal Trade Commission (FTC) or the U.S. Department of Justice (DOJ), attempt to evaluate the competitive effects of the reported mergers *ex ante*. If the regulators find that a merger is likely to result in competitive harm, they try to either block the transaction in its entirety or make the merging entities agree to certain conditions that attempt to reduce the risk of competitive harm (such as divestitures or pricing agreements). As a result, few harmful mergers proceed.

Most participants in the merger review process believe that the effectiveness of the regulatory agencies in hindering anticompetitive mergers should be reviewed periodically. In 2002, then-FTC Chairman Timothy Muris announced the Merger Retrospectives Project, which involved selecting a handful of consummated mergers to determine their actual competitive effects. The project focused primarily on mergers in the hospital industry since the regulatory agencies had recently lost a number of litigated cases where the agencies had tried to block the mergers. Based on the results of the project, the FTC announced that it would change its strategy for handling hospital merger cases and potentially seek administrative legislation.

The results of the project have been released in a series of three working papers: Tenn (2008), Thompson (2009), and Haas-Wilson and Garmon (2009). While the results have been mixed, Tenn (2008) finds that the merger between Alta Bates Medical Center (Sutter) and Summit Medical Center (Summit) caused prices to significantly increase. In particular, Tenn finds that the prices at Summit rose 23.2% to 50.4% against its peers, which was among the largest increase in California. This suggests that the *Sutter-Summit* merger may have reduced consumer welfare and harmed competition.

Sutter and Summit are non-profit general acute care hospitals located in the San Francisco Bay Area. The distance between the two facilities is around three miles. A merger between these hospitals would give the Sutter system 60% of the beds in Oakland and 70% of the beds in Berkeley. Moreover, there was a large overlap in the service areas of these two hospitals. For these reasons, the regulators carefully reviewed this transaction. Although the FTC eventually decided not to oppose the merger, the California Attorney General filed an injunction in federal court to block it. Following a lengthy trial, the U.S. District Court allowed the merger to proceed based on its opinion that Summit was a failing firm and its rejection of the plaintiffs proposed geographic market. The Ninth Circuit upheld the District Court's decision upon appeal.[1] Sutter completed its acquisition of Summit at the end of 1999.

My paper seeks to evaluate whether the *Sutter-Summit* hospital merger caused prices to increase above competitive levels. It differs from Tenn (2008) in several important aspects. First, I evaluate the prices for all insurers that covered private-pay patients. Tenn (2008) just looked at the prices for three insurers. Second, I use publicly available data which can be replicated. Tenn (2008) uses proprietary data from three unnamed insurers. Third, I employ an improved method to identify the control group of hospitals that Sutter and Summit should be compared to. Tenn (2008) uses a method that does not account for the degree of competition that the various hospitals faced. Finally, assuming that I find the *Sutter-Summit* merger caused hospital prices to significantly increase, I will also examine whether the merger caused the prices to increase to supracompetitive levels. This is an important distinction because an increase in prices is a necessary but not sufficient condition for concluding that the *Sutter-Summit* merger harmed competition. Tenn (2008) considered price changes only.

[1] California v. Sutter Health Sys., 84 F. Supp. 2d 1057 (N.D. Cal.), *aff'd mem.*, 2000-1 Trade Cas. (CCH) ¶ 87,665 (9th Cir. 2000), *revised*, 130 F. Supp. 2d 1109 (N.D. Cal. 2001).

The remainder of my paper is organized as follows. Section 2 reviews the previous literature, including the merger retrospective studies conducted by Vita and Sacher (2001) and Tenn (2008). Section 3 discusses the methodology and econometric model that I use to evaluate the *Sutter-Summit* merger. Section 4 describes the data that I employ to estimate my model, and Section 5 discusses the empirical results. Lastly, Section 6 provides some concluding remarks.

II. Previous Literature

A. Measuring Merger Effects

The most recent FTC publications that examine post-merger price effects use a methodology outlined in Vita and Sacher (2001). Vita and Sacher base their methodology on two approaches. Barton and Sherman (1984) and Kim and Singal (1993) compare the prices of a merged entity against competitive benchmark levels to examine if the merger led to supracompetitive prices. To determine the competitive benchmark levels, these papers create a control group of firms similarly situated to the merging firms. Schumann et al. (1992, 1997) develop a price equation including cost and demand factors as well as a merger dummy variable to measure the effect of a merger on price. Vita and Sacher (2001) combine these methods to create a difference-in-difference price equation. They subtract the average value of the variables for the control group from the values of the variables for the merged entity and then run a regression similar to Schumann, et al. (1992, 1997). This approach focuses on price changes only. However, a significant advantage to this approach is it can be applied to evaluate the effects of any event (in this case a merger) on the prices of any product (in this case general acute care hospital services) compared to a set of similarly situated competitors. Additionally, to implement their approach, Vita and Sacher use publicly available data from the California Office of Statewide Health Planning and Development (OSHPD). Thus, their results can be easily replicated and applied to other hospital mergers.

Tenn (2008) applies Vita and Sacher's methodology but adjusts it to account for his more detailed dataset. This dataset includes detailed claims data obtained from three insurers. To implement the methodology, Tenn uses a three-step approach. First, he uses his detailed claims data to estimate a fixed-effects price regression. The regressand equals the log of price and the regressors include patient characteristic variables (e.g., length of stay, diagnosis, cost category, plan type, sex, and age) as well as dummy variables for the merged hospitals and control group hospitals. Second, Tenn uses the estimated price equation to calculate the pre-merger to post-merger price change for each of the merged hospitals and control group hospitals. Finally, Tenn uses the calculated price changes to run a regression, where the regressand equals the price change for each hospital and the regressors include a merger dummy variable (equal to 1 if the observation corresponds to the merging hospitals, 0 otherwise) and hospital characteristic variables (to control for other factors that could explain the variation in the price changes besides the merger). He believes that a positive and significant coefficient for the dummy variable indicates that the merger caused prices to increase above competitive levels. Unfortunately, Tenn's approach can neither be replicated nor applied to other mergers because it employs proprietary data from three unnamed insures. Also, even if one could replicate his results, Tenn does not account for the price level issue.

B. Choosing a Control Group

A control group allows for a comparative study of price changes among similar hospitals not directly impacted by the merger. Hence, a group of similarly situated hospitals needs to be chosen. Vita and Sacher (2001) select their control group as follows. First, they eliminate hospitals that do not provide general acute care hospital services (such as psychiatric hospitals and skilled nursing facilities). Second, they eliminate hospitals located in counties significantly different from those of the merging hospitals (such as rural counties or mega urban counties like

Los Angeles). Third, they eliminate hospitals with a bed size not between 100 and 300. They choose 100 and 300 because the largest of their merging hospitals had a bed size of around 200. Lastly, they eliminate hospitals either directly involved in a merger or in the same metropolitan statistical area as a merging hospital.

Although hospitals with similar bed sizes likely have similar cost structures, the range of bed sizes considered for Vita and Sacher's control group is arbitrary. Dranove (1998) investigates economies of scale with respect to non-revenue producing cost centers in hospitals. He finds that hospitals with over 10,000 discharges (270 licensed beds), face small efficiency gains as they continue to grow. Applying this to the choice of a control group, a hospital with 600 beds could conceivably be similarly situated to one with 300 beds. Additionally, Dranove considers discharges to be superior to bed size for comparing hospitals because bed size measures capacity or potential output, whereas number of discharges is a measure of observed output.

Tenn (2008) selects his control group in a way similar to Vita and Sacher (2001). First, he only considers urban, non-government, general service hospitals with a bed size of at least 200. He then eliminates hospitals that have been recently involved in a merger as well as other hospitals in the same metropolitan statistical area. Lastly, he eliminates hospitals that only sporadically admit patients from the three insurers for which he has obtained data.

C. Not-For-Profit Hospitals

Both of the hospitals in the *Sutter-Summit* transaction are non-profit facilities. This raises important implications because the literature is split on the effect of non-profit mergers. Lynk (1995) finds that mergers between not-for-profit hospitals do not necessarily lead to an exercise in market power even if the mergers result in large increases in market concentration. Lynk also finds that mergers between for-profit hospitals do generally lead to sizeable increases in prices if the mergers result in large increases in market concentration. Lynk attributes these findings to

not-for-profit hospitals having different objective functions than for-profit hospitals. His results have been cited in several court cases in support of mergers.[2]

Dranove and Ludwick (1999) assess Lynk's results and find several methodological mistakes. After correcting these mistakes, they cannot reproduce Lynk's findings. Keeler, Melnick, and Zwanziger (1999) find price increases following non-profit mergers which also contradicts Lynk's findings. In response to these two papers, Lynk (1999) reemphasizes his hypothesis and explains why each of these other papers incorrectly replicated his original paper. Lynk maintains that the not-for-profit status of a merging hospital needs to be considered when analyzing mergers because not-for-profit and for-profit hospitals may engage in different pricing behavior.

This issue may be important in how to interpret the empirical results. If I find that the *Sutter-Summit* merger did not lead to an increase in prices, the not-for-profit status of the merging hospitals could explain this result. However, if I find that the merger did result in a reduction in competition, this would add to the literature that concludes that not-for-profit hospitals behave the same as for-profit hospitals. As such, this would support the conclusion that the regulators should not consider a hospital's profitability status when deciding whether to allow a merger.

D. Price Changes vs. Price Levels

In evaluating the competitive effects of a merger, one needs to look at both price changes and price levels. If one of the firms was engaging in distressed pricing prior to the merger in an effort to attract customers and stay in business, then any increase in prices that one sees as a result of the merger may just reflect prices returning to normal, competitive levels. This means that an

[2] Most notably in *FTC v. Butterworth Health Corp.* In this case, the FTC showed, and the defense conceded, anticompetitive effects of the merger based on a structural analysis. But, the judge allowed the merger based mainly on Lynk's (1995) assertion.

increase in prices is a necessary but not sufficient condition for concluding that a merger reduced competition. Alternatively, if one can show that a merger caused a firm's prices to both increase and significantly exceed the price levels of similarly situated firms, this would represent strong evidence that the merger reduced competition. Neither Vita and Sacher (2001) nor Tenn (2008) investigate this issue, but Tenn does explain that Summit could have been engaged in distressed pricing and this would bias his results. However, Tenn should have directly considered this issue since the U.S. District Court found Summit to be a failing firm,

III. Methodology

A. Estimating the Control Group

The first step in analyzing the actual competitive effects of a merger is to create a control group. My paper introduces a new empirical methodology for doing this. The prior literature does not consider market concentration in creating a control group; yet, literature from the field of industrial organization concludes that market concentration is a key determinant of firm behavior. To emphasize, the role of the control group is to measure the variation in prices at similarly situated hospitals who were not involved in an acquisition, thus allowing for an estimation of what Sutter's and Summit's prices would have been had the merger not occurred. Therefore, it is essential to use hospitals with similar market concentration to choose a control group.

To identify similarly situated hospitals based on market concentration, I estimate market shares for all of the general acute care hospitals in California at the time the merger was consummated (i.e. 2000) based on each hospital's primary service area (PSA). I define each PSA to equal the smallest set of zip codes from which the hospital draws 90% of its total patients. The 90% threshold represents the percentage that has most often been accepted by the courts in the litigated hospital merger cases, including the *Sutter-Summit* merger (McCarthy and Thomas,

2003). I estimate the market shares to equal the total discharges of patients living in the PSA for the originating hospital's system divided by the total discharges of all patients living in the PSA.

Once I obtain the estimated market shares, I estimate a probability density function for the distribution of market shares. Given the probability density function, I then create market share intervals for both Sutter and Summit such that 20% of the total density function is encompassed by the intervals, with 10% on both the lower and upper bounds of each interval. The probability density function takes the form of the common, continuous probability distribution (normal, exponential, etc.) that best fits my distribution such that I can take the integral of this function using maximum likelihood parameters. The intervals, based on this probability density function, are considered the range of market shares statistically similar to Sutter and Summit. Thus, I do not consider hospitals outside of these market share intervals for the control group. I also exclude rural, teaching, municipal, and non-acute care hospitals because these hospitals face different competitive constraints and/or cost structures than urban general acute care hospitals. Lastly, I also exclude any remaining hospital either involved in a horizontal merger during the period under analysis (1996-2006) or located in the same county as Sutter and Summit (Alameda County).

I could also potentially exclude all hospitals in any metropolitan statistical area (MSA) where a merger occurred. This would more closely follow the methods of Vita and Sacher (2001) and Tenn (2008). However, because of the rampant consolidation during this period, most MSAs have had at least one acquisition and most of the people residing in MSAs reside in these MSAs.[3] For similar reasons, I have included hospitals in systems involving a merger in the control group as long as the other conditions are met. This includes other hospitals in the Sutter system. Because it is my understanding that certain hospital systems began to collectively engage in price

[3] 11 of 25 MSAs (44%) had at least one acquisition and these MSAs contain 81.26% of the total population (28,974,524 / 35,655,641) that lives in a MSA.

contracting in the late 1990s, it is possible that intersystem mergers could have affected prices throughout the system during the final years of my analysis.

B. Econometric Model

To follow the methodology of Vita and Sacher (2001) as closely as possible, I analyze quarterly data covering the 1996 through 2006 period. While Vita and Sacher (2001) do not consider a lag between the date the parties completed the merger and the beginning of merger effects, I assume a one year lag as is done in Tenn (2008). Thus, I define 1996-2001 as the pre-merger period and 2001-2006 as the post-merger period.

Using my control group, the econometric model can be estimated as follows:

$$\log(P_t) - \log(\bar{P}_{t,cg}) = \left(X_t - \bar{X}_{t,cg}\right)\beta + M_t\alpha + u_t \,, u_t \sim IID(0, \sigma^2) \qquad (1)$$

The regressand equals the estimated real private pay inpatient price for either Sutter or Summit at time t (by quarter) differenced by the average estimated real private pay inpatient price for the control group at time t. The analysis focuses on private pay prices only since the government sets the Medicare and Medi-Cal prices and the hospitals do not have the ability to change them. Likewise, the analysis focuses on inpatient prices only since the antitrust authorities typically consider inpatient hospital services to be in a separate relevant market than outpatient hospital services.[4] I create the real prices by dividing the nominal prices by an inflation factor based on the

[4] To calculate inpatient prices for privately insured patients, I use the same basic methodology as described in Vita and Sacher (2001). In particular, they use three steps to estimate the private-pay inpatient prices. First, they subtract the total Medicare revenues and Medi-Cal revenues from the total net revenues to create a private pay net revenues. Second, they divide the private pay net revenues by the total private pay discharges to create a private pay price (i.e., private pay net revenue per discharge). Lastly, they multiply the private pay price by the ratio of total inpatient charges to total inpatient and outpatient charges to create a private pay inpatient price. Vita and Sacher also suggest adjusting the total private pay discharges for bad debts using a bad debt ratio ((net total revenues-bad debts) / net total revenues)) and I will test to see whether this impacts my results. However, I disagree with using a bad debt ratio because bad debt is not subcategorized by patient type (Medicare, Medical, indigent, etc.) and thus I could incorrectly be adjusting discharges based on a large number of Medicare or Medi-Cal related bad debts. Also, I believe that bad debt may already be controlled for by some of the regressors (such as unemployment, Medicare share, and Medi-Cal share).

consumer price index. Because of the assumption of asymptotic normality,

$P_n \xrightarrow{d} P \ \ where\ P \overset{a}{\sim} N(0, V)$.

The regressors referenced by X_t in Equation 1 represent supply and demand factors for either Sutter or Summit at time t differenced by the corresponding average values for the control group at time t.[5] These are the exact same supply and demand factors used by Vita and Sacher (2001) to control for hospital heterogeneity, and their descriptions and expected signs are listed in Table 1. For example, Table 1 shows that the casemix variable represents the average severity of the private pay patients treated at Sutter or Summit minus the average severity of the private pay patients treated at the control group hospitals. Since sicker patients require more resources, and since more resources cost more money, I would expect the estimated regression coefficient for this variable to be positive. Likewise, Table 1 shows that the wage variable represents the wage index for Sutter and Summit minus the average wage index for the control group hospitals. Since the wage index reflects the cost of nurses and other hospital personnel, and since higher labor costs should result in higher prices, I would expect the estimated regression coefficient for this variable to be positive.

Finally, the regressor referenced by M_t in Equation 1 is a merger dummy variable that equals 0 for quarters from 1996 to 2001 and 1 for quarters from 2001 to 2006. This is the key regressor in the regression model. If the estimated regression coefficient for this variable turns out to be positive and statistically significant, this will indicate that the merger resulted in the average price at Sutter or Summit increasing relative to the average price at the control group hospitals, holding the other regressors that could have impacted the relative prices constant. As such, this

[5] Producer price index for medicine is not differenced because this variable changes over time, not hospital or county, thus differencing it would always produce a value of zero. I assume Vita and Sacher (2001) did the same.

would support the conclusion that the merger may have harmed competition—although price levels would then need to be investigated.

Vita and Sacher (2001) also include time and time squared as separate regressors in their econometric model. However, I have decided to drop these regressors from my econometric model since since I assume asymptotic normality instead of normality. Time and time squared terms cannot be used under asymptotic assumptions because the limit of the covariance matrix as time goes to infinity would diverge for these variables since $\lim_{n\to\infty} \frac{t^2}{n}$ does not converge.

If the estimated regression coefficient for the merger dummy variable in Equation 1 is positive and statistically significant, then I will need to directly address the issue of price levels. To do this, I will run a panel level data regression for all the hospitals based on the post-merger years 2001-2006. The specification of this regression will be as follows:

$$\log(P_{i,t}) = X_{i,t}\beta + H_i\alpha + u_{i,t}\ , u_{i,t} \sim IHD(0, \sigma_i^2) \qquad (2)$$

The regressand will equal the real price of each merged and control group hospital, i, at time t. That is, the dataset used to estimate this regression will include a separate observation for each hospital and each quarter. Once again, I assume asymptotic normality such that $P_n \xrightarrow{d} P \ where\ P \overset{a}{\sim} N(0, V)$. The regressors are basically the same as described above for Equation 1, except they are not specified in difference form. Again, the key regressor will be the merged hospital dummy variable, this time H_i, which will equal 1 if the observation corresponds to one of the merged hospitals and 0 otherwise. If the merger caused the prices at the merged hospitals to increase above competitive levels, I would expect the estimated regression coefficient for the merged hospital dummy variable to be positive and statistically significant.

IV. Data

The data that I use to estimate the competitive effects of the *Sutter-Summit* merger come from various publicly available sources. These sources include the California Office of Statewide Health Planning and Development (OSHPD), the Bureau of Labor Statistics (BLS), the Centers for Medicare and Medicaid Services (CMS), and *Modern Healthcare*. OSHPD provides quarterly financial and utilization data for each hospital in the state of California. This includes gross inpatient revenue, gross outpatient revenue, net revenue and discharges, each subcategorized by specific type of payer (Medicare, Medi-Cal, traditional, etc.). OSHPD also provides bad debt, operating expenses, staffed beds, patient origin data, and information about each hospital (such as its profitability status and whether the hospital has undergone a change of ownership). BLS provides income per capita by county, unemployment rate by county, producer price index for medicine, and consumer price index. CMS provides casemix index and Medicare wage index. Finally, *Modern Healthcare* provides additional information about which hospitals have been involved in mergers. A more detailed summary of my data is included in Table 1 and the appendix. Descriptive statistics of all the variables are included in Table 2.

V. Empirical Results

Figures 1 and 2 show the price per day and price per discharge for the Sutter and Summit hospitals during the years before and after the merger. The dashed line represents the date that the merger closed. Both figures show that the post-merger prices are greater than the pre-merger prices. This suggests that the merger may have caused prices to increase above competitive levels. However, to test whether the merger caused price increase, one needs to examine whether the merged hospitals experienced greater price increases than the control group hospitals when

controlling for other factors that could cause price to increase. Otherwise, the price increase may be due to factors unrelated to the merger. As such, a regression analysis needs to be performed.

The control group hospitals that I use for my regression analysis are listed in Tables 3 and 4. The table shows that I have a different control group for the two hospitals since each hospital had a different estimated market share and thus a different center to their market share interval. To identify the control groups, I used the various steps mentioned above, including the market share step. The PSA shares that I calculated for Summit and Sutter equal 14.28% and 24.44%, respectively. Based on these shares, the market share intervals that I used to identify the Summit and Sutter control groups equal 10.496% to 18.896% and 18.638% to 32.472%, respectively. These intervals were created using an exponential distribution with the maximum likelihood parameter being the sample mean (21.004%).

Table 5 presents the regression results for Equation 1. I obtained these results using the control group hospitals in Tables 3 & 4 and the data described in the previous section. The results show that both regressions explain a large amount of the variation in the dependant variable: the R-Squares equal 0.7450 and 0.8866, respectively. Likewise, the results show that many of the difference-in-difference regressors have the expected signs but that most of them are insignificant at the 5 percent level.[6] Finally, the results show that the merger dummy variables in both regressions are positive but insignificant at the 5 percent level based on a two-sided test. I believe that a two-sided test is the appropriate test since the literature indicates that mergers involving not-for-profit hospitals and mergers resulting in large cost savings can both reduce prices. Thus, these results support the conclusion that the merger did not cause either Sutter or Summit to increase their prices above competitive levels.

[6] These significance results are based on standard t-statistics using two-sided tests, where the t-statistics equal the estimated regression coefficients divided by the standard errors. These significance results also hold for asymptotic tests, where these t-statistics are compared to chi-squared critical values.

Given that the results show the *Sutter-Summit* merger did not cause a positive and significant increase in prices, I do not have to estimate Equation 2. However, if they had shown a significant price increase, then I would have to estimate Equation 2 in order to evaluate whether the price change had resulted in supracompetitive prices.

VI. Conclusion and Summary

The results in this paper differ from the ones in Tenn (2008). I find that the *Sutter-Summit* merger did not result in a significant price increase, whereas Tenn (2008) finds that it did. What is causing the difference in these findings? There are several possibilities. First, Tenn uses data for just three insurers, while I use data for all of the insurers. This means Tenn's results may be correct for the three insurers, but not correct when you take into account all of the insurers. Second, I use an improved methodology to create my control group. If Tenn had used the same methodology, he might have found the same results. Finally, although the methodology that I use is based on publicly available data that can be replicated, a number of manipulations have to be made to those data to create the private-pay inpatient prices. These manipulations may be masking what actually happened to the prices.

One of the main issues of dispute at the *Sutter-Summit* trial was the extent of the relevant geographic market. The merging parties argued that the geographic market covered a fairly broad area including many hospital competitors, while the government argued that it covered a relatively narrow area including only a few hospital competitors. The results of this paper indicate that either (1) the merging parties were correct in their delineation of the relevant geographic market, (2) the not-for-profit status of the merging hospitals prevented the hospitals from exercising market power post-merger, and/or (3) the merger resulted in substantial cost savings that kept the

prices from rising.[7] In any event, all of these factors are currently considered by the regulatory agencies when evaluating mergers. This means my results suggest that substantial revisions do not need to be made to the *Horizontal Merger Guidelines*.

Finally, because I find that the merger did not result in significant price increases, I did not have to examine the price levels issue. However, a finding of significant price increases would not be sufficient for concluding that a merger has harmed competition. A researcher would also have to demonstrate that the merger caused the price levels of the merging hospitals to significantly exceed the price levels of the control group hospitals, holding other relevant factors constant.

[7] The merging parities identified the relevant geographic market using the Elzinga-Hogarty test. This test has been criticized in several recent papers claiming that it results in markets that are overly broad. If the merging parties were correct in their delineation of the relevant geographic market, this would support the conclusion that the Elzinga-Hogarty test is an appropriate test—at least in some situations.

Data Appendix

I use the OSHPD quarterly financial data to calculate the private pay inpatient prices as well as the HMO, Medicare, Medi-Cal, and length of stay variables. These data include revenue, bad debt, discharge, and length of stay information by payer category (i.e., Medicare, Medi-Cal, traditional, etc.). I have explained earlier how I calculate the private pay inpatient prices. I calculate the HMO, Medicare, and Medi-Cal variables by taking the discharges for each of those categories of patients and dividing them by the total discharges for all patients. Likewise, I calculate the length of stay variable by taking the total private pay patient days and dividing that figure by the total private pay discharges. The expected sign for Medicare and Medi-Cal is unknown. These variables could cause prices to go down because they could indicate that the hospital caters mainly to non-commercial patients, i.e. it is a signal that indicates a low quality or municipal hospital. Alternatively, these variables could cause prices to increase because of hospitals shifting costs to private pay patients because Medicare and Medi-Cal pay lower prices than private pay patients.

I use the OSHPD annual hospital discharge data and the Centers for Medicare and Medicaid Services (CMS) diagnosis related group (DRG) weights to calculate the private pay casemix. The OSHPD discharge data indicate the discharge date, DRG, and payer category for every patient discharged from every California hospital during the year. Likewise, the CMS DRG weights indicate the severity of each DRG: the more severe the DRG (e.g., open heart surgery), the higher the weight. I calculate the casemix using several steps. First, I exclude all of the observations from the OSHPD discharge data that do not represent private pay patients. Second, I merge the DRG weights to the OSHPD discharge data so that each patient has a unique weight. Third, I sum the DRG weights for the private pay patients by hospital and by quarter. Fourth, I sum the private pay discharges by hospital and by quarter. Lastly, I divide the sum of the DRG

weights by the sum of the private pay discharges. This results in an average private pay casemix for each hospital. The only tricky part of creating the casemix is that the DRG weights change every government fiscal year and the government fiscal year does not equal the calendar year.

Finally, the other variables that I use in my regression model come from CMS and the Bureau of Labor Statistics (BLS). Specifically, I get the Wage Index from CMS and the income per capita by county, unemployment rate by county, producer price index for medicine, and consumer price index from BLS. I use the consumer price index to convert the private pay inpatient prices and the income per capita by county from nominal into real figures.

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