

## Appendix 1

This Appendix 1 includes detailed documentation regarding:

- ❖ Data sources and variable construction
- ❖ Detailed description of construction of key study variables
- ❖ Descriptive statistics
- ❖ Regression results
- ❖ Description of methods using regression results to construct exhibits

## Data sources and variable construction

| Variable  | Data Source  | Construction Notes   |
|---|--|--|
| Dependent Variables   |  |  |
| Net Revenue (commercial patients)   | OSPHD - Pivot 1995–2019  | Combine traditional and managed care fields.   |
| Medicare wage index   | Medicare Impact Files 1995–2019 merged with OSPHD Pivot                  | Merged Medicare Impact files using Medicare ID from OSHPD disclosure reports. If missing wage for a hospital/year: find hospital within the same county with the same wage index for non-missing year, if N/A - use county average; if entire county/year is missing - find nearest county with matching (or closest) wage index for non-missing years |
| Commercial patients' CMI  | OSHPD Patient Discharge Data + CMS Medicare DRG weights files, 1995–2019 | Every discharge with non-missing DRG was assigned Medicare weight for corresponding year and DRG code, then average of the weights across all commercial discharges  |
| Adjusted discharges (commercial patients)   | OSPHD - Pivot 1995–2019  | $\text{thirdadjdistotal} = \text{dis\_thrd\_total} * (1 + \text{gr\_op\_thrd\_total}) / \text{gr\_ip\_thrd\_total}$  |
| Commercial Inpatient Net Revenue per Adjusted Discharge   | OSPHD - Pivot 1995–2019  | $\text{gen\_nrev\_adjdis} = \text{netrv\_thrd\_total} / \text{thirdadjdistotal}$   |
| Commercial Inpatient Net Revenue per Adjusted Discharge, adjusted for average CMI and Medicare wage indices | Derived  | $= \text{meanWage} * \text{meanCCMI} * \text{nrev\_adjdis} / (\text{wage\_} * \text{CommericalCCMI})$ *** multiplied by meanWage and multiplied by meanCCMI to recalibrate such as above   |
| Hospital Characteristics  |  |  |
| Trauma Status   | OSHPD pivot 1995–2019  | 1 if Hospital ER Trauma Center   |
| Teaching Hospital   | OSHPD pivot 1995–2019  | 1 if Teaching hospitals designated by OSHPD  |
| Rural   | OSHPD pivot 1995–2019  | Designated Rural hospitals based on H&S Code Sec. 124840   |
| Beds - Total Staffed  | OSHPD pivot 1995–2019  | Total staffed beds   |
| Beds - Small (under 150)  | OSHPD pivot 1995–2019  | 1 if staffed beds $\leq 150$ , 0 otherwise   |
| Beds - Large (above 350)  | OSHPD pivot 1995–2019  | 1 if staffed beds $\geq 350$ , 0 otherwise   |
| For Profit  | OSHPD pivot 1995–2019  | 1 if for-profit ownership  |
| District  | OSHPD pivot 1995–2019  | 1 if district ownership  |
| Ratio OP Visits/ IP Days  | OSHPD pivot 1995–2019  | Ratio of Outpatient Visits to Inpatient Days   |
| Hospital CMI Above 2.0  | OSHPD discharge data 1995–2019   |  |

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|  |   |  |
|--|---|--|
| Payor/Revenue Mix                                      |   |  |
| Disproportionate Share Hospital Status (DSH)           | OSHDP pivot 1995–2019                                   | 1 if Disproportionate Share Hospital   |
| Hospital % Commercial                                  | OSHDP pivot 1995–2019                                   | Total Commercial Charges as a percent of All Patient Total Charges   |
| Hospital % Medicare                                    | OSHDP pivot 1995–2019                                   | Total Medicare Charges as a percent of All Patient Total Charges   |
| Hospital Systems Variables                             |   |  |
| Sutter System Member Indicator – Price                 | derived   | 1=for each time period for each Sutter system member hospital  |
| Sutter HHI   | derived   | Hospital HHI value for each Sutter Hospital in time period each year   |
| Dignity System Member Indicator – Price                | derived   | 1=for each time period for each Dignity system member hospital   |
| Dignity HHI  | derived   | Hospital HHI value for each Dignity Hospital in time period each year  |
| Herfindahl Index (HHI)                                 | OSHDP discharge data 1995–2019                          | Hospital HHI measures market concentration based on top 20 hospital zip codes, taking into account system membership                       |
| Member of Hospital System Other than Sutter or Dignity | OSHDP pivot 1995–2019                                   | 1 if Member of a system with 3 or more hospitals, as defined by OSHDP  |
| Hospital Quality/ Satisfaction                         |   |  |
| Hospital Rating  | HCAHPS (Hospital Patient Satisfaction Survey) 2010–2019 | % patients that rated hospital as 9 or 10 on a 10-point scale (highly correlated with other measures of patient satisfaction and outcomes) |

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Note: OSHDP refers to the Office of Health Planning and Development recently renamed Health Care Access and Information (HCAI).

## **Variable construction—key study measures**

### ***Hospital market competition/hospital market concentration***

For each hospital in each year we compute the Herfindahl-Hirschman Index (HHI), a standard measure of market structure (concentration). To take into account common ownership among system hospitals, we compute a hospital system based HHI by assigning (coding) hospitals in the same system with same hospital ID code. When there is no overlap in a geographic market between a hospital and its system members, the HHI-system value is equal to the HHI for the hospital. value. The hospital geographic markets are based on the zip codes that a hospital draws from (up to 20) and calculates the HHI value for each zip code. A hospital's HHI is calculated as a sum of the zip code HHI values, giving each zip code a weight proportional to the number of patients coming from that zip code. Zip code level HHI is calculated as the sum of the squared market shares of competing hospitals serving the zip code. Zip code level data for calculation of HHIs are drawn from OSHPD's Patient Discharge Data files.

### ***Hospital prices***

Our dependent variable is a price measure for commercial (other third party) payors. Below we summarize variable construction and the steps used to convert the regression results to percentage changes:

### ***Total net revenue per adjusted admission***

Net revenue per adjusted admission is constructed for each hospital in each year with data from OSHPD's annual hospital financial PIVOT reports. We first calculate total net revenue by summing traditional (fee for service) and managed care net revenue. Total net revenue from third party payors is divided by total adjusted admissions for third party payor patients within each hospital. Total adjusted admissions are calculated to include an adjustment to reflect outpatient volume ( $\text{thirdadjdistotal} = \text{dis\_thrd\_total} * (1 + \text{gr\_op\_thrd\_total}) / \text{gr\_ip\_thrd\_total}$ ). This approach follows other studies that have used OSHPD data to construct price measures.<sup>1</sup> The sample excludes state, county, Kaiser Permanente, long-term care, psychiatric, rehabilitation and other specialty hospitals.

### ***Calculation of net revenue per adjusted admission to control for differences in hospital patient case-mix and input prices***

To create prices that are comparable across hospitals, net revenue per adjusted discharge is further adjusted for hospital differences in patient case mix and input prices. This measure is calculated by dividing net revenue per adjusted discharge by both commercial Case Mix Index (CMI) and Medicare Wage Index.

### ***Transform price measure from dollar format to natural log***

We transform the measure created in step 2 above (Net Revenue Per Adjusted Admission, Adjusted for Hospital Patient Case-Mix and Input Prices) to the natural log format. Logarithmic transformations can reduce the skewness in the data. Skewed data can lead to biased parameter estimates and inaccurate model predictions. IN addition, transforming the variable can help make the variance more consistent across the range of the independent variable and taking the natural logarithm of a variable makes it easier to interpret the effects in terms of percentage changes.

### ***Exponentiate regression coefficient to calculate percentage change***

We transform the dependent variable using the natural logarithm (ln) of the variable. This transforms it for the regression into a logarithmic scale. This facilitates interpretation of the results in terms of percentage change. To achieve this, we convert the coefficient values to calculate the percentage change as follows: 1).

First, we perform regression analysis using the transformed variable (e.g., the natural logarithm of a variable) and obtain the coefficient associated with the transformed variable in the regression model, 2) To interpret the coefficient in terms of percentage change, we then exponentiate it. For example, if the coefficient is "b," we would calculate  $e^b$  (where "e" is the base of the natural logarithm, approximately 2.71828) where the result of  $e^b$  is the multiplicative factor by which the original variable changes for a one-unit change in the transformed variable. This multiplicative factor represents the percentage change. To convert it to a percentage, we subtract 1 and multiply by 100 as follows: Percentage Change =  $(e^b - 1) * 100$ .

## Descriptive statistics

### Period 1: 1995–1999

| Variable     | Sutter |      |           | Dignity |      |           | Other |      |           |
|--------------|--------|------|-----------|---------|------|-----------|-------|------|-----------|
|              | Obs    | Mean | Std. dev. | Obs     | Mean | Std. dev. | Obs   | Mean | Std. dev. |
| chainHHI     | 64     | 0.40 | 0.11      | 89      | 0.39 | 0.14      | 983   | 0.29 | 0.11      |
| Above2       | 64     | 0.09 | 0.04      | 89      | 0.14 | 0.08      | 984   | 0.09 | 0.05      |
| oth_sys      | 64     | 0.00 | 0.00      | 89      | 0.00 | 0.00      | 984   | 0.37 | 0.48      |
| bed_stf      | 64     | 197  | 192       | 89      | 242  | 106       | 984   | 196  | 138       |
| small_bed150 | 64     | 0.63 | 0.49      | 89      | 0.21 | 0.41      | 984   | 0.43 | 0.50      |
| large_bed350 | 64     | 0.20 | 0.41      | 89      | 0.15 | 0.36      | 984   | 0.13 | 0.34      |
| forprofit    | 64     | 0.00 | 0.00      | 89      | 0.00 | 0.00      | 984   | 0.27 | 0.45      |
| trauma       | 64     | 0.08 | 0.27      | 89      | 0.31 | 0.47      | 984   | 0.15 | 0.36      |
| district     | 64     | 0.00 | 0.00      | 89      | 0.00 | 0.00      | 984   | 0.13 | 0.34      |
| Teaching     | 64     | 0.14 | 0.35      | 89      | 0.07 | 0.25      | 984   | 0.06 | 0.24      |
| Rural        | 64     | 0.16 | 0.37      | 89      | 0.09 | 0.29      | 984   | 0.16 | 0.36      |
| DSH          | 64     | 0.11 | 0.31      | 89      | 0.10 | 0.30      | 984   | 0.18 | 0.39      |
| shr_3P       | 64     | 0.40 | 0.13      | 89      | 0.44 | 0.14      | 984   | 0.40 | 0.15      |
| shr_MCR      | 64     | 0.38 | 0.11      | 89      | 0.38 | 0.08      | 984   | 0.36 | 0.11      |
| vis2dis3P    | 64     | 20   | 13        | 89      | 14   | 9         | 984   | 17   | 17        |

### Period 2: 2001–2005

| Variable     | Sutter |      |           | Dignity |           |      | Other |      |           |
|--------------|--------|------|-----------|---------|-----------|------|-------|------|-----------|
|              | Obs    | Mean | Std. dev. | Mean    | Std. dev. | Min  | Obs   | Mean | Std. dev. |
| chainHHI     | 105    | 0.44 | 0.12      | 137     | 0.39      | 0.13 | 900   | 0.32 | 0.13      |
| Above2       | 105    | 0.07 | 0.05      | 137     | 0.08      | 0.04 | 902   | 0.07 | 0.04      |
| oth_sys      | 105    | 0.00 | 0.00      | 137     | 0.00      | 0.00 | 902   | 0.40 | 0.49      |
| bed_stf      | 105    | 214  | 203       | 137     | 234       | 102  | 902   | 203  | 149       |
| small_bed150 | 105    | 0.52 | 0.50      | 137     | 0.23      | 0.42 | 902   | 0.45 | 0.50      |
| large_bed350 | 105    | 0.21 | 0.41      | 137     | 0.10      | 0.30 | 902   | 0.14 | 0.35      |
| forprofit    | 105    | 0.00 | 0.00      | 137     | 0.00      | 0.00 | 902   | 0.32 | 0.47      |
| trauma       | 105    | 0.16 | 0.37      | 137     | 0.20      | 0.40 | 902   | 0.18 | 0.38      |
| district     | 105    | 0.00 | 0.00      | 137     | 0.00      | 0.00 | 902   | 0.13 | 0.34      |
| Teaching     | 105    | 0.09 | 0.28      | 137     | 0.04      | 0.19 | 902   | 0.08 | 0.27      |
| Rural        | 105    | 0.19 | 0.39      | 137     | 0.10      | 0.30 | 902   | 0.14 | 0.35      |
| DSH          | 105    | 0.14 | 0.35      | 137     | 0.18      | 0.38 | 902   | 0.29 | 0.45      |
| shr_3P       | 105    | 0.38 | 0.09      | 137     | 0.32      | 0.12 | 902   | 0.32 | 0.13      |
| shr_MCR      | 105    | 0.41 | 0.08      | 137     | 0.44      | 0.09 | 902   | 0.41 | 0.12      |
| vis2dis3P    | 105    | 30   | 23        | 137     | 21        | 20   | 902   | 22   | 21        |

Period 3: 2010–2019

| Variable     | Sutter |       |           | Dignity |       |           | Other |       |           |
|--------------|--------|-------|-----------|---------|-------|-----------|-------|-------|-----------|
|              | Obs    | Mean  | Std. dev. | Obs     | Mean  | Std. dev. | Obs   | Mean  | Std. dev. |
| chainHHI     | 211    | 0.41  | 0.09      | 278     | 0.39  | 0.12      | 1789  | 0.32  | 0.13      |
| pc_rated_~10 | 209    | 70.71 | 8.74      | 278     | 67.65 | 4.81      | 1763  | 66.50 | 9.10      |
| Above2       | 211    | 0.07  | 0.03      | 278     | 0.08  | 0.04      | 1792  | 0.07  | 0.04      |
| oth_sys      | 211    | 0.00  | 0.00      | 278     | 0.00  | 0.00      | 1792  | 0.54  | 0.50      |
| bed_stf      | 211    | 139   | 149       | 278     | 149   | 86        | 1792  | 166   | 141       |
| small_bed150 | 211    | 0.65  | 0.48      | 278     | 0.47  | 0.50      | 1792  | 0.57  | 0.50      |
| large_bed350 | 211    | 0.11  | 0.31      | 278     | 0.00  | 0.06      | 1792  | 0.09  | 0.29      |
| forprofit    | 211    | 0.00  | 0.00      | 278     | 0.00  | 0.00      | 1792  | 0.32  | 0.47      |
| trauma       | 211    | 0.23  | 0.42      | 278     | 0.26  | 0.44      | 1792  | 0.22  | 0.42      |
| district     | 211    | 0.00  | 0.00      | 278     | 0.00  | 0.00      | 1792  | 0.11  | 0.32      |
| Teaching     | 211    | 0.02  | 0.15      | 278     | 0.02  | 0.15      | 1792  | 0.08  | 0.27      |
| Rural        | 211    | 0.19  | 0.39      | 278     | 0.14  | 0.35      | 1792  | 0.13  | 0.34      |
| DSH          | 211    | 0.27  | 0.45      | 278     | 0.23  | 0.42      | 1792  | 0.37  | 0.48      |
| shr_3P       | 211    | 0.29  | 0.10      | 278     | 0.24  | 0.09      | 1792  | 0.25  | 0.11      |
| shr_MCR      | 211    | 0.43  | 0.09      | 278     | 0.44  | 0.10      | 1792  | 0.43  | 0.10      |
| vis2dis3P    | 211    | 24    | 26        | 278     | 29    | 32        | 1792  | 29    | 39        |

# Regression output: pre-period + post period 1

|  | Coefficient | std. err. | t      | P>t    | [95% conf. | interval] |
|--|-------------|-----------|--------|--------|------------|-----------|
| <b>Constant</b>  | 8.4056      | 0.1386    | 60.63  | 0.0000 | 8.1326     | 8.6786    |
| <b>Time Control Variables</b>                            |             |           |        |        |            |           |
| Year 1996  | -0.0306     | 0.0094    | -3.26  | 0.0010 | -0.0490    | -0.0121   |
| Year 1997  | -0.0654     | 0.0172    | -3.80  | 0.0000 | -0.0993    | -0.0315   |
| Year 1998  | -0.1061     | 0.0239    | -4.44  | 0.0000 | -0.1532    | -0.0590   |
| Year 1999  | -0.1282     | 0.0294    | -4.36  | 0.0000 | -0.1861    | -0.0702   |
| Year 2001  | -0.3833     | 0.0241    | -15.87 | 0.0000 | -0.4308    | -0.3357   |
| Year 2002  | -0.3188     | 0.0209    | -15.23 | 0.0000 | -0.3600    | -0.2776   |
| Year 2003  | -0.1881     | 0.0148    | -12.69 | 0.0000 | -0.2173    | -0.1589   |
| Year 2004  | -0.0916     | 0.0095    | -9.61  | 0.0000 | -0.1104    | -0.0728   |
| Year2005 (omitted)                                       |             |           |        |        |            |           |
| Post Period 1 (2001-2005) Indicator                      | -0.3088     | 0.0971    | -3.18  | 0.0020 | -0.4999    | -0.1176   |
| <b>HHI Control Hospitals - Pre and Post Period 1</b>     |             |           |        |        |            |           |
| HHI - Control Hospitals Pre-Period                       | 0.5115      | 0.2238    | 2.29   | 0.0230 | 0.0707     | 0.9523    |
| HHI - Control Hospitals Post-Period 1                    | 0.4627      | 0.2281    | 2.03   | 0.0440 | 0.0135     | 0.9118    |
| <b>Sutter Pre-Period (1995-1999) Variables</b>           |             |           |        |        |            |           |
| HHI - Sutter Hospitals Pre-Period                        | -0.0855     | 0.4947    | -0.17  | 0.8630 | -1.0598    | 0.8887    |
| Sutter Price Difference - Pre-Period                     | 0.0958      | 0.0890    | 1.08   | 0.2830 | -0.0795    | 0.2712    |
| <b>Sutter Post Period 1 Variables</b>                    |             |           |        |        |            |           |
| HHI - Sutter Hospitals Post-Period 1                     | -1.3196     | 0.5304    | -2.49  | 0.0130 | -2.3641    | -0.2752   |
| Sutter Price Difference - Post -Period 1                 | 0.3128      | 0.0944    | 3.31   | 0.0010 | 0.1269     | 0.4987    |
| <b>Control Variables</b>                                 |             |           |        |        |            |           |
| <b>Hospital Characteristics</b>                          |             |           |        |        |            |           |
| For Profit   | 0.0898      | 0.0520    | 1.73   | 0.0850 | -0.0126    | 0.1923    |
| District   | -0.0152     | 0.0614    | -0.25  | 0.8040 | -0.1361    | 0.1057    |
| Teaching Hospital  | 0.0769      | 0.0653    | 1.18   | 0.2400 | -0.0516    | 0.2054    |
| Rural  | 0.0872      | 0.0680    | 1.28   | 0.2010 | -0.0466    | 0.2210    |
| Beds - Total Staffed                                     | 0.0004      | 0.0003    | 1.63   | 0.1050 | -0.0001    | 0.0009    |
| Beds - Small (under 150)                                 | -0.0214     | 0.0567    | -0.38  | 0.7060 | -0.1330    | 0.0903    |
| Beds - Large (above 350)                                 | 0.0247      | 0.0522    | 0.47   | 0.6360 | -0.0780    | 0.1275    |
| Designated Regional Trauma Center                        | 0.1834      | 0.0397    | 4.62   | 0.0000 | 0.1051     | 0.2616    |
| Hospital CMI Above 2.0                                   | -0.3591     | 0.5434    | -0.66  | 0.5090 | -1.4292    | 0.7110    |
| Ratio OP Visits/ IP Days                                 | 0.0027      | 0.0011    | 2.46   | 0.0150 | 0.0005     | 0.0049    |
| <b>Payor/Revenue Mix Variables</b>                       |             |           |        |        |            |           |
| Disproportionate Share Hospital (DSH)                    | -0.0442     | 0.0521    | -0.85  | 0.3970 | -0.1468    | 0.0584    |
| Hospital % Commercial                                    | 0.2422      | 0.1403    | 1.73   | 0.0860 | -0.0342    | 0.5185    |
| Hospital % Medicare                                      | 0.0540      | 0.2014    | 0.27   | 0.7890 | -0.3426    | 0.4505    |
| <b>Hospital Systems Variables - Non-Sutter</b>           |             |           |        |        |            |           |
| Member of Hospital System (Other Than Sutter or Dignity) | 0.0403      | 0.0393    | 1.03   | 0.3060 | -0.0371    | 0.1177    |
| HHI - Dignity Hospitals Pre-Period                       | 0.3466      | 0.3530    | 0.98   | 0.3270 | -0.3485    | 1.0417    |
| HHI - Dignity Hospitals Post-Period 1                    | -0.5398     | 0.4798    | -1.13  | 0.2620 | -1.4846    | 0.4050    |
| Dignity Price Difference - Pre-Period                    | -0.0920     | 0.0484    | -1.90  | 0.0590 | -0.1874    | 0.0034    |
| Dignity Price Difference - Post -Period 1                | 0.1790      | 0.0645    | 2.77   | 0.0060 | 0.0519     | 0.3061    |

## Regression output: post period 2 (2010–2019)

|   | Coefficient | Robust<br>std. err. | t     | P>t    | [95% conf.<br>interval] |         |
|---|-------------|---------------------|-------|--------|-------------------------|---------|
| <b>Constant</b>   | 8.4997      | 0.189262            | 44.91 | 0.0000 | 8.1270                  | 8.8725  |
| <b>Time Control Variables</b>                               |             |                     |       |        |                         |         |
| Year_2010-omitted   |             |                     |       |        |                         |         |
| Year_2011   | 0.0937      | 0.0249              | 3.76  | 0.0000 | 0.0446                  | 0.1429  |
| Year_2012   | 0.1042      | 0.0256              | 4.07  | 0.0000 | 0.0538                  | 0.1546  |
| Year_2013   | 0.1523      | 0.0283              | 5.38  | 0.0000 | 0.0966                  | 0.2080  |
| Year_2014   | 0.2259      | 0.0313              | 7.21  | 0.0000 | 0.1642                  | 0.2876  |
| Year_2015   | 0.2441      | 0.0335              | 7.29  | 0.0000 | 0.1782                  | 0.3100  |
| Year_2016   | 0.3176      | 0.0351              | 9.04  | 0.0000 | 0.2484                  | 0.3868  |
| Year_2017   | 0.3494      | 0.0364              | 9.61  | 0.0000 | 0.2778                  | 0.4210  |
| Year_2018   | 0.3465      | 0.0360              | 9.62  | 0.0000 | 0.2755                  | 0.4174  |
| Year_2019   | 0.3318      | 0.0419              | 7.93  | 0.0000 | 0.2493                  | 0.4142  |
| <b>HHI Control Hospitals - Post<br/>Period 2</b>            |             |                     |       |        |                         |         |
| HHI - Control Hospitals Post-<br>Period 1                   | 1.0310      | 0.1885              | 5.47  | 0.0000 | 0.6597                  | 1.4023  |
| <b>Sutter Post Period 2 Variables</b>                       |             |                     |       |        |                         |         |
| HHI - Sutter Hospitals Post-Period<br>1                     | -1.2708     | 0.2937              | -4.33 | 0.0000 | -1.8492                 | -0.6924 |
| Sutter Price Difference - Post -<br>Period 1                | 0.3376      | 0.0574              | 5.89  | 0.0000 | 0.2246                  | 0.4506  |
| <b>Control Variables</b>                                    |             |                     |       |        |                         |         |
| <b>Hospital Characteristics</b>                             |             |                     |       |        |                         |         |
| For Profit  | 0.1288      | 0.0514              | 2.5   | 0.0130 | 0.0275                  | 0.2301  |
| District  | -0.0895     | 0.0967              | -0.93 | 0.3560 | -0.2801                 | 0.1010  |
| Teaching Hospital   | 0.2320      | 0.0614              | 3.78  | 0.0000 | 0.1110                  | 0.3530  |
| Rural   | 0.0413      | 0.0682              | 0.61  | 0.5460 | -0.0931                 | 0.1757  |
| Beds - Total Staffed  | 0.0003      | 0.0002              | 1.39  | 0.1650 | -0.0001                 | 0.0008  |
| Beds - Small (under 150)                                    | -0.0391     | 0.0502              | -0.78 | 0.4370 | -0.1381                 | 0.0599  |
| Beds - Large (above 350)                                    | -0.1046     | 0.0710              | -1.47 | 0.1420 | -0.2445                 | 0.0353  |
| Designated Regional Trauma<br>Center                        | 0.0815      | 0.0386              | 2.11  | 0.0360 | 0.0054                  | 0.1575  |
| Hospital CMI Above 2.0                                      | 1.6567      | 0.6032              | 2.75  | 0.0060 | 0.4685                  | 2.8448  |
| Ratio OP Visits/ IP Days                                    | 0.0030      | 0.0006              | 4.7   | 0.0000 | 0.0017                  | 0.0042  |
| Hospital Quality Score                                      | 0.0063      | 0.0021              | 2.92  | 0.0040 | 0.0020                  | 0.0105  |
| <b>Payor/Revenue Mix Variables</b>                          |             |                     |       |        |                         |         |
| Disproportionate Share Hospital<br>(DSH)                    | -0.0360     | 0.0445              | -0.81 | 0.4200 | -0.1237                 | 0.0518  |
| Hospital % Commercial                                       | 0.0901      | 0.2378              | 0.38  | 0.7050 | -0.3782                 | 0.5584  |
| Hospital % Medicare   | 0.2760      | 0.2400              | 1.15  | 0.2510 | -0.1967                 | 0.7486  |
| <b>Hospital Systems Variables -<br/>Non-Sutter</b>          |             |                     |       |        |                         |         |
| Member of Hospital System<br>(Other Than Sutter or Dignity) | 0.0413      | 0.042621            | 0.97  | 0.3340 | -0.0427                 | 0.1252  |
| HHI - Dignity Hospitals Post-<br>Period 1                   | -0.8643     | 0.256774            | -3.37 | 0.0010 | -1.3700                 | -0.3585 |
| Dignity Price Difference - Post -<br>Period 1               | 0.2767      | 0.054507            | 5.08  | 0.0000 | 0.1694                  | 0.3841  |

**Statistical Software and Statistical Methods:** For our ordinary least squares (OLS) regression analysis, we employed the STATA software and implemented robust standard error estimation along with clustering at the hospital ID level. Our observation is hospital-year, and we have multiple years per hospital. Error terms are likely to be correlated within clusters (individual hospitals) but independent across hospitals, in which case regular standard errors, which assume independence between all observations, will be incorrect. Cluster-robust standard errors are designed to allow for correlation between observations within cluster (hospital). In addition, we do not employ hospital fixed effects since we are interested in measuring whether the effects of competition, as measured by the HHI, have differentially weakened for Sutter compared to other hospitals that do not engage in all of nothing contracting. Hospital HHIs generally change very little from year to year. By adding hospital fixed effects, since the HHI does not change over time, the effect of HHI is largely absorbed by the hospital fixed effect.

### **Description of methods using regression pre-post period 1 regression results**

The estimated Sutter coefficient in the regression reflects the increase in the logarithm of hospital prices for facilities within the Sutter system during the pre-period. This analysis considers a hospital with an average Herfindahl-Hirschman Index (HHI). To capture potential variations during the post-period (2001–2005), the model incorporates the interaction of Sutter with the post-period, effectively controlling for additional differences during this time frame. As a result, the overall effect of Sutter on the logarithm of hospital prices during the post-period is the sum of the Sutter coefficient (0.0958) and the Sutter-post-period interaction term (0.312), resulting in a total effect of 0.40. To express this effect in percentage terms for a binary variable (Sutter) on the original variable (Price), we transform the estimated effect on  $\log(\text{Price})$  by computing  $(\exp-1)$ .

The estimated coefficient for the HHI variable (0.51) represents the impact of HHI on hospital prices for hospitals and periods that were not adjusted for with HHI interactions. In other words, this coefficient reflects the effect on prices for non-Sutter hospitals during the pre-period. To estimate the HHI effect for Sutter hospitals during the pre-period, we add the HHI estimated coefficient to the Sutter-HHI interaction term  $[0.51+(-0.08)=0.425]$ .

However, it's important to note that the Sutter-HHI estimate during the pre-period is not significantly different from the main HHI coefficient.

In the post-period, we add the estimates for post-period HHI interactions to the main HHI and Sutter-HHI coefficients from the pre-period. This results in a value of  $0.51+0.46=0.97$  for non-Sutter hospitals, and  $0.51+(-0.08)+0.46-1.31=-0.43$  for Sutter hospitals. Notably, the Sutter-HHI coefficient in the post-period is significantly different from the HHI effect for the control hospitals.

### **Description of methods using regression period 2 regression results**

In this section, we outline our approach for estimating price differences between Sutter hospitals and control group hospitals using regression coefficients. We illustrate these steps with data from post-period 2 (2010–2019) for a single Sutter hospital. The coefficients used are directly obtained from the post-period 2 regression results.

Starting with the regression coefficient (0.3376149) for the “Sutter Price Difference” variable, which estimates the price differential between Sutter hospitals and control group hospitals in post-period 2.

Since the dependent variable is the natural logarithm of price (net revenue per adjusted admission), we need to transform the coefficient to calculate the percentage difference in price:  $\exp(0.338)-1=40\%$ .

This 40% price difference assumes that Sutter hospital HHI values are at the estimated average level for Sutter hospitals (as the Sutter-HHI interaction is zero when Sutter HHI equals the average HHI).

The data show that Sutter HHI values differ from the average HHI value in the sample:

Average HHI for Control Group Hospitals: 0.3392.

Average HHI for Sutter Hospitals: 0.3985.

In the next step, we adjust the estimated price difference to account for the fact that Sutter Hospital HHIs differ from the average HHI. We use the following coefficients from the regression model:

HHI Price Effect Coefficient (for all hospitals): 1.0310.

HHI Price Effect Coefficient for Sutter Hospitals (assuming average HHI):  $-1.2708$ .

To calculate the percentage price difference for Sutter and non-Sutter hospitals with average HHI (using the regression coefficient for the Sutter dummy, 0.3376), we need to consider that the HHI effect on prices for Sutter hospitals is different from that of the control group.



This difference is accounted for in the construction of HHI values for Sutter hospitals, using a centered variable for the interaction. For each Sutter hospital, we calculate the difference between the average HHI and the specific hospital's HHI value, allowing us to estimate the marginal differences in the HHI effect for each Sutter hospital directly.

Difference between HHI for Sutter Hospital vs. Control Group: 0.06.

Difference in HHI Price Effect for Sutter Hospitals (0.06x-1.2708): -0.0753.

Price Difference for Sutter Hospitals (0.4016) with Average Sutter HHI: 0.4016.

Estimated Price Difference for Sample Hospital with HHI of 0.3985: 32.6%.

To account for the additional difference in prices due to varying HHI effects, we multiply the Sutter-HHI interaction effect by the HHI difference between each Sutter hospital and the average HHI (since we use a centered variable for the interaction). For example, if a hospital (e.g., Alta Bates) has an HHI of 0.3985, which is 0.06 higher than the average HHI of 0.3392, we calculate the competition effect of -0.0753 (the difference in the HHI effect on price).

The net effect of Sutter membership on pricing at this hospital is 0.3985 (mean HHI) + additional competition effect of -0.08, resulting in a net effect of 0.326. This

process is repeated for all Sutter hospitals in all periods to estimate Sutter-specific price differences based on HHI values for each Sutter hospital.

**Sensitivity Tests:** To ensure the robustness of our findings, we conducted additional tests by employing two different weighting approaches to the data: patient-weighting and hospital-weighting. These alternative weighting schemes were applied to the data for each time period.

The hospital-weighted analysis assigned equal weight to each hospital facility, irrespective of its size or patient volume. Under this approach, small hospitals and large hospitals contributed equally to the overall results, effectively treating each hospital as a single observation.

Conversely, in the patient-weighted analysis, we weighted the results based on the number of patients served by each hospital. This method ensured that hospitals with larger patient populations had a proportionally greater influence on the estimates, reflecting their relative importance.

Both the patient-weighted and hospital-weighted tests yielded highly consistent and similar results, reinforcing the reliability and validity of our core findings. The consistency across these alternative weighting approaches suggests that our conclusions are not dependent on the specific weighting scheme employed, but rather are robust to different methodological considerations.

## Cross Walk: Labels in Regression Output and Variable Description

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| Labels in Regression | Description   |
|----------------------|---|
| Price                | Commercial Inpatient Net Revenue per Adjusted Discharge, adjusted for average CMI and Medicare wage indices |
| Above2               | Code = 1 for hospitals w Case Mix Index above 2.0, zero otherwise   |
| bed_stf              | Beds - Total Staffed  |
| chainHHI             | Hospital HHI adjusted for system membership   |
| chainHHI-post        | Hospital HHI adjusted for system membership - post period   |
| chainHHI-pre         | Hospital HHI adjusted for system membership-pre period  |
| DIGNITY              | Code = 1 for Dignity hospitals, zero otherwise  |
| district             | Code = 1 for District hospitals, zero otherwise   |
| DSH                  | Code = 1 for Disproportionate Share hospitals, zero otherwise   |
| forprofit            | Code = 1 for For-Profit hospitals, zero otherwise   |
| log_Price            | Natural log of Price (per adjusted discharge, CMI, Wage adjusted)   |
| oth_sys              | Code = 1 for Dignity hospitals, zero otherwise  |
| pc_rated_~10         | Measure of hospital quality/satisfaction  |
| Rural                | Code = 1 for Dignity hospitals, zero otherwise  |
| shr_3P               | Share of volume commercial payors patient's   |
| shr_MCR              | Share of volume Medicare patients   |
| small_bed150         | Code = 1 for Dignity hospitals, zero otherwise  |
| SUTTER               | Code = 1 for Dignity hospitals, zero otherwise  |
| Teaching             | Code = 1 for Dignity hospitals, zero otherwise  |
| trauma               | Code = 1 for Dignity hospitals, zero otherwise  |
| vis2dis3P            | Ration of commercial visits to commercial discharges  |

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