Appendices: For Online Publication Only

APPENDIX A: Description of Data and Data Cleaning

Appendix A1: Datasets and Sources

Health Care Cost Institute (HCCI) Data: Our paper draws on data from the Health Care Cost Institute (HCCI). The HCCI data include claims from beneficiaries with employer-sponsored coverage from Aetna, Humana, and UnitedHealthcare. More details on HCCI can be found at www.healthcostinstitute.org.

The data include claims for individuals with fully-insured and self-insured plans that receive employer-sponsored insurance.[1] This includes insurance products in the national, large, and small group markets. The data cover 27.6 percent of individuals in the US with employer-sponsored insurance. The data begin with sheets of membership data, inpatient facilities data, outpatient data, physician data, and pharmacy data. We use these to construct our inpatient and procedure samples. A sample hip replacement case constructed from these claims is posted online at http://healthcarepricingproject.org/sites/default/files/papers/sample_hip_claims.xlsx. This illustrates how we aggregate claims up to the case level and calculate a price.

While the HCCI data include more than forty million covered lives per year (see Table 1 in the body of the paper), the data are from health insurance claims for individuals with health care coverage from Aetna, Humana, or UnitedHealthcare. While these are three of the largest five health insurers in the US, we do not have claims from Blue Cross Blue Shield (BCBS) health insurers. BCBS is an association of 38 for-profit and not-for-profit health insurers in the US who purchase a license to use the BCBS name. We use membership data from our database and compare it to coverage rates in the American Community Survey and the Census Bureau's Small Area Health Insurance Estimates (SAHIE) to estimate the coverage of our three insurers at the state and county level. We also use data from the HealthLeaders Interstudy database to estimate the share of lives BCBS insurers cover by county. We use this information to show that our results are robust to areas with different levels of HCCI and BCBS coverage (See Appendix F).

The most prominent alternative source of private health insurance claims data is the MarketScan database from Truven Health Analytics. MarketScan data include claims for individuals with health insurance from a number of large employers and also some smaller employers (although it seems that the MarketScan coverage for smaller employers is substantially lower than their coverage for larger employers). Most previous research using the MarketScan data to analyze health spending has relied on only the claims for individuals employed by large firms. We use the HCCI data to analyze claims for individuals employed in small, medium, and large firms. Using the HCCI data allows us to look at a substantially larger population than has been analyzed using the MarketScan data. Chernew et al. (2010) report that the MarketScan data contain between 16.9 million and 22.9 million covered lives per year between 1996 through 2006. By contrast, the HCCI data contain between 42 and 46 million lives per year (see Table 1).

While the MarketScan database is useful for many research applications, it has drawbacks for the type of analysis we undertake in this project. First, the MarketScan database does not contain hospital IDs and sub-three digit geographic identifiers. A unique hospital identifier is necessary

[1] With fully-insured plans, the insurer pools and bears risk. With self-insured plans, the firm pays all insurance claims themselves and relies on insurance companies for administrative services.

so that we can merge in hospital characteristics and, more importantly, analyze price variation within and between providers. With HCCI, we can merge on hospital characteristics, identify individual hospitals, and merge in local characteristics at the zip code level. Second, MarketScan has very thin coverage in a number of markets. For example, while the smallest HRR in the HCCI data has 2,932 unique individuals, MarketScan includes HRRs with fewer than two hundred individuals.

In addition to the core HCCI data, we merge on a number of other datasets listed below.

American Hospital Association Annual Survey: We obtain data on hospital characteristics from the American Hospital Association (AHA) annual survey. More information on the AHA survey data can be obtained from: http://www.ahadataviewer.com/book-cd-products/AHA-Survey/. The survey polls hospitals on characteristics, staffing, technology, finances, and other information and has been running since 1946. We use the AHA data to create our technology measures and measures of hospital market structure.

American Community Survey Data: We use data on the percentage of working age (18-64) adults with employer-based health insurance coverage by county from the American Community Survey conducted by the US Census Bureau, https://usa.ipums.org/usa/acs_healthins.shtml.

American Hospital Directory Data: We use data on hospitals' Medicare activity that we obtained from the American Hospital Directory (AHD). The AHD is a for-profit data vendor that sells cleaned Medicare claims data derived from the Medicare Provider Analysis and Review limited access database. This includes claims records for 100% of Medicare fee-for-service inpatient claims. Details on the AHD data can be found at www.ahd.com.

Census Data: Data on the number of uninsured lives by county, lives privately insured per county, and median household income come from the US census. See: http://www.census.gov/did/www/sahie/ and http://www.census.gov/did/www/saipe/index.html.

Dartmouth Data: We use data on Medicare spending per HRR that we downloaded from the Dartmouth Atlas. Full details on the Dartmouth Atlas Medicare data can be obtained from: http://www.dartmouthatlas.org.

FactSet Research Systems: These reports provide a roster of merger and acquisition (M&A) activity across industries and include the names of firms involved in transactions and the date of transactions. We used the database to find hospital mergers. The data are accessible with a subscription at: https://www.factset.com/data/company_data/mergers_acq

HealthLeaders Interstudy Data: The HealthLeaders Interstudy database, available for purchase from the Decision Resources Group, includes the count of individuals enrolled, by county, by insurer in the small, medium, and large group markets. The data include coverage of the self-insured and fully-insured market. See: decisionresourcesgroup.com.

Irving Levin Associates' Health Care Services Acquisition Reports: These reports provide a roster of M&A activity in hospitals, managed care companies, physician medical groups, rehabilitation centers, labs, and behavioral health groups. We used reports for 2007 to 2011 to identify the hospital mergers that we include in this analysis. The reports can be purchased from: https://products.levinassociates.com/downloads/har-2017/

Medicare Quality Scores: We use data on hospital quality obtained from data.medicare.gov. The data include quality scores drawn from both Medicare and private claims data. The data can be downloaded from: https://data.medicare.gov/data/hospital-compare. The quality scores used were developed by the Agency for Health Care Research and Quality (AHRQ).

Securities Data Company (SDC) Platinum: This database provides a historical transaction database including a roster of hospital mergers. The data are accessible with a subscription via: https://financial.thomsonreuters.com/en/products/data-analytics/market-data/sdc-platinum-financial-securities.html.

U.S. News & World Report Rankings: We obtained rankings of hospitals printed in the US News and World Report from 2007 – 2011. Some data were obtained from online rankings. For some years, we obtained the physical copy of the printed magazine issues.

Appendix A2: Identifying Hospitals Using National Plan and Provider Enumeration System Identifiers

Single hospitals can be assigned multiple National Plan and Provider Enumeration System Identifiers (NPI) because different wings of the hospitals and different units can each have their own NPI (e.g. a hospital's radiology service could have a separate NPI to its Emergency Room). To address this issue, we made a crosswalk that consolidates providers' multiple NPIs into a single, master NPI. We use the master NPI to merge on data from the AHA and Medicare. To consolidate NPIs, we undertake the following steps:

1. Compile all variations of AHA ID/hospital name/address/city/state/ZIP Code in the 2000-2011 AHA survey data, retaining the row for the latest year.
2. Add NPI from the AHA survey files, beginning with the most recent year.
3. Make sure there is only one NPI per AHA ID. If more than one AHA ID have the same NPI, look up in the CMS NPI Registry to resolve the discrepancy.
4. Check all NPIs in the CMS NPI Registry to make sure they are valid and accurate. Remove invalid NPIs.
5. Look up hospitals in the NPI Registry that do not have an NPI in AHA by name and address. Attach NPI to the AHA file when a match is found.
6. Extract all organizational rows from the CMS NPI Registry where primary taxonomy code is for a hospital (287300000X, 281P00000X, 281PC2000X, 282N00000X, 282NC2000X, 282NC0060X, 282NR1301X, 282NW0100X, 282E00000X, 286500000X, 2865C1500X, 2865M2000X, 2865X1600X, 283Q00000X, 283X00000X, 283X00000X, 283XC2000X, 282J00000X, 284300000X) or hospital unit (273100000X, 275N00000X, 273R00000X, 273Y00000X, 276400000X).
7. Match AHA compiled address file to the hospital NPI file on NPI. Add AHA number to the hospital NPI file and mark the NPI as 'PRIMARY' NPI for that hospital.
8. Match remaining rows in the hospital NPI file according to the following hierarchy:
    1. Organization name, address1, city, state, ZIP Code
    2. Address1, city, state, ZIP Code, similar organization name
    3. Other organization name, address1, city, state, ZIP Code
    4. Address1, city, state, ZIP Code, similar other organization name

5. Address, city, state, ZIP Code, different name (validated name changes via web search)[2]
6. Organization name, similar address1, city, state, ZIP Code[3]
7. Other organization name, similar address1, city, state, ZIP Code
8. Similar organization name, similar address1, city, state, ZIP Code
9. Similar other organization name, similar address1, state, ZIP Code
10. Medicare number, city, state, ZIP Code

9. When a match is found, append AHA ID and 'PRIMARY' NPI.
10. Some hospitals in the NPI Registry were not in the AHA survey data files. For these hospitals, we pick one NPI as 'PRIMARY' and, using the match steps outlined above, add an 'X' to the AHA ID column and append the 'PRIMARY' NPI to all matched rows.
11. We also consolidated NPIs to ZIP codes. To do so, we:
    1. Sort file by ZIP Code, primary taxonomy code, address1
    2. Where more than one 'PRIMARY' NPI exists within a ZIP Code for the same organization name and primary taxonomy, change all rows to the 'PRIMARY' NPI associated with the AHA ID.
    3. Where more than one 'PRIMARY' NPI exists within a ZIP Code for the same organization name and primary taxonomy but none of the rows is associated with an AHA ID, double check against the AHA file. If no match is found, consolidate the rows to one single 'PRIMARY' NPI.

Appendix A3: Constructing a consistent hospital-level panel from the AHA Data

When hospitals merge, the AHA Survey will often consolidate two hospital IDs into a new single ID. While this does not affect our measure of hospital prices (since those are generated from the HCCI data), it does delete observations from the AHA data. This creates two issues. First, according to the AHA data, the count of AHA hospital sites (as opposed to systems) decreases over time. This is caused mechanically by mergers, which reduce the numbers of IDs. Second, because we measure prices for hospital sites, AHA characteristics that we use as control variables are only available at the more aggregated level of the consolidated sites. While most of our control variables are categorical (e.g. whether a hospital is a teaching facility), some are continuous measures (e.g. hospital beds, the count of Medicare discharges per year, and the count of Medicaid discharges per year).

A good example of this issue is that after their merger, the IDs for New Britain General Hospital in New Britain, CT and Bradley Memorial Hospital in Southington, CT are consolidated into a new ID number for the Hospital of Central Connecticut in 2006. In the AHA Survey data the IDs for "New Britain General" and "Bradley Memorial" vanish from the survey in 2006 and a new hospital ID for "Hospital of Central CT" appears in the same year.

This is a standard problem in firm-level analysis. A firm is composed of a number of establishments and often data are only available at the higher firm-level (e.g. Compustat). When

[2] Because there can be hospitals within hospitals (e.g., specialty or children's hospital on one floor of a general hospital), all of these occurrences were manually validated to ensure that the correct hospital was identified.

[3] Suburb names are occasionally used in addresses (e.g., Brentwood vs. Los Angeles). If the address1, state, and ZIP Code matched but the city name differed, this was still considered a valid match at each level.

two firms merge information is often only available at the aggregate consolidated level and not for the individual firms (even when they are still run as separate businesses). A standard approach to this problem is to freeze the organizational structure at a point of time, so the researcher can analyze a consistent set of firm sub-units (or at least until they exit). We perform an analogous exercise for hospital sites.

In order to maintain the information at the more disaggregated level we "undo" the site-level consolidation in AHA after 2001 by (i) maintaining the original (vanished) ID at the site level in the year the consolidation occurs and for all years afterwards; (ii) remove the new consolidated ID from the data in all years after it occurs.[4] We then construct a new master hospital system ID. The challenge that arises from "undoing" this consolidation of IDs is we do not know the correct bed count (and other observables) at the hospital site-level after consolidation.

We address this by imputing the information at the consolidated level to the site level for all continuous variables for these hospitals in the following manner. Consider the following example of imputing hospital beds. Let two separate hospitals have distinct IDs *A* and *B* at time *T-1*. Assume that hospitals *A* and *B* merge at time *T* and become hospital C (hospital C may have already been in existence at T-1 or may be a new hospital created from the merger of A and B at time T). The merged hospital is given the ID *C* and the IDs for A and B cease to exist. Let b_t^h be the number of beds at hospital *h* at time *t* where $h \in \{A,B,C\}$ and $t \in \{2001,2002,\ldots,2014\}$. Let $w^h = \frac{b_{T-1}^h}{\sum_{h \in \{A,B\}} b_{T-1}^h}$. w^h is hospital *h*'s share of the total number of beds between hospitals *A* and *B* at time *T-1*. If $\frac{\left|b_T^C - \sum_{h \in \{A,B\}} b_{T-1}^h\right|}{\frac{b_T^C + \sum_{h \in \{A,B\}} b_{T-1}^h}{2}} \leq 0.2$, then we assume hospital *h*'s bed total is $w^h b_t^C$ for all *t* in which hospital *C* exists in the AHA Survey. Otherwise, we assume hospital *h*'s bed total is b_{T-1}^h for all *t* in which hospital *C* exists.

In other words, if the percentage difference between the total number of beds at *A* and *B* in *T-1* and the number of beds of the consolidated hospital ID in time *T* is less than or equal to 20 percent, then we impute hospital *A*'s bed count to be its share of the total beds at *A* and *B* at time *T-1* (w^A), multiplied by the consolidated hospital's total number of beds (b_t^C) for all years that hospital *C* exists in the AHA Survey. If this percentage difference is greater than 20 percent, then we assign hospital *A* the bed total it has at time *T-1* to all the years in which hospital *C* exists (from time T forward).[5]

We carry out this same imputation procedure for the share of Medicare and Medicaid discharges using the above methodology.

Appendix A4: Defining the Inpatient and Procedure Pricing Samples

The inpatient sample in our data includes all inpatient claims aggregated to the level of a single hospital admission (which we call a case), each of which has a unique DRG. The procedures we

[4] In some cases, the merger is recorded using the aggregation of an acquired hospital into an existing AHA ID. In these cases, the procedure is the same except we do not delete observations for the acquiring hospital.

[5] We choose a threshold because if the difference is large then it indicates that the merged hospital is undergoing a large restructuring, so this casts doubt on the assumption that the relative size of original entities is stable. 20 percent is an arbitrary threshold, of course, but the results are robust to other reasonable thresholds.

use are defined using combinations of ICD9 codes and DRGs. In the case of MRIs, we identify cases using CPT-4 codes. The specific codes we use to define samples include:

Coding Definitions for the Seven Procedure Samples

Procedure	**ICD9**	and	**MS-DRG**	or	**CPT-4**
Hip Replacement	8151		470		
Knee Replacement	8154		470		
Cesarean Section	741		766		
Vaginal Delivery	7359		775		
PTCA	0066		247		
Colonoscopy	V7651 (CM)				
MRI					73721

For hip and knee replacements, we limit our analysis to individuals between forty-five and sixty-four years of age. For vaginal deliveries and cesarean sections, we limit our analysis to delivering mothers who are between the ages of twenty-five and thirty-four. In order to be included, an MRI case must be a single-line facility claim and we must observe a separate physician payment for the reading of the MRI. We do this to ensure that we are isolating the professional component (reading of the MRI) from the technical component (administering the scan). We also limit MRIs to those carried out on individuals who had no other hospital claims on the day that the MRI was provided and for whom the hospitalization was exclusively for the MRI. Similarly, for colonoscopies, we limit our analysis to individuals aged forty-five through sixty-four and only include hospital-based cases where nothing else was done to the patient that day and for which the colonoscopy was the reason for the trip to the hospital. We exclude colonoscopies where a biopsy was taken.

In order to minimize the impact of unusually complicated cases or clerical billing errors, we exclude cases above the 99th percentile of length-of-stay as well as cases where the price is below the 1st percentile or above the 99th percentile. In the inpatient sample, these restrictions are implemented by DRG.

Appendix Table 2 shows the impact on the number of hospitals and cases of the main selection criteria we use to derive our inpatient sample. After conditioning our data to cases delivered at hospitals that are registered with the AHA, we have 5,865,727 inpatient cases delivered at 4,326 facilities between 2008 and 2011. Excluding critical access hospitals drops our number of providers by 1,124 (26 percent), but only lowers the number of cases we observe by 51,349 (less than one percent). We further exclude three hospitals where we do not have data on Medicare activity. We then exclude all cases from 2007. This lowers our cases by 769,104 (13 percent) and number of hospitals by 10 (less than one percent). In order to have sufficient data at each hospital to calculate an inpatient price index, we exclude providers that had fewer than 50 cases per year. This drops 74,705 cases (1.5 percent) and 831 hospitals (26 percent).

Appendix A5: Construction of Price Fixed Spending and Quantity Fixed Spending Used in Section III.B.

We calculate Medicare and private spending per beneficiary where we fix quantities nationally (and only allow price variation to drive variation in spending) and fix prices (and only allow quantity variation to drive spending variation).

To do so, we first calculate inpatient spending per beneficiary for the privately insured and for Medicare recipients. Inpatient spending per beneficiary in HRR *r* (y_r) is a function of the quantity (q_r) of care provided and the price of care (p_r):

$$y_r = \frac{\sum_{h,d}(p_{h,d}q_{h,d})}{B_r},$$

where the price of DRG *d* at hospital *h* in HRR *r* is represented by $p_{h,d}$ and quantity is $q_{h,d}$ (we suppress the subscript *r* for economy of notation), B_r is the number of beneficiaries in HRR *r*, and $\sum_{h,d}$ indicates summing across all DRGs in a hospital and the all hospitals in an HRR.

We compute counterfactuals to calculate the relative contributions of price and quantity to variation in inpatient spending. The first counterfactual we create is to fix all prices per DRG to be the same as the national average ($\bar{p}_d$) and then analyze spending variation. This allows us to identify the relative contribution that differences in the quantity of care provided across regions make to variation in spending per beneficiary. Spending per beneficiary calculated with national average prices is (where ~ indicates a counterfactual calculation):

$$\tilde{y}_r^{\bar{p}_d} = \frac{\sum_{h,d}(\bar{p}_d q_{h,d})}{B_r}.$$

The second counterfactual is to fix the quantity and mix of inpatient care delivered in each HRR to be the same as the national average mix and quantity of care ($\bar{q}_d$) and then analyze spending variation.[6] To do so, we calculate:

$$\tilde{y}_r^{\bar{q}_d} = \frac{\sum_{h,d}(\bar{q}_d p_{h,d})}{B_r}.$$

This allows us to identify the relative contribution that differences in price make to variation in spending per beneficiary across HRRs. These are, of course, purely accounting decompositions to gauge rough magnitudes, as quantity and price are both endogenously determined in the private sector.

Appendix Tables 3 and 4 contain the results of these counterfactual calculations for individuals age 55 to 64 (Appendix Table 3) and individuals age 18 to 64 (Appendix Table 4).

Appendix A6: Construction of Control Variables for Sections VI and VII

[6] To do so, we identify the mix of DRGs at a national level and set every HRR to have that mix of DRGs.

In our estimates of the relationship between market structure, mergers, and hospital prices in Sections VI and VII, we also include a range of additional hospital and local area controls. Below are descriptions of these additional measures.

Hospital Characteristics and Hospitals' Local Area Characteristics: In our cross-sectional and merger analysis, we include controls for hospital characteristics drawn from the AHA annual survey. These include: the number of hospital beds, ownership type (not-for-profit, for-profit, government), teaching status, and indicators for the technologies available at a hospital in a specific year. In addition, we link hospitals' zip codes to local area characteristics from the Census Bureau's Small Area Health Insurance Estimates and Small Area Income and Poverty Estimates, including the proportions of the population who are uninsured and the median income in the county where the hospital is located.

Technology Index: We follow Acemoglu and Finkelstein (2008) in using a count of hospital technologies offered by a hospital as recorded in the AHA survey data. The AHA data include binary indicators for whether a hospital has various technologies and services, such as computer-tomography (CT) scanners, electron beam computed tomography, or proton beam therapy. We sum the number of these technologies available at each hospital in each year.

Hospital Quality: To capture reputational quality, we include a yearly indicator for whether or not a hospital was ranked by the U.S. News & World Report as a top hospital. We indicate a hospital was ranked in the U.S. News and World Report if it was ranked as an overall top hospital or received a ranking as a top hospital for cancer care; gastrointestinal care; ear nose and throat; geriatric care; gynecology; cardiology; orthopedics; rheumatology; or urology. In total, from 2008 through 2011, the U.S. News & World Report ranked 192 hospitals in our sample in their annual 'Best Hospital' rankings across clinical specialties and the overall ranking.

To measure clinical performance, we merge in data on hospital quality from https://data.medicare.gov/, which includes the hospital quality scores reported publicly on the CMS Hospital Compare webpage (https://medicare.gov/hospitalcompare). These include measures of patient safety, patient outcomes, and process measures of care captured from public and private claims data. We included quality scores for 2008 through 2011 for four measures: the percentage of heart attack patients given aspirin upon arrival to the hospital; the percentage of surgery patients given an antibiotic prior to surgery; the percentage of patients treated within twenty-four hours of surgery to prevent blood clots; and the 30-day risk adjusted mortality from heart attacks.[7] These are widely acknowledged measures of the quality of care and they are all available for hospitals in our sample from 2008 through 2011 (Yale Center for Outcomes Research and Evaluation 2013). We focus on these four clinical quality measures in the robustness analysis, but we also examine the effect of conditioning on all 41 quality measures. Note that we do not have CMS quality measures for 168 hospitals (7.5 percent) from our inpatient sample. As a result, we present analysis of these measures separately from our main analysis.

Medicare and Medicaid Activity: We include the Medicare base payment rate for hospitals, since this may proxy for hospital costs. This comes from annual Medicare Impact Files. We also include

[7] For the technical descriptions of the measures of performance we used in this analysis, see http://www.medicare.gov/hospitalcompare/Data/Measures.html.

data from the AHA on the share of hospitals' inpatient cases paid by Medicare and Medicaid each year.

APPENDIX B: Measures of Providers Private Prices and Medicare Reimbursements

Appendix B1: Inpatient Private-Payer Hospital Price Index: Our private-payer inpatient price index captures the combined amount paid by patients and insurers for patient case *i* in DRG *d* delivered in hospital *h,* and provided in year *t.* Following Gaynor and Vogt (2003) and Gowrisankaran, Nevo, and Town (2015), we regress hospital payments ($p_{i,h,d,t}$) on year-specific hospital fixed effects ($\alpha_{h,t}$), a vector of patient characteristics ($X_{i,h,d,t}$) comprised of indicators for patient age (measured in ten-year age bands), a dummy for the patient's sex, and a vector of DRG fixed effects (γ_d). The regression to produce our inpatient prices has the form:

$$p_{i,h,d,t} = \alpha_{h,t} + X_{i,h,d,t}\beta + \gamma_d + u_{i,h,d,t} \quad \text{(A1)}$$

where $u_{i,h,d,t}$ is the stochastic error term. We recover the vector of hospital fixed effects $\hat{\alpha}_{h,t}$ and calculate a hospital price index for each year at the sample means of the patient characteristics ($\bar{X}$) and the DRG indicators, $\bar{d}$ (i.e., the sample mean basket of DRGs).

$$\hat{p}_{h,t} = \hat{\alpha}_{h,t} + \bar{X}\hat{\beta} + \bar{d}\hat{\gamma}_d \quad \text{(A2)}$$

This yields the hospital's price, adjusted for its mix of treatments and mix of patients (note the fixed effect $\hat{\alpha}_{h,t}$ is the key output: $\bar{X}\hat{\beta} + \bar{d}\hat{\gamma}_d$ is just a constant across all hospitals to match the mean in the data).

For robustness, we also created alternate price indexes using many different functional forms. For example, in Appendix Table 10 we show robustness of the estimates reported in Table 6 in the paper to alternative approaches. Panel A has the baseline results which are the same as Panel A of Table 6, i.e. using $ln(\hat{p}_{h,t})$ as the dependent variable. Panel B constructs the risk-adjusted inpatient price by estimating Equation (A1) but using $ln(p_{i,h,d,t})$ instead of $p_{i,h,d,t}$. We then implement the analog of Equation (A2) to obtain an alternative *ln(price)* that we use as the dependent variable in Panel B. In Panel C of Appendix Table 10, we use the level of price ($\hat{p}_{h,t}$) instead of the logarithm of price. In Panel D we include the Charlson Score of co-morbidities to the $X_{i,h,d,t}$ vector in Equation (A1). In Panel E we include a full set of ICD9 dummies instead of DRG dummies.

In addition, we also looked at many other approaches. For example, we calculated regressions where DRG complexity was parameterized using CMS's MS-DRG weights as right hand side control variables, rather than as fixed-effects for each DRG. We also calculated a price index where we regressed the DRG price divided by the DRG weight against patient characteristics and hospital fixed effects. These price measures are all highly correlated with each other (correlation coefficients greater than 0.95), and using alternative price measures does not materially affect our baseline results.

Appendix B2: Procedure-Level Private-Payer Hospital Price Index:

In addition to creating an inpatient price index, we also create risk-adjusted prices for the specific procedures we study. We adjust prices for differences in patient characteristics, just as we did in the inpatient price index. These regressions take the form:

(A3) $$p^P_{i,h,d,t} = \alpha^P_{h,d,t} + X_{i,h,d,t}\beta^P_d + e^P_{i,h,d,t}$$

Superscript *P* indicates one of our seven procedures. We then recover our estimates of the hospital-year-procedure fixed effects as we did when we constructed our inpatient price index.

Appendix B3: Constructing Hospital-Insurer Contracts

Determining between Share of Charge and Prospective Payment contracts

Unfortunately we do not directly observe the contracts struck between insurers and hospitals. In order to classify cases into contracts we "reverse engineer" our data using an *ex post* algorithmic method from observations of prices, charges, and case characteristics. We did this after extensive discussions with insurers on a sensible way to back out contracts.

The first step is to search for repeated absolute prices and repeated price-to-charge ratios within a hospital for our narrowly defined procedures sample (or within DRGs in the inpatient sample). For each hospital and procedure, we look at all cases *i* over the two year period for which we observe hospital charge data (i.e. January 1st 2010 to December 31st 2011). Prices are considered repeated if for all cases *i* and *i'* (i) their prices match to the cent ($0.01) or (ii) their price-to-charge ratios match within 0.1 percent (0.001). Type (i) contracts are likely to be prospective (say tied to a DRG) whereas type (ii) will be share of charge contracts.

If there is only ever one charge for a procedure, we cannot distinguish whether a case falls into one of these two categories. For example, if cases *i* and *i'* have the same payment for a knee replacement (e.g. $1,000), then we will suspect them of being on prospectively paid contracts. But, if their charges are identical (e.g. $2,000), the price to charge is also at 50 percent for both. This is usually the case for lower limb MRIs, for example, which is why we cannot successfully implement our algorithm on this procedure. We can, however, identify the payment type if there exists a third hospital case *i''* which has the same price level but a different charge (or vice versa). For example if knee replacement case *i'' was also* $1,000, but had a charge of $4,000 we would classify all three cases as falling under a prospective pay contract as although its price was always $1,000, its price-to-charge ratio differed (i.e. was 25 percent for contract *i''* and 50 percent for *i* and *i'*).

There are, of course, a number of cases that cannot be classified in this manner, since they are singleton prices or singleton price-to-charge ratios. This may be because they are on a "hybrid" contract, which is prospective but with outlier payments. Or it may be that they are on one of the two standard contracts (share of charge or prospective payments) but there has only been one case over our period so we cannot distinguish the contract. We denote these "unclassified cases."

Repeated contracts

Repeated price-to-charges and repeated absolute prices define a "primitive contract," which we can then use to construct a more persistent set of payment agreements over time by observing whether the classifications hold sequentially over time. We define primitive contracts not only by their price, but also by the first and last date at which that agreement is executed. We calculate characteristics of these contracts, measuring the average monthly volume of patients who are paid under those agreements and measuring the plan characteristics of those contracts (percent of

patients on ASO or fully insured plans; the percent of patients by market segment: large group or small group; and the percent of patients by product type: health maintenance organization (HMO), preferred provider organization (PPO), point of service plan, exclusive provider organization, indemnity, and other). We use all of this information to find contracts that precede or follow each other in order to match primitive contracts over time. Matching contracts are those which begin/end within 45 days of the end/beginning of the candidate contract, and minimize the Euclidean distance of characteristics (patient volume and plan characteristics):

$$d(\vec{x},\vec{y}) = \sqrt{\sum_{i=1}^{k} \frac{(x_i - y_i)^2}{s_i^2}} \quad \text{(B1)}$$

where x and y are vectors of contract characteristics, and s_i is the standard deviation of the i^{th} characteristic across contracts. We recognize "valid" matches to be two contracts that mutually minimize this distance for each other.

While we can determine the type of contract without this matching procedure, the fact that matches are well determined by plan characteristics gives us confidence that distinct contracts reflect distinct agreements across insurers at the same hospital. As we illustrate in Figure 8 in the paper, we are able to link primitive contracts over renegotiations. For example, we can link two primitive contracts if, before and after a price increase, both have 60 percent of cases where the beneficiary is on an ASO product and 80 percent are part of a PPO plan.

Illustrative Examples and Descriptive Statistics

To illustrate this, re-consider Figure 9 in the paper for vaginal deliveries in one of the hospitals in our sample. This hospital had between 500 and 600 cases overall in 2010 and 2011.[8] We were able to identify that 59.5 percent of these fall under a share of charge contract (the circles) and 38.0 percent of these fall under a prospective pay contract (the triangles). The remaining 2.5 percent were unclassified. In one month in 2011, for example, we had 24 cases of which 10 were the same absolute price of $1000 and 14 were all on a 60 percent price-to-charge ratio. This means that for this hospital-month, 41.7 percent of cases were prospective payment contracts, 58.3 percent were price-to charge contracts and zero cases were unclassified.

Figure 10 shows how the contracts are split by the inpatient sample and for each procedure (these are all in terms of fractions of cases). The fraction unclassified is related to the sparsity of the data. As we noted above, the unclassifieds are a mixture of truly hybrid contracts and those we cannot classify, due to the fact we may only observe one case under a particular contract so do not have any other cases we can "match prices" with. This is particularly an issue for the inpatient sample where we are seeking to assign cases to contracts to every one of the approximately 750 DRGs for every hospital. Many hospitals (especially the smaller ones) will only have one case in a particular DRG over this time period. Recall that the only threshold the cases data have is that a hospital must have at least 50 inpatient cases over *all* DRGs in a year.

Appendix Figure 7 illustrates this issue by showing what is the impact on contract classification (across cases in the inpatient sample) of introducing more stringent cut-offs over the minimum number of cases per DRG in the hospital. We start with our baseline of zero on the far left of the

[8] To keep the figure anonymous, we are providing a range of the count of vaginal deliveries performed each year.

x-axis, i.e. we do not insist on any minimum number of cases per DRG in a hospital. At this point we reproduce the first bar chart in Figure 10 for the inpatient sample: 33.6 percent of cases are on prospective contracts; 17.3 percent are share of charges and 49.1 percent are unclassified. As we move to the right we see the fraction of unclassified cases shrink. This is because we are reducing the number of "singleton" prices by focusing on DRGs where we have more chance of identifying contracts. Importantly, the fraction of cases under share of charge contracts asymptotes after we condition on having only about 20 cases per DRG. This suggests, that the true fraction of cases which are on share of charge contracts are genuinely around 23 percent in our sample.

By contrast, the fraction on perspective payments contracts is still rising over the whole range of the x-axis. By the time we restrict attention to DRGs with at least 100 cases in a hospital, we have shrunk the fraction of unclassifieds to under 10 percent and when we reach a 200 cases threshold, it is 4.2 percent.

It is tempting to conclude from this that all the remaining unclassified cases are prospective, so the "true" breakdown of cases is 23 percent on share of charges and 77 percent on prospective contracts. An important caveat to this reading of Appendix Figure 7 is that the sample is changing as we move along the x-axis. We are effectively conditioning on larger and larger hospitals. Hence, the increasing incidence of prospective payment contracts may be due to selection if prospective contracts are more prevalent in the larger volume hospitals. One might have reason to doubt this selection-based explanation of the Figure however, as share of charge contracts are more commonly associated with larger hospitals in the cross sectional regressions on the full inpatient sample. Appendix Table 8 (the full results of Table 6 Panel B) shows that there is a *positive* coefficient on hospital size (as measured by number of beds) in the regressions where the percentage of cases on share of charge is the dependent variable (and this is significant in our preferred Column (3)). Hence, our view is that Appendix Figure 7 shows that the unclassifieds are mainly prospective contracts (rather than hybrids) and this is simply disguised by the fact we only have finite samples of patients with many singleton observations.

This selection effect is very unlikely to be an explanation for our estimate of the percent of cases under share of charge contracts, as the fraction does not change much after a threshold of 5 cases per DRG. Hence we feel confident that the true share of charge incidence is really around 23 percent. The breakdown of the remaining 77 percent of cases between prospectives and hybrids has a bit more uncertainty. An upper bound for prospectives is 77 percent, but in principle a lower bound could be the 33.6 percent in the first column in Figure 10. As argued in the previous paragraph, however, our view is that the true incidence of prospective contracts is closer to 77 percent given the evidence in Appendix Figure 7.

Share of Prospective Payment contracts that are Medicare Related

As discussed in the text, we divide the prospective payments contracts into those that appear to be linked to the Medicare fee schedule and those that are not. Figure 12 in the paper illustrates the methodology for four hospitals.

In the inpatient sample as a whole, 74 percent of prospective payment contracts were linked to Medicare. This fraction was reasonably stable throughout the support of Appendix Figure 7. At baseline, when we do not require a minimum DRG-hospital count restriction, we observed that 72 percent of cases paid prospectively were linked to Medicare. This rose to 75 percent when we

limited our analysis to DRG-hospital pairs with more than 100 cases. In order to estimate the overall fraction of cases that paid prospectively and linked to Medicare, we have to make an assumption about how the unclassifieds are split. Appendix Figure 7 strongly suggests that the share of charge contracts are about 23 percent across all sample restrictions. If *all* of the remaining 77 percent of claims were under prospective contracts (which we have argued is not a bad assumption), the upper bound of the share of claims on Medicare related contracts would be 57 percent (= 77*0.74). Even this upper bound is considerably below the share of physician cases under prospective payment contracts linked to Medicare, which is estimated by Clemens and Gottlieb (2017) to be around 75 percent.

Appendix B4: Medicare Reimbursements

We also construct hospital Medicare reimbursement rates for the services we observe from the HCCI data. Medicare reimburses providers for inpatient care on the basis of DRGs; these are set in an attempt to compensate hospitals slightly above their costs of treating Medicare patients. To calculate the payment for specific cases of care, Federal regulations stipulate that a hospital's base payment is multiplied by a DRG weight that is set by CMS to capture the complexity of treating a particular type of case. Using data obtained from the CMS webpage, we follow the regulations and calculate the base payment rate for every hospital for every year from 2008 through 2011, including adjustments for wage index reclassifications, indirect medical education payments, and disproportionate share payments. The base payment rate is the hospital's Medicare price before any adjustment for its specific mix of DRGs. This is analogous to the risk-adjusted private price. In addition, we also obtain DRG weights from CMS that allow us to know the rates CMS paid hospitals for every DRG per year from 2008 through 2011. We also create Medicare reimbursement rates for our outpatient services using the relevant ambulatory payment classification weights.

APPENDIX C: Measuring Hospital Market and Insurer Market Structure

Appendix C1: Hospital Market Structure:

We construct our measures of hospital market structure in a two-step process. The first step is to define a hospital's market area.[9] We define both fixed- and variable-radius markets. For our fixed-radius markets, we draw a radius around each hospital, which places hospitals in the center of circular markets of radius *z*. We construct hospital markets using five-mile, ten-mile, fifteen-mile, and thirty-mile radii extending outwards from hospitals' locations.[10] Previous analysis of Medicare beneficiaries found that 80 percent of patients were admitted to hospitals within ten miles of their home (Tay 2003). We generally report statistics for markets with a radius *z* of fifteen-miles drawn around each hospital, so that we capture the travel distance of most patients. We illustrate our results are robust to using radii of longer and shorter distances.

The second step is to measure market structure within our defined market areas. We do so in two ways. First, we identify whether the geographically defined markets are monopolies, duopolies, triopolies, or include four or more providers. Second, we calculate either counts of hospitals or Herfindahl-Hirschman Indexes (HHIs) within our various market definitions.

The HHI for each hospital-centered market containing *H* hospitals is:

$$\text{(C1)} \qquad \textit{Hospital HHI}_{m,t} = \sum_{h=1}^{H} (s_{h,t}^{m})^2,$$

where $\textit{Hospital HHI}_{m,t}$ is concentration in market *m* at time *t*, where $s_{h,t}^{m}$ is the market share of hospital *h* in market *m* at time *t*, calculated using hospital bed count.[11]

There are well-known endogeneity concerns about the use of concentration measures in pricing equations (e.g., Bresnahan 1989). For example, higher quality hospitals may attract more patients and have higher market shares, resulting in a higher HHI for their market. Since they will likely also have higher prices, this can lead to an estimated positive relationship between price and concentration driven by omitted quality rather than by market power. It is also possible that hospitals with higher shares may be lower cost, which could create a negative association between price and concentration, again due to an omitted variable. This may be less of a problem in our paper, since we have a number of observable measures of quality and of cost. Nonetheless, the estimates should be interpreted as associations, not causal effects.[12]

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[9] These are approximations to hospitals' geographic markets, not precise antitrust markets. Since these are not precise markets, we test the robustness of our results to various market delineations.

[10] We also calculate a variable radius market where the radius that defines a hospitals' market is a function of the urban-rural classification defined by the US census. Hospitals located in 'large urban' areas are assigned a market defined by a ten-mile radius; hospitals located in 'urban' have a market defined around them using a fifteen-mile radius; and hospitals located in 'rural' areas have a market defined around them using a twenty-mile radius. For details on the Census definitions, see: https://www.census.gov/geo/reference/ua/uafaq.html.

[11] We also compute HHIs using hospital discharges and total days of care delivered. All measures have correlations of over 0.98.

[12] Kessler and McClellan (2000) propose one strategy to mitigate endogeneity by using a choice model to predict patient flows and then calculate market concentrations using predicted rather than actual patient flows. We cannot use this strategy because we do not see every patient treated at each hospital; we only see patients at a hospital who are insured by one of the three payers in our dataset. Moreover, as Cooper et al. (2011) note, fixed-radius HHIs measured

Appendix Figure 10 shows the relationship between hospital HHI, measured with our 15 mile radius market boundary, and our set of observable covariates. Unsurprisingly, rural areas have a higher hospital HHI. We also observe that higher hospital HHI is associated with hospitals having fewer technologies, lower rankings from the U.S. News and World reports, fewer beds, and lower quality scores. We also observe that hospitals with higher HHIs have lower Medicare payment levels and treat more Medicare patients.

Appendix C2: Insurance Market Structure:

There are few reliable sources of information on market structure in the health insurance industry (Dafny et al. 2011). We measure insurance market structure in the following way. We measure, by county, the share of privately insured lives per county that are covered in our data. To do so, we use data from the Census Bureau's Small Area Health Insurance Estimates to identify total covered lives per county. We then use the count of covered lives per county from the HCCI data; the fraction of HCCI covered lives over total covered lives provides the share of county covered lives that received insurance coverage from the HCCI payers annually. Although this does not capture the market share across all private insurers, the measure is both county specific and is most relevant for the prices negotiated with the HCCI insurers (our dependent variable).

using actual patient flows are correlated at over 0.90 with Kessler and McClellan (2000) style predicted flow HHIs. Instead, we measure hospital market size and hospital market share based on the total number of beds within a market and a facility, respectively. We also note that the number of hospital beds is a measure potentially less subject to endogeneity than patient flows because it is costly for hospitals to alter the number of beds.

APPENDIX D: Identifying Hospital Mergers

The American Hospital Association Annual Survey contains data on respondent hospitals in the United States. While the AHA data are an invaluable source of information regarding hospital characteristics and geography, they provide an incomplete picture of hospital ownership transitions for multiple reasons. As a result, we have implemented several corrections in order to create more comprehensive and accurate roster of hospital mergers.

First, the AHA reports data for a reference period preceding the year of the survey. As a result, system information in the AHA typically refers to the year following the reference year. In general, we deal with this issue by utilizing the lagged system information.

Second, the AHA sometimes deals with mergers and acquisitions in a way that complicates our analysis. In a case where one hospital merges with another, the AHA contains a single observation for the merged entity. However, when a system *acquires* a hospital, it sometimes retains its unique AHA ID and experiences a change in its system ID. In order to obtain a complete picture of hospital geography and ownership, we generate imputed observations for those hospitals, which are deleted from the data as a result of a merger, while noting the change in ownership structure through the system information.

We also incorporate several additional changes, which are motivated by validations with external data sources. We used data from the following databases to track mergers and acquisitions of hospitals: Irving-Levin Associates, Factset, and SDC Platinum. Each database contains detailed information (e.g. parties involved, announcement and closing dates) on both completed and failed M&A deals. To incorporate this merger information into the AHA survey, we aggregated the 2006 to 2011 AHA surveys to create a panel dataset of hospital IDs where the time unit is year. We then created a new health system ID for each hospital (called *sysid2*). If a hospital's health system ID (*sysid* in the AHA survey) was non-missing, we assigned this health system ID to *sysid2*. For those hospitals where the value was missing, we "filled-down" *sysid2* with the health system ID of the first non-missing year before it. That is, if hospital *h* had health system ID *A* in 2007, but the *sysid* was blank in 2008 and 2009, we assigned health system *A* to *h* in 2008 and 2009.[13] If a hospital had a missing *sysid* for all years, then we assigned the hospital's unique hospital ID number to the *sysid2* to denote that the hospital was an independent hospital in all years.

Next, we reviewed each merger description in the three M&A databases and determined which AHA hospital IDs were parties to a merger, which health system IDs corresponded to the parties involved, and the date the merger closed. We then recorded the system ID of the acquiring party in a new variable called *ilsysid* for the target hospital in the year the merger closed.[14] After completing this for every hospital merger in the three M&A databases, we then "filled-down" the blank values of the *ilsysid* variable in a similar manner to *sysid2* (i.e. the years where a hospital did not experience a merger). If the hospital was not involved in any mergers (according to our

[13] "Fill-down" in this context assumes the panel data are sorted by AHA hospital ID number and in ascending order by year.

[14] If the closing date was not populated in one of the M&A databases and we could not find a news article or report that documented the closing of the deal, we used the announcement date as an estimate of when the deal was completed.

three databases), then we assigned the hospital's unique ID number to the *ilsysid* variable to denote it was an independent hospital.

We then flagged all instances where *sysid2* did not equal *ilsysid* and reviewed each instance on a case-by-case basis to determine why there were discrepancies between the two health system IDs. We used resources such as Becker's Hospital Review and local newspapers to determine if *sysid2* or *ilsysid* (or neither) were the correct health system ID. We then created a consolidated health system ID variable (called *msysid*) to account for this new information; *msysid* is the variable we use to identify mergers. If the *msysid* of hospital h switched from s_1 to s_2 between year $T-1$ and year T, then we say hospital h experienced a merger in year T.

We have created a database of hospital mergers that are available at www.healthcarepricingproject.org.

Appendix E: Matching Estimators for our Merger Analysis

In order to demonstrate the robustness of our result to choices of control hospitals, we implement several matching procedures. First, we follow Dranove and Lindrooth (2003) in generating propensity score matches using a probit regression including controls for the share of hospital admissions covered by Medicare and Medicaid, whether the hospital was located in an urban area, HMO penetration, number of hospitals in the market, miles to the closest hospital, teaching status, ownership type, and the number of beds in the hospital.

We perform K-Nearest Neighbor (KNN) matching to select the 20 closest matches for each hospital using the propensity score generated from a probit regression. Specifically, we predict the probability of merger using lagged controls for monopoly, duopoly, and triopoly indicators, combined county market share of HCCI insurers, county level insurer HHI, technologies, whether the hospital was ranked by US News and World Reports, number of beds, teaching status, ownership type, median income and un-insurance rate of the county, Medicare base payment rate, and share of hospital admissions paid by Medicare or Medicaid. We then use the predicted values from the probit to select the 20 closest matches for each hospital as control observations.

We also match based on Mahalanobis distance nationally and within state using the same controls used in the KNN matching (which rely on the hospital controls we use in our main analysis – i.e. in Table 8 Panel B).

APPENDIX F: Robustness of Key Results in Markets Where Blue Cross and Blue Shield Insurance Plans Have High and Low Market Share

Although we provide the most comprehensive picture of privately insured spending and prices to date, we do not have claims from every insurer and, in particular, from the Blue Cross Blue Shield (BCBS) insurers. In this Appendix, we analyze the robustness of our results to focusing on segments of the data with high and low BCBS market share. The areas where the BCBS plans have high market share correspond to areas where we have low HCCI insurer market share.

We use data from HealthLeaders Interstudy to compute the BCBS market share by county (see Appendix Figure 13). The map in this figure shows the national distribution of BCBS market share. We estimate that BCBS plans account for approximately 41 percent of the privately insured market. The median county has BCBS market share of 51 percent. We use this measure directly in our hospital-level regression analyses, restricting attention to hospitals located in counties above and below the median.

In order to analyze the impact BCBS has on our spending results, we need a measure of BCBS market share by HRR. While there is not a one-to-one mapping between counties and HRRs (or even counties and zip codes), we estimate HRR level market share in the following way:

(1) We generate an estimate of zip code level market share using the counties which overlap it, weighting them by the share of residents in the zip code who live in each county;

(2) We then aggregate these zip code level market shares to the HRR level using the Dartmouth Atlas zip code to HRR crosswalk, again weighting by the fraction of the HRR who live in each zip code. We estimate the median HRR to have a BCBS market share of 47 percent, and present our spending results separately for HRRs above and below the median.

Appendix F1: Correlation of Private Health Spending Per Beneficiary and Medicare Spending Per Beneficiary

BCBS market share is not strongly correlated with private health spending per beneficiary on the HCCI beneficiaries. There is a -0.064 correlation between total private spending per beneficiary in our HCCI data and BCBS county-level market share. There is a -0.026 correlation between private inpatient spending per beneficiary in our HCCI data and BCBS county-level market share. In Section III.A, we show that there is a 0.044 correlation across all HRRs in total spending per Medicare beneficiary per HRR and total spending per privately insured beneficiary per HRR. We also find a 0.172 correlation across all HRRs in inpatient spending per Medicare beneficiary per HRR and inpatient spending per privately insured beneficiary per HRR. In Appendix Table 21, we segment our sample into HRRs in which we estimate BCBS to have market share above and below 47 percent. As can be seen, the correlations differ little between high and low BCBS areas.

Appendix F2: Decomposing the Drivers of Spending Per Beneficiary into the Contributions of Price and Quantity

In Section III.B, we decompose the drivers of inpatient spending variation on the privately insured into the relative contributions of price variation and quantity variation across HRRs in the US. We find that across the nation, variation in hospital prices drives 49.6 percent of the variation in inpatient spending and variation in the quantity of each DRG provided across HRRs accounts for

49.5 percent of the variation (the remainder is captured by a covariance term). In Appendix Table 22 we redo this analysis on the 153 HRRs with BCBS market share above 47 percent and the half of HRRs with BCBS below 47 percent.

As these results demonstrate, we see a similar role for prices and quantities to drive spending variation in HRRs where BCBS plans have above and below median market shares.

Appendix F3: Variation in Hospital Prices

We find significant variation in hospital prices across HRRs, within HRRs, and within hospitals. In Table 5, we identify the share of the variation explained by a combination of HRR fixed effects, hospital fixed effects, and controls for plan characteristics. We found that including HRR fixed effects capture 33.5 percent of the national variation in hospitals' MRI prices and introducing hospital fixed effects captures 78.0 percent of price variation, which implies that roughly 22 percent of the variation in MRI prices across the nation occurs within hospitals. In Appendix Table 23 we recreate Table 5 for the half of counties with BCBS market share below 51 percent and the half of counties with BCBS market share above 51 percent.

These results are nearly identical to our main results and the key findings do not differ as a function of the BCBS market share.

In addition, we report the national coefficient of variation across our main procedures across HRRs, within HRRs, and within hospitals by month. For lower limb MRIs, the coefficient of variation across hospitals in the US is 0.40, the average within HRR coefficient of variation across hospitals is 0.31, and the average within hospital, within month coefficient of variation for lower-limb MRIs is 0.17. In Appendix Table 24, we replicate those numbers for all our procedures using hospitals in counties where BCBS market share is above 51 percent and in counties where BCBS market share is below 51 percent.

These results illustrate that we observe similar variation in procedure-level prices in counties with above and below average BCBS plan market share.

Appendix F4: Cross-Sectional Analysis of Hospital Prices

In our cross-sectional results in Section VI (Column (3) in Table 6), we show that monopoly hospitals have prices that are 12.5 percent higher than hospitals in markets with four or more competitors, have 10.5 percentage points more of their cases paid as a share of charges and have 11.3 percent less of their prospectively set payment rates pegged to Medicare payment rates. In Appendix Table 25 Panels A and B, we replicate these results for hospitals in counties where BCBS has market share above and below 51 percent. These specifications include HRR, year fixed effects, and the same controls we use in the above mentioned analysis.

Our cross-sectional pricing results are similar in areas with high and low BCBS coverage when we do not include HRR fixed effects. When we include HRR fixed effects, we lose precision on our hospital market structure point estimates in HRRs with high BCBS market share. This is because while there are 70 low BCBS-share HRRs with both a monopoly hospital and a hospital facing three or more competitors, there are only 42 high BCBS-share HRRs with both a monopoly hospital and a hospital facing three or more competitors. As a result, we lose the variation we need to estimate these cross-sectional results with precision.

Another approach to testing the sensitivity of our results to insurer composition is to control for BCBS market share directly as a covariate in the regressions. We have also run specifications using a high order polynomial on HCCI insurers, as well as versions where we control for the top 10 insurers in each market, allowing their effects to differ based on whether they are HCCI insurers or not. In all of these exercises, the results are qualitatively unchanged. Likewise, as we illustrate in Appendix Table 25, introducing the county-level BCBS insurer share as a control variable does not change our main monopoly/duopoly/triopoly point estimates (see Column (2) of Appendix Table 25).

Appendix Table 25 Panel C examines whether hospital market structure is associated with the share of cases at a hospital paid as a share of hospital charges is robust in areas with high and low BCBS coverage with and without the inclusion of hospital fixed effects. Panel D shows that in markets where BCBS insurers have high and low market share, hospitals in markets with fewer other hospitals have a lower share of prospective payments that are linked to the Medicare fee schedule.

Appendix F5: Merger Analysis

In our merger analysis in Section VII, we show that mergers of two hospitals that are located less than 5 miles apart raise prices by over 6 percent. In Appendix Table 26 we analyze mergers that occurred in counties with BCBS market shares above and below the median BCBS market share. As these results illustrate, while we observe that mergers raise prices in areas where the BCBS plans have low market share, we do not observe a price effect in areas where the BCBS plans have high market share. In part, this reflects that we observe considerably more mergers in areas where BCBS have low market share. For instance, we have 188 hospitals that are exposed to mergers where the merging parties are less than 15 miles apart. However, only 56 of them are in markets where BCBS payers have high market share. Likewise, for mergers involving hospitals located less than 5-miles apart, we have 34 hospitals within the support of our treatment effect estimation. However, only 6 of these are in high BCBS HRRs.

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Appendix Table 1: Comparison of AHA Hospitals, the Inpatient Sub-sample and the Procedure Sub-samples

	All AHA Hospitals	Inpatient	Hip Replacement	Knee Replacement	Cesarean Section	Vaginal Delivery	PTCA	Colonoscopy	MRI
Market Characteristics									
Monopoly	0.275	0.163	0.028	0.073	0.07	0.105	0.04	0.129	0.168
Duopoly	0.194	0.194	0.087	0.153	0.153	0.161	0.125	0.185	0.198
Triopoly	0.108	0.123	0.06	0.099	0.102	0.096	0.09	0.099	0.125
Hospital HHI	0.541	0.461	0.314	0.38	0.374	0.402	0.338	0.425	0.472
HCCI Market Share, County	15.3	17.8	25.3	23.6	21.1	20.5	24.1	20.6	19.3
Hospital Characteristics									
Number of Technologies	51.1	59.3	74.3	68.3	67.7	66.2	71.8	65.1	62.7
Ranked in US News & World Reports	0.037	0.053	0.137	0.08	0.076	0.072	0.124	0.081	0.063
Beds	218.4	269.7	420.5	345.6	342.1	327.1	417.3	290.3	267.8
Teaching Hospital	0.306	0.38	0.622	0.503	0.478	0.455	0.555	0.428	0.389
Government Owned	0.167	0.122	0.068	0.074	0.088	0.101	0.074	0.108	0.117
Non-Profit	0.64	0.693	0.83	0.785	0.754	0.744	0.75	0.75	0.735
Local Area Characteristics									
Percent of County Uninsured	17.5	17.1	16.3	16.8	16.9	17.1	17.3	16.3	16.5
Median Income	49,019	51,516	55,663	53,892	55,116	54,566	52,968	53,691	51,745
Rural	0.292	0.162	0.01	0.042	0.048	0.068	0.029	0.124	0.164
Other Payers									
Medicare Payment Rate	6,295	6,437	6,339	6,207	6,464	6,482	6,400	6,381	6,208
Share Medicare	46.2	44.6	42.8	43.9	41.9	42	43.6	44.3	45.2
Share Medicaid	18.7	18.8	15.2	16.2	17.9	18.3	16.7	17.4	17.7
Quality Scores									
30-Day AMI Survival Rate	16.1	16	15.5	15.8	15.8	15.9	15.6	15.9	16
% of AMI Patients Given Aspirin at Arrival	95.7	97.3	98.5	98.1	98.2	98.1	98.5	97.6	97.4
% of Patients Given Antibiotics Pre Surgery	91.5	93.3	94.4	94.4	94.1	94.1	94	94	93.9
% of Surgery Patients Given Treatment to Prevent Blood Clots	85.9	88	89.8	89.3	88.8	88.7	88.7	88.8	88.9
Number of Observations	12,847	8,772	1,259	2,660	3,794	4,096	1,764	3,512	5,082
Number of Hospitals	3,272	2,358	470	932	1,163	1,280	652	1,237	1,628
% of Inpatient Cases Represented	100	88.4	23.4	38.4	54.3	55.1	31.1	40.9	52.4

Notes: The inpatient data is derived from the inpatient sample. The procedure files are drawn from the procedure samples. MRIs include only lower-limb scans.

Appendix Table 2: Effect of Sample Restrictions on Number of Cases and Hospitals

	Cases	Facilities
1. Condition on match to AHA	5,865,727	4,326
2. Exclude critical access hospitals	5,814,378	3,202
3. Condition on match to Medicare payment data	5,808,583	3,199
4. Exclude 2007 data	5,039,479	3,189
5. Exclude hospitals with fewer than 50 cases per year	4,964,774	2,358

Notes: This table tracks the impact of each of our successive cleaning rules on the inpatient data used in our main analyses. The data contains cases drawn from all claims in the HCCI database from 2007 to 2011.

Appendix Table 3: Counterfactual Spending Holding Price or Quantity Fixed, 2011

All Medicare vs Private Ages 55-64

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Private Spending					Medicare Spending				
	Raw	**Fix Price at National Level**	*Effect of fixing price*	**Fix Quantity at National Level**	*Effect of fixing quantity*	**Raw**	**Fix Price at National Level**	*Effect of fixing price*	**Fix Quantity at National Level**	*Effect of fixing quantity*
Mean	1,817	1,763		1,284		3,704	3,820		3,544	
SD	800	581		472		1,281	1,157		655	
Coefficient of Variation	0.44	0.33	*-0.11*	0.37	*-0.07*	0.35	0.30	*-0.04*	0.18	*-0.16*
Gini	0.21	0.15	*-0.05*	0.21	*-0.0004*	0.18	0.17	*-0.01*	0.10	*-0.08*
p90/p10	2.39	1.85	*-0.53*	2.71	*0.32*	2.23	2.20	*-0.03*	1.53	*-0.70*
Number of HRRs	306	306		306		306	306		306	

Notes: Counterfactual spending measures are calculated at the HRR level using 2011 spending data. Columns (1) and (6) present raw inpatient spending per beneficiary for the privately insured and Medicare populations, respectively. Columns (2) and (7) present the spending per privately insured and Medicare beneficiary when DRG-level prices are fixed to be the national average in all regions. Columns (3) and (8) report the reduction in measures of spending variation that result from fixing price. Columns (4) and (9) present spending per privately insured and Medicare beneficiary when the quantity of care (i.e. mix of DRGs as well as the rate at which beneficiaries are admitted across DRGs) is fixed to the national average. Columns (5) and (10) report the reductions in measures of spending variation that result from fixing quantity.

Appendix Table 4: Counterfactual Spending for Holding Price and Quantity Fixed, 2011

All Medicare vs Private, Ages 18-64

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Private Spending					Medicare Spending				
	Raw	**Fix Price at National Level**	*Effect of fixing price*	**Fix Quantity at National Level**	*Effect of fixing quantity*	**Raw**	**Fix Price at National Level**	*Effect of fixing price*	**Fix Quantity at National Level**	*Effect of fixing quantity*
Mean	963	942		790		3,704	3,820		3,544	
SD	446	332		250		1,281	1,157		655	
Coefficient of Variation	0.46	0.35	*-0.11*	0.32	*-0.15*	0.35	0.30	*-0.04*	0.18	*-0.16*
Gini	0.21	0.15	*-0.05*	0.17	*-0.03*	0.18	0.17	*-0.01*	0.10	*-0.08*
p90/p10	2.34	1.87	*-0.47*	2.14	*-0.20*	2.23	2.20	*-0.03*	1.53	*-0.70*
Number of HRRs	306	306		306		306	306		306	

Notes: Counterfactual spending measures are calculated at the HRR level using 2011 spending data. Columns (1) and (6) present raw inpatient spending per beneficiary for the privately insured and Medicare populations, respectively. Columns (2) and (7) present the spending per privately insured and Medicare beneficiary when DRG-level prices are fixed to be the national average in all regions. Columns (3) and (8) report the reduction in measures of spending variation that result from fixing price. Columns (4) and (9) present spending per privately insured and Medicare beneficiary when the quantity of care (i.e. mix of DRGs as well as the rate at which beneficiaries are admitted across DRGs) is fixed to the national average. Columns (5) and (10) report the reductions in measures of spending variation that result from fixing quantity.

Appendix Table 5: Results of Formal Price/Quantity Decomposition of Medicare and Private Health Spending, 2011, Ages 18-64

	Private			Medicare		
	(1) Share Price	(2) Share Quantity	(3) Share Covariance	(4) Share Price	(5) Share Quantity	(6) Share Covariance
Craniotomy & endovascular intracranial procedures w MCC	0.386	0.535	0.079	0.120	0.860	0.020
Pulmonary edema & respiratory failure	0.488	0.437	0.075	0.213	0.770	0.017
Simple pneumonia & pleurisy w MCC	0.546	0.482	-0.028	0.160	1.073	-0.233
Simple pneumonia & pleurisy w CC	0.493	0.747	-0.240	0.221	0.989	-0.210
Respiratory system diagnosis w ventilator support 96+ hours	0.609	0.540	-0.150	0.102	0.771	0.127
Respiratory system diagnosis w ventilator support <96 hours	0.571	0.484	-0.055	0.155	0.987	-0.143
Cardiac valve & oth maj cardiothoracic proc w/o card cath w MCC	0.396	0.617	-0.013	0.086	0.840	0.074
Cardiac valve & oth maj cardiothoracic proc w/o card cath w CC	0.312	0.618	0.071	0.069	0.846	0.085
Coronary bypass w cardiac cath w/o MCC	0.238	0.852	-0.090	0.074	1.168	-0.242
Major cardiovasc procedures w MCC or thoracic aortic anuerysm repair	0.478	0.447	0.075	0.166	0.871	-0.037
Major cardiovascular procedures w/o MCC	0.360	0.760	-0.120	0.163	1.059	-0.222
Perc cardiovasc proc w drug-eluting stent w MCC or 4+ vessels/stents	0.329	0.722	-0.052	0.089	1.004	-0.094
Perc cardiovasc proc w drug-eluting stent w/o MCC	0.463	0.889	-0.352	0.153	1.113	-0.265
Circulatory disorders except AMI, w card cath w/o MCC	0.339	0.877	-0.216	0.112	1.110	-0.222
Major small & large bowel procedures w MCC	0.584	0.421	-0.005	0.213	0.888	-0.101
Major small & large bowel procedures w CC	0.387	0.564	0.049	0.193	0.811	-0.005
Esophagitis, gastroent & misc digest disorders w/o MCC	0.372	0.835	-0.208	0.164	1.028	-0.192
Spinal fusion except cervical w/o MCC	0.280	0.571	0.149	0.085	1.067	-0.152
Major joint replacement or reattachment of lower extremity w/o MCC	0.331	0.724	-0.055	0.213	0.973	-0.186
Cellulitis w/o MCC	0.406	0.995	-0.401	0.128	0.923	-0.051
Kidney & urinary tract infections w/o MCC	0.372	0.750	-0.122	0.151	1.062	-0.212
Infectious & parasitic diseases w O.R. procedure w MCC	0.590	0.306	0.104	0.112	0.769	0.119
Septicemia w MV 96+ hours	0.768	0.269	-0.038	0.072	0.860	0.067
Septicemia w/o MV 96+ hours w MCC	0.508	0.457	0.035	0.120	0.815	0.064
Rehabilitation w CC/MCC	0.420	0.507	0.074	0.056	1.164	-0.219
Average Shares (weighted by spending)	***0.438***	***0.567***	***-0.005***	***0.127***	***0.953***	***-0.081***

Notes: The decomposition of ln(spending per beneficiary) is carried out on the 2011 Medicare and HCCI inpatient spending samples. The Medicare analysis is based on data drawn from the 100% sample of Medicare claims that we accessed via the AHD. The HCCI data includes all inpatient claims and is drawn from our spending sample. "CC" is short for with "complication or comorbidity"; "MCC" is short for with "major complication or comorbidity"; "proc"="procedure"; "cath" = "catheter"; "w"=With"; "w/o"="without". Because of space constraints, we show the top 25 highest spending DRGs in the HCCI data; the "Average Shares" in the final row are the average decomposition results by DRG (weighted by spending) across the 735 DRGs (HCCI) 562 DRGs (Medicare).

Appendix Table 6: Hospital Procedure Prices (Mean and Coefficient of Variation) for the 25 Most Populated HRRs, 2011

	Inpatient		Hip Replacement		Knee Replacement		Cesarean Section		Vaginal Delivery		PTCA		Colonoscopy		Lower Limb MRI	
	Mean	CoV	Mean	CoV	Mean	CoV	Mean	CoV	Mean	CoV	Mean	CoV	Mean	CoV	Mean	CoV
Phoenix, AZ	15,710	0.427	16,350	0.195	20,376	0.471	7,378	0.262	4,982	0.297	15,236	0.298	1,724	0.522	1,326	0.6
Los Angeles, CA	14,836	0.355	25,658	0.387	22,447	0.465	9,205	0.342	5,998	0.317	20,773	0.52	2,459	0.325	1,453	0.281
Denver, CO	15,876	0.291	20,475	0.287	22,849	0.38	8,471	0.229	4,912	0.237	25,423	0.22	2,127	0.356	1,306	0.335
Washington, DC	10,830	0.204	19,669	0.183	18,521	0.302	7,532	0.216	5,603	0.143	21,855	0.297	1,302	0.394	1,010	0.378
Ft Lauderdale, FL	12,329	0.288	21,230	0.278	22,008	0.365	6,349	0.247	4,471	0.205	23,574	0.287	1,639	0.309	753	0.405
Miami, FL	12,983	0.257	22,418	0.34	25,454	0.287	6,439	0.165	4,827	0.189	23,942	0.41	1,855	0.422	1,213	0.654
Orlando, FL	13,902	0.28	24,987	0.3	23,137	0.288	7,800	0.21	4,685	0.276	23,779	0.336	2,142	0.287	1,219	0.309
Atlanta, GA	11,368	0.253	20,617	0.266	20,105	0.319	5,905	0.281	4,303	0.261	19,038	0.28	1,653	0.408	1,040	0.377
Louisville, KY	9,509	0.241	18,508	0.207	15,628	0.173	5,611	0.278	4,138	0.341	14,680	0.193	1,343	0.273	1,206	0.386
Minneapolis, MN	14,225	0.177	23,613	0.192	22,542	0.167	8,488	0.19	4,953	0.137	24,412	0.179	1,499	0.165	1,299	0.395
Kansas City, MO	11,240	0.222	19,441	0.252	18,499	0.239	5,935	0.251	4,012	0.206	20,567	0.297	1,448	0.181	1,182	0.295
St. Louis, MO	10,091	0.317	15,225	0.117	14,415	0.155	5,070	0.236	3,922	0.317	18,401	0.2	1,227	0.238	1,188	0.298
Camden, NJ	13,131	0.487	20,351	0.237	20,142	0.262	9,144	0.295	6,542	0.249	21,064	0.39	1,548	0.362	1,006	0.265
E Long Island, NY	13,664	0.216	40,049	0.135	31,567	0.201	8,905	0.136	6,279	0.142	32,862	0.174	2,154	0.232	1,294	0.4
Manhattan, NY	13,529	0.229	30,464	0.082	28,323	0.214	8,337	0.26	5,715	0.201	28,654	0.292	1,745	0.287	1,050	0.241
Cincinnati, OH	11,749	0.156	25,085	0.091	23,153	0.12	6,381	0.079	4,465	0.134	21,641	0.125	1,794	0.154	1,259	0.455
Columbus, OH	13,638	0.171	30,246	0.198	27,439	0.288	7,783	0.304	5,265	0.224	25,401	0.287	1,506	0.402	1,446	0.307
Philadelphia, PA	12,236	0.257	27,697	0.231	26,173	0.287	9,464	0.274	6,402	0.247	29,369	0.302	1,945	0.387	1,512	0.515
Austin, TX	11,957	0.216	24,713	0.183	23,964	0.172	6,435	0.099	4,523	0.087	27,261	0.21	1,349	0.211	1,069	0.296
Dallas, TX	13,691	0.244	32,427	0.186	31,826	0.209	6,992	0.207	5,070	0.164	29,935	0.2	1,627	0.169	1,277	0.312
Fort Worth, TX	13,632	0.248	39,709	0.115	34,626	0.24	7,001	0.185	5,220	0.173	29,917	0.232	1,617	0.222	1,191	0.375
Houston, TX	12,643	0.434	26,855	0.341	22,642	0.31	6,319	0.218	4,308	0.302	29,663	0.299	1,409	0.338	1,178	0.402
San Antonio, TX	12,770	0.288	24,733	0.138	22,621	0.205	6,247	0.291	3,608	0.34	26,139	0.125	1,179	0.289	1,082	0.319
Arlington, VA	12,987	0.126	24,672	0.137	24,428	0.136	7,868	0.129	5,420	0.135	22,984	0.201	1,707	0.155	1,460	0.177
Milwaukee, WI	14,084	0.159	25,284	0.167	24,491	0.169	8,585	0.165	5,103	0.126	26,266	0.251	2,450	0.213	1,561	0.248
National Average	*13,815*	*0.218*	*24,658*	*0.162*	*23,567*	*0.182*	*7,825*	*0.184*	*4,957*	*0.183*	*25,992*	*0.196*	*1,719*	*0.228*	*1,373*	*0.249*
Medicare Average	*6,461*	*0.087*	*13,389*	*0.064*	*13,039*	*0.068*	*4,954*	*0.067*	*3,175*	*0.096*	*12,907*	*0.072*	*656*	*0.073*	*354*	*0.033*

Notes: Prices are regression adjusted transaction prices for 2011. CoV = coefficient of variation. The national averages present the mean within HRR Coefficient of Variation (CoV) and the average within HRR price. The data are drawn from the pricing samples and include prices that are risk-adjusted for age and sex. The inpatient analysis uses our risk-adjusted inpatient price index.

Appendix Table 7: Inpatient Cross-Sectional Price Regressions with All Controls, 2008-2011; Full Results

Dependent Variable:	ln(Facilities Price)		
Market Characteristics			
Monopoly	0.234***	0.190***	0.118***
	(0.024)	(0.024)	(0.024)
Duopoly	0.161***	0.130***	0.073***
	(0.021)	(0.020)	(0.024)
Triopoly	0.115***	0.083***	0.036
	(0.023)	(0.023)	(0.023)
Share HCCI		-0.006***	-0.007***
		(0.002)	(0.002)
Hospital Characteristics			
ln(Technologies)	0.012**	0.011**	0.010**
	(0.005)	(0.005)	(0.004)
Ranked by US News and World Reports	0.118***	0.138***	0.134***
	(0.031)	(0.031)	(0.033)
ln(Number of Beds)	0.046***	0.040***	0.067***
	(0.012)	(0.011)	(0.010)
Teaching Hospital	-0.006	0.001	0.020
	(0.018)	(0.018)	(0.014)
Government Owned	-0.129***	-0.133***	-0.148***
	(0.031)	(0.031)	(0.030)
Non-Profit	-0.049**	-0.053**	-0.074***
	(0.022)	(0.022)	(0.023)
County Characteristics			
Percent Uninsured	0.006**	0.009***	-0.002
	(0.002)	(0.002)	(0.003)
ln(Median Income)	0.137***	0.236***	0.048
	(0.047)	(0.050)	(0.056)
Other Payers			
ln(Medicare Base Payment Rate)	0.430***	0.299***	0.088
	(0.083)	(0.085)	(0.078)
Share Medicare	-0.003***	-0.004***	-0.002***
	(0.001)	(0.001)	(0.001)
Share Medicaid	-0.004***	-0.004***	-0.002**
	(0.001)	(0.001)	(0.001)
R-square	0.143	0.170	0.453
Year Fixed Effects	Yes	Yes	Yes
HRR Fixed Effects	No	Yes	Yes
Observations	8,772	8,772	8,772

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates with standard errors clustered at the HRR-level in parentheses. We use hospital price data from 2008 to 2011. Facilities prices are regression adjusted transaction prices that are risk-adjusted for DRG, age, and sex. All regressions include yearly fixed effects. The omitted hospital market structure is quadropoly or greater and the omitted ownership category is private hospitals.

Appendix Table 8: Inpatient Regressions for Percent of Cases Paid as Share of Charges, 2010-2011; Full Results

Dependent Variable:	Percent of Cases Paid as Share of Charges		
Market Characteristics			
Monopoly	17.335***	15.241***	10.455***
	(1.828)	(1.823)	(1.778)
Duopoly	9.979***	8.424***	5.702***
	(1.760)	(1.740)	(1.596)
Triopoly	7.804***	6.235**	4.909**
	(1.909)	(1.938)	(1.608)
Share HCCI		-0.288***	-0.403***
		(0.077)	(0.120)
Hospital Characteristics			
ln(Technologies)	0.733**	0.750**	0.462
	(0.271)	(0.270)	(0.249)
Ranked by US News and World Reports	3.860	4.807*	1.728
	(2.299)	(2.284)	(1.501)
ln(Number of Beds)	1.099	0.809	2.905***
	(0.791)	(0.776)	(0.601)
Teaching Hospital	1.343	1.615	0.528
	(0.934)	(0.949)	(0.784)
Government Owned	3.265	3.048	4.407*
	(1.847)	(1.842)	(1.828)
Non-Profit	6.651***	6.514***	4.532***
	(1.188)	(1.219)	(1.103)
County Characteristics			
Percent Uninsured	-0.338*	-0.215	0.248
	(0.136)	(0.141)	(0.347)
ln(Median Income)	-2.637	1.934	3.761
	(3.961)	(4.205)	(5.049)
Other Payers			
ln(Medicare Base Payment Rate)	-18.993***	-25.057***	-16.714***
	(4.833)	(5.367)	(4.679)
Share Medicare	-0.377***	-0.388***	-0.206***
	(0.079)	(0.077)	(0.050)
Share Medicaid	-0.032	-0.015	-0.086
	(0.068)	(0.069)	(0.045)
R-square	0.166	0.179	0.557
Yearly FE	Yes	Yes	Yes
HRR FE	No	Yes	Yes
Observations	4,344	4,344	4,344

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. We measure percent of inpatient cases paid as share of charges for 2010-2011. The omitted hospital market structure is quadropoly or greater and the omitted ownership category is private hospitals.

Appendix Table 9: Inpatient Regressions for Share of Linked to Medicare, 2010-2011; Full Results

Dependent Variable:	Share of Prospective Payments Linked to Medicare		
Market Characteristics			
Monopoly	-16.849***	-11.275***	-11.293***
	(2.882)	(2.696)	(3.160)
Duopoly	-8.791***	-4.272*	-5.595**
	(2.441)	(2.443)	(2.316)
Triopoly	-7.111**	-2.422	-5.747**
	(2.866)	(2.727)	(2.790)
HCCI Market Share		0.890***	0.616***
		(0.091)	(0.174)
Hospital Characteristics			
ln(Technologies)	0.465	0.453	0.809*
	(0.511)	(0.461)	(0.459)
Ranked in US News & World Reports	7.662**	4.591	5.339*
	(3.390)	(3.266)	(2.722)
ln(Beds)	7.998***	9.138***	9.320***
	(1.317)	(1.209)	(1.239)
Teaching	4.402***	3.405**	2.504*
	(1.511)	(1.429)	(1.472)
Government	-0.859	-0.481	-3.377
	(2.588)	(2.535)	(2.638)
Non-Profit	2.781	3.031	1.485
	(2.022)	(1.881)	(2.084)
County Characteristics			
Percent Uninsured	-0.024	-0.394**	-0.118
	(0.264)	(0.186)	(0.483)
ln(Median Income)	-0.747	-14.915***	-3.349
	(5.510)	(4.781)	(7.177)
Other Payers			
ln(Medicare Base Payment Rate)	-34.805***	-14.562*	-18.145**
	(8.942)	(7.824)	(8.960)
Share Medicare	-0.210**	-0.140*	-0.231***
	(0.087)	(0.081)	(0.080)
Share Medicaid	-0.071	-0.126	-0.185**
	(0.091)	(0.086)	(0.086)
R-Squared	0.115	0.172	0.380
Yearly-FE	Yes	Yes	Yes
HRR-FE	No	Yes	Yes
Observations	3,669	3,669	3,669

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. We measure share of inpatient cases linked to Medicare from 2010 to 2011. All regressions include yearly fixed effects. The omitted hospital market structure is quadropoly or greater and the omitted ownership category is private hospitals.

Appendix Table 10: Cross-sectional Pricing Regressions Using Alternative Price Measures

Panel A: Baseline Result, Observations = 8,772			
Monopoly	0.234***	0.190***	0.118***
	(0.024)	(0.024)	(0.024)
Duopoly	0.161***	0.130***	0.073***
	(0.021)	(0.020)	(0.024)
Triopoly	0.115***	0.083***	0.036
	(0.023)	(0.023)	(0.023)
HCCI Market Share		-0.006***	-0.007***
		(0.002)	(0.002)
Panel B: ln(Price) Before Risk-Adjustment, Observations = 8,772			
Monopoly	0.222***	0.182***	0.096***
	(0.027)	(0.028)	(0.026)
Duopoly	0.148***	0.119***	0.047*
	(0.023)	(0.022)	(0.024)
Triopoly	0.095***	0.066***	0.002
	(0.025)	(0.025)	(0.023)
HCCI Market Share		-0.006***	-0.007***
		(0.002)	(0.002)
Panel C: Levels of Price, Observations = 8,772			
Monopoly	3080.604***	2402.447***	1604.775***
	(350.922)	(343.335)	(339.422)
Duopoly	2168.105***	1685.231***	1006.571***
	(290.420)	(266.204)	(319.430)
Triopoly	1545.485***	1055.851***	470.042
	(303.488)	(300.250)	(314.683)
HCCI Market Share		-96.276***	-116.731***
		(19.530)	(23.029)
Panel D: Adding Charlson Score to Risk Adjustment, Observations = 8,491			
Monopoly	0.230***	0.188***	0.115***
	(0.024)	(0.025)	(0.024)
Duopoly	0.159***	0.129***	0.070***
	(0.021)	(0.020)	(0.024)
Triopoly	0.119***	0.088***	0.038*
	(0.023)	(0.023)	(0.023)
HCCI Market Share		-0.006***	-0.008***
		(0.002)	(0.002)
Panel E: Risk-Adjustment Using ICD9 Codes, Observations = 8,772			
Monopoly	0.205***	0.158***	0.076***
	(0.027)	(0.027)	(0.026)
Duopoly	0.156***	0.123***	0.055**
	(0.024)	(0.022)	(0.026)
Triopoly	0.107***	0.073***	0.012
	(0.024)	(0.025)	(0.024)
HCCI Market Share		-0.007***	-0.008***
		(0.002)	(0.002)
HRR FE	No	No	Yes

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates with standard errors clustered at the HRR-level in parentheses. All regressions include controls in Table 6 notes. In Panel B ln(prices) rather than levels are used in Equation (A1). Panel C uses level instead of logs of prices. In Panels A, B, and C, prices are risk-adjusted for DRG, age, and sex. In Panel D, they are risk-adjusted for DRG, Charlson Score, age, and sex. In Panel E, we risk-adjust using ICD-9 codes, age, and sex.

Appendix Table 11: Procedure-Level Regressions Measured as the Sum of Facility and Physician Prices, 2008-2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample:	**Inpatient**	**Pooled Procedures**	**Hip Replacement**	**Knee Replacement**	**Cesarean Section**	**Vaginal Delivery**	**PTCA**	**Colonoscopy**	**MRI**
Dependent Variable:	ln(Facilities Price + Physician Price)								
Market Characteristics									
Monopoly	0.093***	0.110***	0.026	0.120**	0.084**	0.053**	0.135	0.077**	0.189***
	(0.019)	(0.022)	(0.089)	(0.048)	(0.038)	(0.027)	(0.091)	(0.037)	(0.032)
Duopoly	0.058***	0.078***	0.004	0.012	0.053**	0.044***	0.137**	0.083**	0.125***
	(0.018)	(0.016)	(0.061)	(0.038)	(0.022)	(0.017)	(0.064)	(0.035)	(0.028)
Triopoly	0.028	0.046***	0.070	-0.006	0.026	0.002	0.071	0.043	0.115***
	(0.018)	(0.017)	(0.071)	(0.039)	(0.027)	(0.021)	(0.047)	(0.034)	(0.031)
HCCI Market Share	-0.006***	-0.003**	0.000	-0.003	-0.000	-0.002	-0.002	-0.003	-0.004*
	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
Hospital Characteristics									
ln(Technologies)	0.008**	0.006**	-0.003	-0.004	0.004	0.001	0.014*	0.013**	0.009
	(0.003)	(0.003)	(0.008)	(0.006)	(0.004)	(0.003)	(0.008)	(0.006)	(0.007)
Ranked in US News	0.107***	0.063***	0.032	0.073**	0.072***	0.067***	0.052	0.081**	0.053
& World Reports	(0.027)	(0.021)	(0.033)	(0.031)	(0.022)	(0.020)	(0.040)	(0.032)	(0.034)
ln(Beds)	0.052***	0.010	-0.005	-0.002	0.024**	0.025***	0.079***	-0.021	0.006
	(0.008)	(0.006)	(0.025)	(0.017)	(0.010)	(0.007)	(0.028)	(0.014)	(0.012)
Teaching	0.017	0.006	0.030	0.010	0.010	0.008	-0.036	0.019	-0.001
	(0.011)	(0.010)	(0.027)	(0.019)	(0.012)	(0.013)	(0.029)	(0.025)	(0.017)
Government	-0.113***	-0.049*	-0.107	-0.086	-0.069**	-0.077***	-0.177***	-0.141***	0.059
	(0.023)	(0.026)	(0.072)	(0.056)	(0.031)	(0.027)	(0.061)	(0.041)	(0.049)
Non-Profit	-0.058***	-0.009	-0.006	0.022	-0.001	0.004	-0.078	-0.104***	0.046
	(0.018)	(0.016)	(0.037)	(0.036)	(0.018)	(0.016)	(0.048)	(0.026)	(0.044)
County Characteristics									
Percent Uninsured	-0.002	-0.003	-0.011*	-0.003	-0.009***	-0.006*	-0.004	0.000	-0.002
	(0.002)	(0.002)	(0.006)	(0.006)	(0.004)	(0.003)	(0.008)	(0.005)	(0.005)
ln(Median Income)	0.039	-0.067	-0.315***	-0.097	-0.171***	-0.051	-0.179	0.080	-0.033
	(0.044)	(0.045)	(0.094)	(0.106)	(0.065)	(0.056)	(0.160)	(0.096)	(0.097)
Other Payers									
ln(Medicare Base	0.088	-0.043	0.185	0.143	-0.089	-0.043	-0.075	-0.038	0.003
Payment Rate)	(0.063)	(0.051)	(0.136)	(0.108)	(0.075)	(0.070)	(0.125)	(0.104)	(0.105)
ln(Share Medicare)	-0.002***	-0.001	-0.001	-0.002	-0.003***	-0.002***	-0.001	0.000	0.000

	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln(Share Medicaid)	-0.002***	-0.002***	-0.004**	-0.003***	-0.002***	-0.002***	0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Yearly-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HRR-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.456	0.955	0.627	0.548	0.613	0.614	0.582	0.513	0.398
Observations	8,772	22,167	1,259	2,660	3,794	4,096	1,764	3,512	5,082

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. We rely on data from 2008-2011. Procedure prices are regression-adjusted transaction prices where we risk-adjust for age and sex (plus DRGs for the inpatient index). All regressions include yearly fixed effects. The omitted ownership category is private hospitals. MRIs include only lower limb scans.

Appendix Table 12: Inpatient Cross-Sectional Price Results Using Different Measures of Hospital Market Concentration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: ln(Facilities Price)						
Market Characteristics							
ln(HHI)	0.053***	0.076***	0.100***	0.047***			
	(0.015)	(0.014)	(0.021)	(0.014)			
Hospital Count					-0.005***		
					(0.001)		
Q4 HHI						0.117***	0.077***
						(0.026)	(0.014)
Q3 HHI						0.055**	
						(0.027)	
Q2 HHI						0.023	
						(0.020)	
Market Radius	5 Miles	15 Miles	30 Miles	Variable	15 Miles	15 Miles	15 Miles
HCCI Market Share	-0.009***	-0.008***	-0.008***	-0.009***	-0.009***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	8,772	8,772	8,772	8,772	8,772	8,772	8,772

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates with standard errors clustered at the HRR-level in parentheses. 8,772 observations. The dependent variable is our regression-based inpatient price index that is risk-adjusted for DRG, age and sex. All regressions have the same set of controls in the notes to Table 6 Panel A Column (3). We use multiple measures of hospital market concentration. Column (1) includes hospital HHIs where the market is defined using a five-mile fixed radius drawn around each hospital. Column (2) includes hospital HHIs where the market is defined using a fifteen-mile fixed radius drawn around each hospital. Column (3) includes hospital HHIs where the market is defined using a thirty-mile fixed radius drawn around each hospital. In Column (4), we measure hospital HHIs in variable radii markets. Hospitals located in 'large urban' areas are assigned a market defined by a 10-mile radius; hospitals located in 'urban' have a market defined around them using a 15-mile radius; and hospitals located in 'rural' areas have a market defined around them using a 20-mile radius. In Column (5), we measure market concentration using counts of hospitals within a fifteen-mile radius drawn around each hospital. In Column (6), we use dummy variables to capture the quartiles of our hospital HHIs measured within hospital markets defined using fixed radii extending fifteen-miles around each hospital. The omitted category, quartile 1, is the least concentrated quartile. In Column (7), we measure the effect of being in the most concentrated quartile of hospital HHI within a market defined by a fifteen-mile fixed radius market drawn around each hospital. The reference categories are the other three quartiles of hospital HHI. Facilities prices are regression-adjusted transaction prices. All regressions include yearly fixed effects and controls for number of beds, teaching status, government ownership, non-profit status, county insurance rate and median income, Medicare payment rate, and share of hospital activity covered by Medicare and Medicaid. The omitted ownership category is private hospitals.

Appendix Table 13: Determinants of Share of Cases Paid Percentage of Hospital Charges, Alternative Concentration Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: Share of Contracts Paid Share of Charges						
Market Characteristics							
ln(HHI)	4.339***	7.569***	6.278***	5.202***			
	(1.122)	(1.272)	(1.617)	(1.300)			
Hospital Count					-5.123***		
					(0.933)		
Q4 HHI						11.951***	6.584***
						(2.281)	(1.227)
Q3 HHI						7.541***	
						(2.116)	
Q2 HHI						3.083**	
						(1.493)	
Market Radius	5 Miles	15 Miles	30 Miles	Variable	15 Miles	15 Miles	15 Miles
HCCI Market Share	-0.557***	-0.401***	-0.498***	-0.511***	-0.376***	-0.402***	-0.491***
	(0.122)	(0.121)	(0.125)	(0.121)	(0.122)	(0.120)	(0.119)
Observations	4,344	4,344	4,344	4,344	4,344	4,344	4,344

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. All regressions have the same set of controls in the notes to Table 6 Panel B Column (3). All regressions are based on the inpatient sample of data.

Appendix Table 14: Determinates of the Linkage between Private and Medicare Payments Estimated with Alternative Measures of Concentration, 2010-2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: Percent of Cases Tied to Medicare*100						
Market Characteristics							
ln(HHI)	-1.285	-8.121***	-10.076***	-3.804**			
	(1.723)	(1.703)	(2.582)	(1.668)			
Hospital Count					0.447***		
					(0.125)		
Q4 HHI						-11.778***	-4.863**
						(3.007)	(1.965)
Q3 HHI						-9.171***	
						(2.756)	
Q2 HHI						-5.004**	
						(2.068)	
Market Radius	5 Miles	15 Miles	30 Miles	Variable	15 Miles	15 Miles	15 Miles
HCCI Market Share	0.808***	0.614***	0.680***	0.755***	0.722***	0.663***	0.733***
	(0.170)	(0.172)	(0.167)	(0.168)	(0.170)	(0.170)	(0.172)
Observations	3,669	3,669	3,669	3,669	3,669	3,669	3,669

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of with standard errors clustered at the HRR-level in parentheses. The dependent variable is the percent of cases paid as a percent of Medicare, conditional on being paid on a prospective payment schedule. Controls are the same as in notes to Table 6 Panel C Column (3).

Appendix Table 15: Inpatient Cross-Sectional Price Results with Multiple Measures of Quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable:	**ln(Facilities Price)**						
A standard deviation increase in quality by:							
% AMI pats. given aspirin at arrival		0.022**				0.018**	
		(0.009)				(0.009)	
% of surgery pats. given antibiotic 1 hour			0.010			-0.002	
before surgery			(0.009)			(0.009)	
% of surgery pats. given treatment to				0.025***		0.023***	
prevent blood clots within 24 hours				(0.007)		(0.007)	
30-day death rate for heart attack patients					0.005*	0.005	
					(0.003)	(0.003)	
Full set of 41 quality controls?	No	No	No	No	No	No	Yes
Other Characteristics							
Monopoly	0.118***	0.119***	0.117***	0.118***	0.117***	0.119***	0.117***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Duopoly	0.073***	0.073***	0.072***	0.072***	0.073***	0.072***	0.071***
	(0.024)	(0.024)	(0.024)	(0.023)	(0.024)	(0.023)	(0.023)
Triopoly	0.036	0.036	0.036	0.037	0.035	0.036	0.034
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Share HCCI	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	8,772	8,772	8,772	8,772	8,772	8,772	8,772

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Table 6 with the addition of alternative quality measures. The dependent variable is our regression-based inpatient price index that is risk-adjusted for DRG, age, and sex. Standard errors are clustered at the HRR-level and are in parentheses. Facilities prices are regression adjusted transaction prices for 2008-2011. All regressions include HRR and year fixed effects. All regressions also include same controls as Column (3) Table 6 Panel A.

Appendix Table 16: Cross-Sectional Relationships and Robustness to Sample Restrictions

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	ln(Price)		Percent Paid Share of Charges		Percent Linked to Medicare	
Sample:	Excluding Monopoly Hospitals	Excluding Hospitals in Markets with ≥ 6 Hospitals	Excluding Monopoly Hospitals	Excluding Hospitals in Markets with ≥ 6 Hospitals	Excluding Monopoly Hospitals	Excluding Hospitals in Markets with ≥ 6 Hospitals
Market Characteristics						
Monopoly		0.096***		6.863***		-10.955***
		(0.024)		(1.748)		(3.413)
Duopoly	0.068***	0.071***	5.781***	3.385*	-6.453***	-3.530
	(0.025)	(0.024)	(1.638)	(1.553)	(2.345)	(2.589)
Triopoly	0.031	0.035	5.129**	2.984	-5.578*	-4.887
	(0.023)	(0.023)	(1.567)	(1.671)	(2.868)	(3.119)
HCCI Market Share	-0.007***	-0.006***	-0.475***	-0.274*	0.601***	0.523***
	(0.002)	(0.002)	(0.136)	(0.125)	(0.204)	(0.193)
Observations	7,339	5,727	3,640	2,838	3,228	2,233

Notes: * p<0.10, ** p<0.05, *** p<0.01. "Excluding monopolies" drops all monopoly hospitals and "Excluding Hospitals in Markets with ≥ 6 Hospitals" drops all hospitals in markets with 6 or more hospitals. OLS estimates of Table 6 Panel A Column (3) with different sample restrictions. The dependent variable in Columns (1) and (2) is the log of our regression-based inpatient price index that is risk-adjusted for DRG, age, and sex. The dependent variable in Columns (3) and (4) is the share of cases paid as a percentage of hospital charges. The dependent variable in Columns (5) and (6) is the percent of prospective cases with prices set as a percentage of Medicare payments. Standard errors are clustered at the HRR-level and are in parentheses. Facilities prices are regression adjusted transaction prices for 2008-2011. All regressions include HRR and yearly fixed effects. All regressions also include insurance market controls, controls for beds, teaching status, government ownership, non-profit status, percent county uninsured and median income, Medicare payment rates, and share of hospitals' admits covered by Medicare and Medicaid.

Appendix Table 17: Inpatient Cross-Sectional Price Results with Alternative Sample Restrictions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	ln(Price)									
Monopoly	0.107***	0.109***	0.115***	0.115***	0.118***	0.119***	0.120***	0.123***	0.122***	0.127***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.025)	(0.027)	(0.028)	(0.029)
Duopoly	0.069***	0.073***	0.076***	0.075***	0.073***	0.068***	0.068***	0.074***	0.074***	0.075***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Triopoly	0.029	0.027	0.033	0.036	0.036	0.037*	0.040*	0.041*	0.041*	0.042*
	(0.023)	(0.024)	(0.024)	(0.023)	(0.023)	(0.022)	(0.023)	(0.023)	(0.022)	(0.022)
HCCI Market Share	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***	-0.008***	-0.008***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Minimum Inpatient Case Count	10	20	30	40	50	60	70	80	90	100
Number of Hospitals	3,013	2,793	2,622	2,497	2,358	2,270	2,176	2,089	2,013	1,945
Observations	11,374	10,488	9,789	9,269	8,772	8,380	8,000	7,689	7,389	7,133

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates with standard errors clustered at the HRR-level in parentheses. Market structure variables described in text and Appendix C. The dependent variable is ln(Hospital inpatient prices) that are regression risk-adjusted for DRG, age, and sex. Data runs 2008 to 2011. All regressions include number of technologies, dummy for being ranked in US News and World Reports, size as measured by number of beds, hospital ownership (government, non-profit or for-profit), whether a teaching hospital, percent of county uninsured, county median income, the Medicare payment rate, share of Medicare, share of Medicaid, as well as HRR and year dummies. Minimum inpatient case count indicates the minimum number of unique cases per hospital-year required for inclusion in the sample.

Appendix Table 18: Transactions and Targets by Distance

Distance:		5 Miles	10 Miles	15 Miles	20 Miles	30 Miles	50 Miles	All
2007	Transactions	6	14	18	25	31	37	69
	Target Hospitals	7	17	21	29	38	51	119
	Acquirer Hospitals	7	20	25	39	64	92	493
2008	Transactions	9	15	23	28	39	46	69
	Target Hospitals	11	19	28	33	45	54	86
	Acquirer Hospitals	13	30	43	58	89	136	693
2009	Transactions	9	15	17	21	32	44	70
	Target Hospitals	9	15	17	22	33	48	85
	Acquirer Hospitals	5	12	19	30	60	113	578
2010	Transactions	6	13	17	24	39	50	76
	Target Hospitals	7	15	19	27	42	59	90
	Acquirer Hospitals	7	19	33	45	68	120	753
2011	Transactions	11	21	32	38	49	64	82
	Target Hospitals	11	21	33	40	55	75	106
	Acquirer Hospitals	7	17	33	46	67	114	753
All	Transactions	42	77	108	138	189	243	366
	Target Hospitals	45	87	118	151	212	285	464
	Acquirer Hospitals	39	97	146	204	320	494	1563

Notes: This is based on data from the AHA, Irving-Levin Associates, Factset, and SDC Platinum databases. Data on hospital beds came from the AHA annual survey.

Appendix Table 19: Characteristics of Merging/Non-Merging Hospitals

	(1)	(2)	(3)	(4)
Sample:	Any 5 Mile Merger			
Column contents:	Treated	Controls	Treated	Controls
Covariates:	Static	Static	Differenced	Differenced
Price	10880.8	13066.2***	656.4	663.5
ln(Price)	9.2	9.4**	0.056	0.052
Market Structure				
Monopoly	0.0	48.6***	0.000	-0.050*
Duopoly	40.3	25.0*	0.000	0.076
Triopoly	23.4	9.9*	0.000	0.000
Hospital HHI	0.419	0.719***	-0.023	-0.191
Insurer Market Share	13.6	17.8***	-0.001	<0.001
Hospital Characteristics				
Technologies	64.5	59.6	3.4	1.5
Ranked in US News	1.3	5.4***	-1.4	-0.5
Beds	275.5	271.3	-0.3	0.8
Teaching	53.2	38.1*	0.0	0.4**
Government	14.3	12.2	0.0	-0.2
Non-Profit	70.1	69.7	0.0	-0.1
Local Area Characteristics				
Percent Uninsured	14.8	17.1**	0.3	0.2
Median Income	50841.7	51537.3	-757.1	-533.2
Other Payers				
PPS Payment Rate	6547.4	6439.1	155.7	91.8
Medicare Share	47.1	44.5	-0.4	0.6*
Medicaid Share	18.3	18.8	1.0	0.4
Observations	77	8,415	70	7,944
Number of Hospitals	37	2,241	35	2,153

Notes: These are descriptive statistics for the inpatient sample used in estimating post-merger price differences. This table uses pre-merger data for each hospital. There are 8,492 hospital-year observations representing 2,278 unique hospitals. Hospital prices are hospital prices that are risk-adjusted for DRG, age, and sex. The static columns – (1) and (2) – display the average value of each covariate during our sample period across hospital years pre-merger. The differenced columns – (3) and (4) – capture the average first difference of each covariate pre-merger.

Appendix Table 20: Robustness of Hospital Prices and Mergers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ln(price)						
Distance (miles):	5	10	15	20	25	30	50
Panel A: Baseline							
Post-Merger	0.060**	0.039**	0.021	0.023*	0.024**	0.014	0.008
	(0.025)	(0.019)	(0.013)	(0.013)	(0.011)	(0.011)	(0.009)
Observations	8655	8655	8655	8655	8655	8655	8655
Panel B: Treatment Counts Estimated Log-Linearly							
Post-Merger	0.062**	0.040**	0.021	0.024*	0.024**	0.014	0.008
	(0.025)	(0.019)	(0.013)	(0.013)	(0.011)	(0.010)	(0.009)
Observations	8655	8655	8655	8655	8655	8655	8655
Panel C: Matching (Within State Mahalanobis Distance)							
Post-Merger	0.100***	0.024	0.009	0.011	0.009	0.003	-0.001
	(0.028)	(0.023)	(0.016)	(0.014)	(0.012)	(0.011)	(0.009)
Observations	1286	2295	2993	3417	3954	4215	5120
Panel D: Matched using Mahalanobis Distance							
Post-Merger	0.070***	0.023	0.007	0.014	0.014	0.004	-0.000
	(0.026)	(0.021)	(0.015)	(0.013)	(0.012)	(0.011)	(0.009)
Observations	1921	3124	4058	4745	5216	5509	6265
Panel E: Matching (Dranove/Lindrooth Model)							
Post-Merger	0.075***	0.032	0.013	0.017	0.016	0.004	0.001
	(0.026)	(0.021)	(0.015)	(0.013)	(0.011)	(0.010)	(0.009)
Observations	1918	3506	4522	5154	5636	5972	6786
Panel F: Matched using K-Nearest Neighbor Method							
Post-Merger	0.075***	0.024	0.010	0.016	0.018	0.006	0.001
	(0.026)	(0.021)	(0.014)	(0.013)	(0.011)	(0.011)	(0.009)

Observations	1912	3311	4239	4827	5496	5700	6544
Panel G: Robustness to Minimum Count Restrictions							
Post-Merger (Minimum 40 Cases)	0.060**	0.040**	0.023*	0.023*	0.025**	0.013	0.007
	(0.025)	(0.018)	(0.013)	(0.012)	(0.011)	(0.010)	(0.009)
Observations	9086	9086	9086	9086	9086	9086	9086
Post-Merger (Minimum 10 Cases)	0.076***	0.044**	0.028**	0.027**	0.029***	0.021**	0.014
	(0.024)	(0.018)	(0.013)	(0.012)	(0.011)	(0.011)	(0.009)
Observations	11157	11157	11157	11157	11157	11157	11157
Panel H: Estimated Separately for Targets/Acquirers							
Post-Merger X Target	0.080**	0.055*	0.034	0.033	0.031	0.019	0.010
	(0.040)	(0.031)	(0.026)	(0.023)	(0.020)	(0.019)	(0.017)
Post-Merger X Acquirer	0.039*	0.025	0.012	0.018	0.020*	0.011	0.007
	(0.023)	(0.018)	(0.011)	(0.012)	(0.011)	(0.011)	(0.009)
Observations	8655	8655	8655	8655	8655	8655	8655

Notes: ***significant at 1 percent level; **5 percent level; *10 percent level. Coefficients estimated by OLS with standard errors in parentheses (clustered by hospital). All regressions include hospital fixed effects and time dummies. The dependent variable is the log of our risk-adjusted inpatient price measure. Controls: Insurer HHI, percent privately insured covered by the HCCI insurers, quality scores from News & World Report, technology index, hospital size, whether the hospital is a teaching facility, government-owned facility, or a not-for-profit; country median income and percent uninsured; the Medicare base payment rate, the share of hospitals' discharges that are Medicare and Medicaid patients. Unless otherwise specified, post-merger equals 1 in the year a hospital merges and in all years afterwards and zero otherwise. We match hospitals based on the covariates in described in Appendix E.

Appendix Table 21: Correlation between Private and Medicare Spending Per Beneficiaries

	Total	Inpatient
Overall	0.044	0.172
High BCBS Share	0.011	0.156
Low BCBS Share	0.063	0.201

Notes: Each cell presents the correlation between spending per beneficiary for private and Medicare patients across HRRs in 2011. High and low BCBS share are defined by HRRs which are above or below the median BCBS market share across HRRs (47 percent).

Appendix Table 22: Price/Quantity Decomposition for Cases in High/Low BCBS Market Share, 2011

	Private			Medicare		
	(1)	(2)	(3)	(4)	(5)	(6)
	Share Price	Share Quantity	Share Covariance	Share Price	Share Quantity	Share Covariance
Overall	0.496	0.495	0.009	0.127	0.953	-0.081
Low BCBS	0.541	0.495	-0.036	0.107	0.975	-0.081
High BCBS	0.496	0.488	0.016	0.149	0.921	-0.070

Notes: This table presents results of the price quantity decomposition as described in Section III.B using data from 2011. Shares are averaged across DRGs (weighted by total spending). High and low BCBS share are defined by HRRs which are above or below the median BCBS market share across HRRs (47 percent).

Appendix Table 23: Price Decomposition for Cases in High/Low BCBS Market Share

Panel A: Price Decomposition for High BCBS Market Share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			R^2			Unexplained within hospital-month variance	Observations	Within hospital-month coefficient of variation
Hip Replacement	0.014	0.034	0.461	0.713	0.743	25.7%	3,573	0.164
Knee Replacement	0.010	0.028	0.464	0.702	0.747	25.3%	8,344	0.190
Cesarean Section	0.013	0.052	0.487	0.757	0.792	20.8%	14,367	0.165
Vaginal Delivery	0.014	0.036	0.380	0.612	0.670	33.0%	22,834	0.187
PTCA	0.006	0.037	0.585	0.739	0.768	23.2%	3,455	0.223
Colonoscopy	0.013	0.018	0.404	0.794	0.856	14.4%	13,170	0.145
Lower Limb MRI	0.003	0.016	0.370	0.775	0.789	21.1%	29,018	0.139
Mean						*23.4%*		*0.173*
Patient Characteristics	Yes	Yes	Yes	Yes	Yes			
Plan Characteristics	No	Yes	Yes	Yes	Yes			
Control for Charges	No	No	No	No	Yes			
HRR Fixed Effects	No	No	Yes	—	—			
Hospital Fixed Effects	No	No	No	Yes	Yes			

Notes: Data include cases treated at hospitals in counties with more than 51 percent market share. Each cell contains the R^2 value for the relevant specification and data pair in January, 2011. All regressions rely on case-level data. Patient characteristics include fixed effects for sex, and 10-year age bands. Plan characteristics include the full interaction of market segment (i.e. large vs. small group), and product and funding type. Column (8) reports the within-hospital-month coefficient of variation, averaged across hospital-months.

Appendix Table 23 Panel B: Price Decomposition for Low BCBS Market Share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			R^2			Unexplained within hospital-month variance	Observations	Within hospital-month coefficient of variation
Hip Replacement	0.006	0.016	0.518	0.773	0.782	21.8%	11,549	0.177
Knee Replacement	0.006	0.017	0.418	0.734	0.758	24.2%	28,813	0.211
Cesarean Section	0.011	0.024	0.433	0.717	0.745	25.5%	67,113	0.171
Vaginal Delivery	0.011	0.028	0.395	0.653	0.707	29.3%	85,956	0.194
PTCA	0.006	0.021	0.460	0.718	0.756	24.4%	13,181	0.244
Colonoscopy	0.010	0.028	0.435	0.752	0.813	18.7%	52,847	0.171
Lower Limb MRI	0.001	0.008	0.365	0.773	0.782	21.8%	84,896	0.164
Mean						23.7%		0.190
Patient Characteristics	Yes	Yes	Yes	Yes	Yes			
Plan Characteristics	No	Yes	Yes	Yes	Yes			
Control for Charges	No	No	No	No	Yes			
HRR Fixed Effects	No	No	Yes	—	—			
Hospital Fixed Effects	No	No	No	Yes	Yes			

Notes: Data include cases treated at hospitals in counties with less than 51 percent market share. Each cell contains the R^2 value for the relevant specification and data pair in January, 2011. All regressions rely on case-level data. Patient characteristics include fixed effects for sex and10-year age bands. Plan characteristics include the full interaction of market segment (i.e. large vs. small group), and product and funding type. Column (8) reports the within-hospital-month coefficient of variation, averaged across hospital-months.

Appendix Table 24: Levels of Variation in High/Low BCBS Facilities

Panel A: Overall

	Coefficient of Variation		
	(1) Across HRR	(2) Within HRR	(3) Within Hospital
Inpatient	0.349	0.429	1.000
Hip Replacement	0.348	0.218	0.189
Knee Replacement	0.362	0.306	0.219
Cesarean Section	0.350	0.245	0.178
Vaginal Delivery	0.351	0.254	0.189
PTCA	0.445	0.288	0.242
Colonoscopy	0.383	0.311	0.170
Lower Limb MRI	0.325	0.312	0.173

Notes: Data for each clinical cohort drawn from January, 2011. Each cell presents a coefficient variation. Column (1) presents the CoV of HRR-level average prices across HRRs. Column (2) presents the within-HRR CoV in hospital-level average prices then averaged across HRRs. Column (3) presents within-hospital CoV averaged across hospitals.

Appendix Table 24, continued

Panel B: High BCBS (counties with over 51 percent market share)

	Coefficient of Variation		
	(1) Across HRR	(2) Within HRR	(3) Within Hospital
Inpatient	0.414	0.422	0.907
Hip Replacement	0.340	0.174	0.148
Knee Replacement	0.375	0.237	0.189
Cesarean Section	0.337	0.210	0.175
Vaginal Delivery	0.393	0.243	0.190
PTCA	0.475	0.188	0.183
Colonoscopy	0.377	0.276	0.163
Lower Limb MRI	0.317	0.299	0.157

Notes: Data for each clinical cohort drawn from January, 2011. Each cell presents a coefficient variation. Column (1) presents the CoV of HRR-level average prices across HRRs. Column (2) presents the within-HRR CoV in hospital-level average prices then averaged across HRRs. Column (3) presents within-hospital CoV averaged across hospitals.

Appendix Table 24, continued

Panel C: Low BCBS (counties with under 51 percent market share)

	Coefficient of Variation		
	(1) Across HRR	(2) Within HRR	(3) Within Hospital
Inpatient	0.385	0.429	1.042
Hip Replacement	0.353	0.220	0.203
Knee Replacement	0.351	0.324	0.229
Cesarean Section	0.358	0.251	0.179
Vaginal Delivery	0.324	0.258	0.189
PTCA	0.461	0.283	0.256
Colonoscopy	0.393	0.313	0.172
Lower Limb MRI	0.348	0.312	0.179

Notes: Data for each clinical cohort drawn from January, 2011. Each cell presents a coefficient variation. Column (1) presents the CoV of HRR-level average prices across HRRs. Column (2) presents the within-HRR CoV in hospital-level average prices then averaged across HRRs. Column (3) presents within-hospital CoV averaged across hospitals.

Appendix Table 25: Cross Sectional Analysis of Hospital Payments in High/Low BCBS Counties, 2008-2011

Panel A: Prices without HRR Fixed Effects, 2008-2011

	(1)	(2)	(3)	(4)
Dependent Variable:	ln(Facilities Price)			
Monopoly	0.190***	0.190***	0.155***	0.225***
	(0.024)	(0.025)	(0.031)	(0.039)
Duopoly	0.130***	0.130***	0.108***	0.153***
	(0.020)	(0.020)	(0.024)	(0.038)
Triopoly	0.083***	0.083***	0.056**	0.113***
	(0.023)	(0.023)	(0.028)	(0.041)
HCCI Market Share	-0.006***	-0.006***	-0.007***	-0.004*
	(0.002)	(0.002)	(0.002)	(0.002)
BCBS Market Share		<0.001		
		(0.001)		
Sample	Overall	Overall	Low BCBS	High BCBS
HRR FE	No	No	No	No
Observations	8,772	8,772	6,084	2,688

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. Facilities prices are regression adjusted transaction prices. All regressions include yearly fixed effects. The omitted ownership category is private hospitals. High and low BCBS share defined as above or below 51 percent.

Appendix Table 25, continued

Panel B: Prices with HRR Fixed Effects, 2008-2011

	(1)	(2)	(3)	(4)
Dependent Variable:	ln(Facilities Price)			
Monopoly	0.118***	0.112***	0.126***	0.036
	(0.024)	(0.023)	(0.029)	(0.039)
Duopoly	0.073***	0.069***	0.073***	0.023
	(0.024)	(0.023)	(0.025)	(0.050)
Triopoly	0.036	0.036	0.042	-0.001
	(0.023)	(0.023)	(0.026)	(0.046)
HCCI Market Share	-0.007***	-0.007***	-0.006***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)
BCBS Market Share		0.001		
		(0.001)		
Sample	Overall	Overall	Low BCBS	High BCBS
HRR FE	Yes	Yes	Yes	Yes
Observations	8,772	8,772	6,084	2,688

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. Facilities prices are regression adjusted transaction prices. All regressions include yearly fixed effects. The omitted ownership category is private hospitals. High and low BCBS share defined as above or below 51 percent.

Appendix Table 25, continued

Panel C: Share of Chargemaster, 2010-2011

	(1)	(2)	(3)	(4)
Dependent Variable:	Percent of Cases Paid Share of Charges			
Monopoly	10.455***	10.215***	7.917***	11.924***
	(1.778)	(1.813)	(2.064)	(2.872)
Duopoly	5.702***	5.567***	4.080*	6.604*
	(1.596)	(1.624)	(1.755)	(2.788)
Triopoly	4.909**	4.951**	2.886	4.909
	(1.608)	(1.601)	(1.859)	(2.692)
HCCI Market Share	-0.403***	-0.367**	-0.320*	-0.702**
	(0.120)	(0.125)	(0.128)	(0.254)
BCBS Market Share		0.077		
		(0.051)		
Sample	Overall	Overall	Low BCBS	High BCBS
HRR FE	Yes	Yes	Yes	Yes
Observations	4,344	4,344	2,980	1,364

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. All regressions include controls for the number of technologies, an indicator for whether the hospital was ranked in US News and World Reports, bed count, hospital ownership type, local area characteristics, and public payer characteristics, as well as yearly fixed effects and HRR fixed-effects. The dependent variable is hospital-level measure of proportion of cases paid as a share of charges derived from the full sample of inpatient cases. High and low BCBS share defined as above or below 51 percent.

Appendix Table 25, continued

Panel D: Share Linked to Medicare, 2010-2011

	(1)	(2)	(3)	(4)
Dependent Variable:	Percent of Cases Tied to Medicare			
Monopoly	-11.293***	-11.342***	-14.721***	-2.779
	(3.160)	(3.175)	(3.666)	(5.520)
Duopoly	-5.595**	-5.634**	-6.271**	-7.414
	(2.316)	(2.319)	(2.770)	(4.790)
Triopoly	-5.747**	-5.744**	-6.760**	-1.960
	(2.790)	(2.792)	(3.361)	(4.842)
HCCI Market Share	0.616***	0.626***	0.470**	1.590***
	(0.174)	(0.166)	(0.188)	(0.328)
BCBS Market Share		0.024		
		(0.091)		
Sample	Overall	Overall	Low BCBS	High BCBS
HRR FE	Yes	Yes	Yes	Yes
Observations	3,669	3,669	2,620	1,049

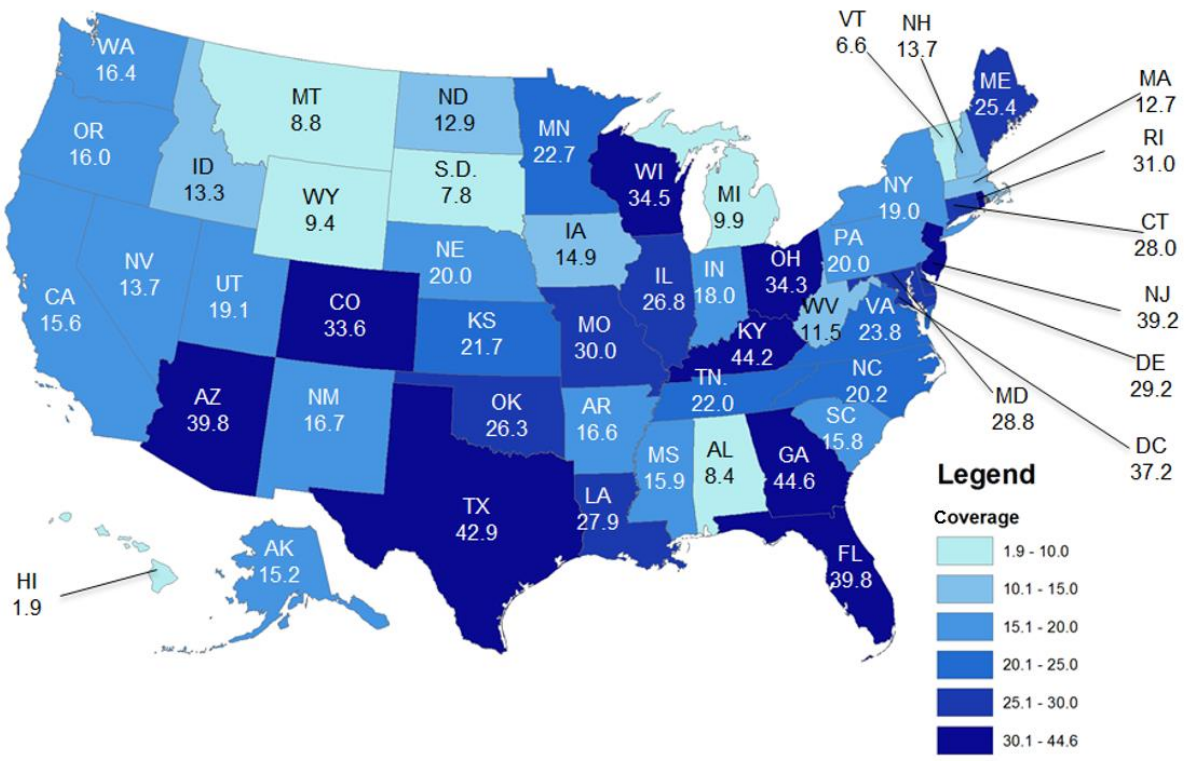
Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates of Equation (2) with standard errors clustered at the HRR-level in parentheses. The dependent variable is the percent of cases paid as a percent of Medicare, conditional on being paid on a prospective payment schedule. All regressions include controls for the number of technologies, an indicator for whether the hospital was ranked in US News and World Reports, bed count, hospital ownership type, local area characteristics, and public payer characteristics, as well as yearly fixed effects and HRR fixed-effects. High and low BCBS share defined as above or below 51 percent.

Appendix Table 26: Post-Merger Price Effects in High/Low BCBS Markets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ln(price)						
Distance (miles):	5	10	15	20	25	30	50
Panel A: Full Sample							
Post-Merger	0.060**	0.039**	0.021	0.023*	0.024**	0.014	0.008
	(0.025)	(0.019)	(0.013)	(0.013)	(0.011)	(0.011)	(0.009)
Observations	8,655	8,655	8,655	8,655	8,655	8,655	8,655
Panel B: Low BCBS Share							
Post-Merger	0.074***	0.053**	0.040**	0.038**	0.035***	0.027**	0.022**
	(0.028)	(0.021)	(0.016)	(0.015)	(0.013)	(0.013)	(0.011)
Observations	5,831	5,831	5,831	5,831	5,831	5,831	5,831
Panel C: High BCBS Share							
Post-Merger	0.021	0.015	-0.003	0.013	0.016	0.014	0.007
	(0.050)	(0.033)	(0.021)	(0.018)	(0.015)	(0.014)	(0.012)
Observations	2,847	2,847	2,847	2,847	2,847	2,847	2,847

Notes: * p<0.10, ** p<0.05, *** p<0.01. OLS estimates with standard errors clustered at the hospital-level in parentheses. Facilities prices are regression adjusted transaction prices. All regressions include hospital fixed effects and yearly fixed effects.

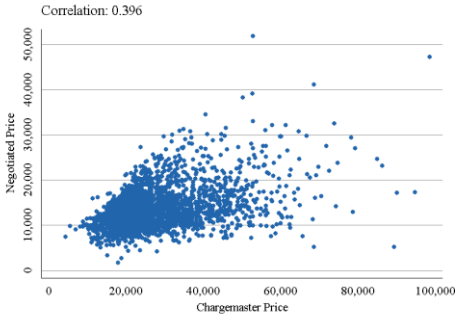
Appendix Figure 1: HCCI Data Coverage Rates by State



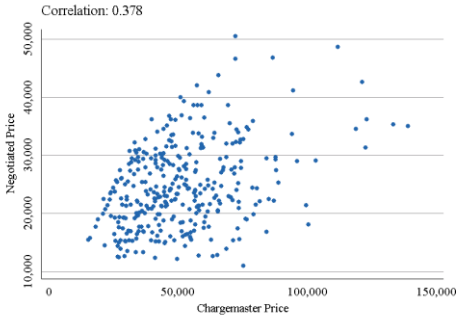
Notes: Coverage rates = number of HCCI lives enrolled divided by total number of beneficiaries. Coverage rates were calculated using 2011 HCCI enrollment data. Statewide insurance coverage totals were derived from the American Community Survey for 2011. All numbers in percentages.

Appendix Figure 2: Correlations between Negotiated Prices and Charges for All Procedures, 2011

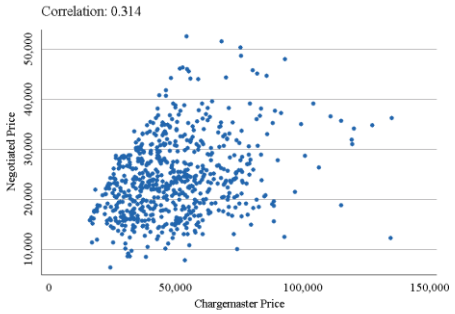
Inpatient



Hip Replacement

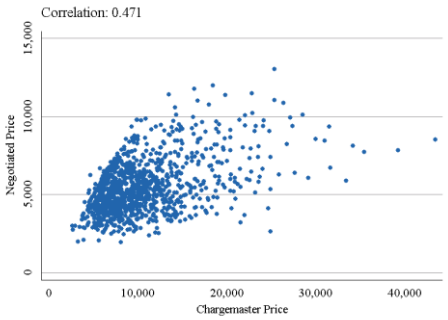


Knee Replacement

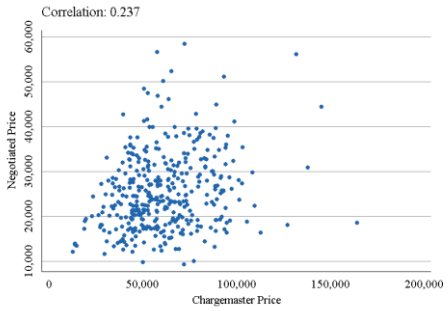


Cesarean Section

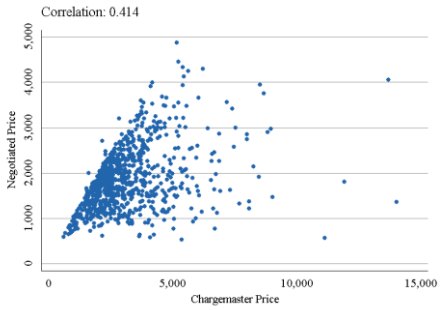
Vaginal Delivery



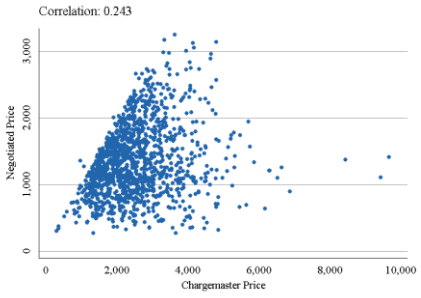
PTCA



Colonoscopy

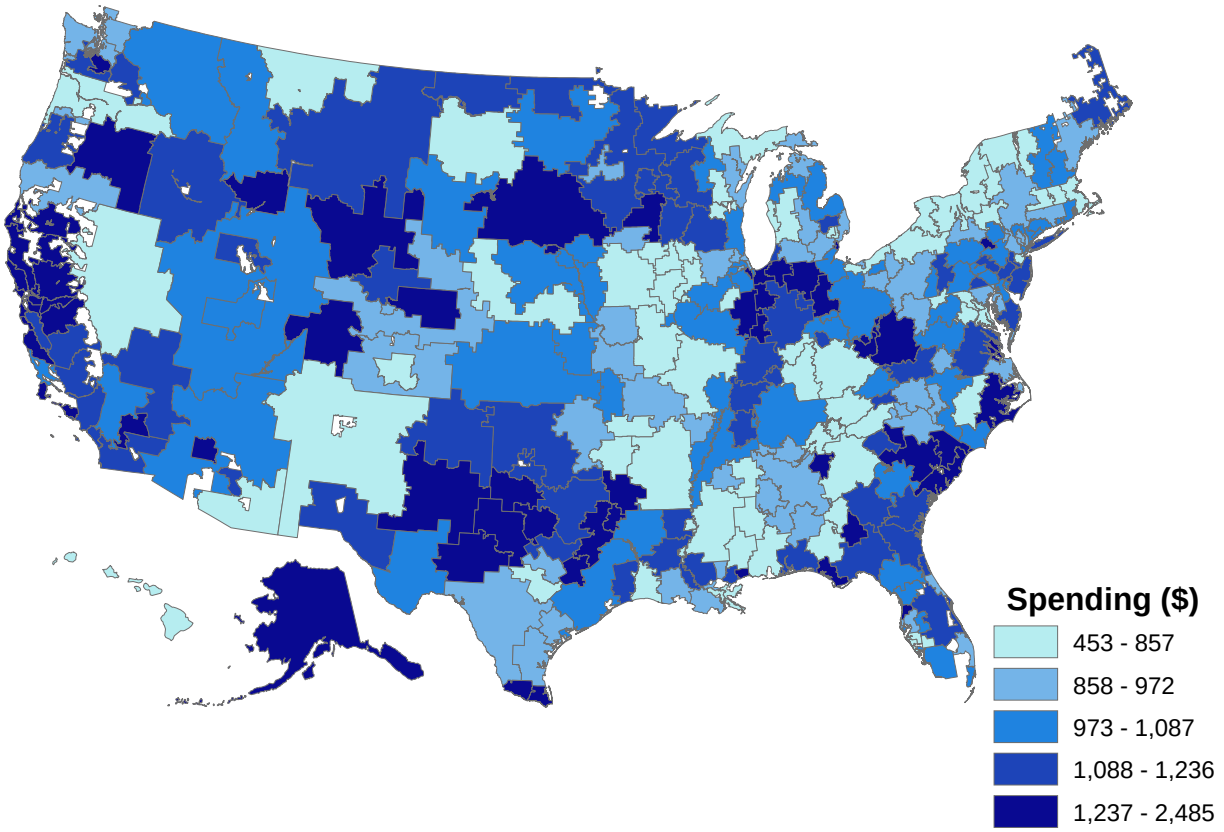


Lower Limb MRI



Notes: These are scatter plots of hospital charges for our main procedures and regression-adjusted transaction prices ("negotiated prices"). We include providers who deliver 10 or more of the specific procedure per year (50 for inpatient). We include prices from 2011. The figures contain the correlation between charges and transaction prices.

Appendix Figure 3: Map of Inpatient Spending per Privately Insured Beneficiary, 2011

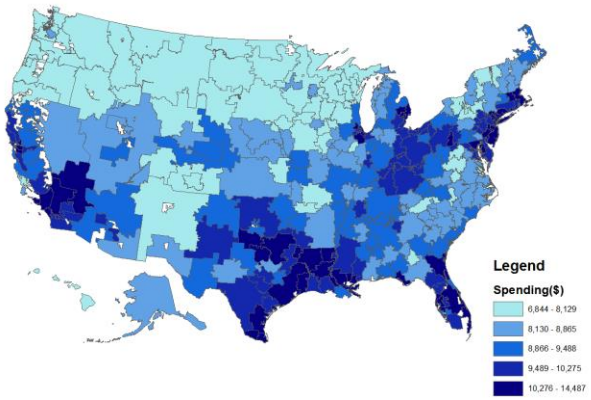


Mean	SD	Min	Max
$1,059	$258	$453	$2,485

Notes: This figure captures risk-adjusted inpatient spending per beneficiary by HRR using data from 2011. Each bin captures a quintile of spending per beneficiary.

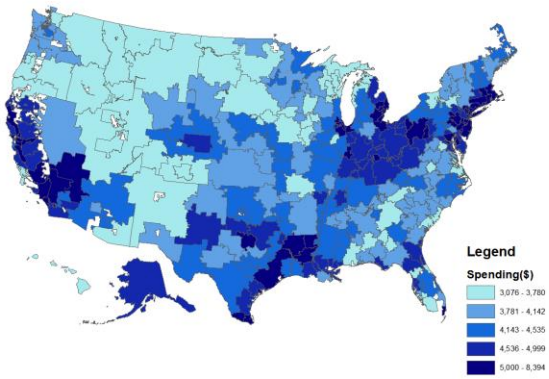
Appendix Figure 4: Map of Total and Inpatient Spending per Medicare Beneficiary, 2011

Panel A: Total Medicare Spending per Beneficiary, 2011



Mean	SD	Min	Max
$9,316	$1,315	$6,843	$14,487

Panel B: Medicare Inpatient Spending Per Beneficiary, 2011

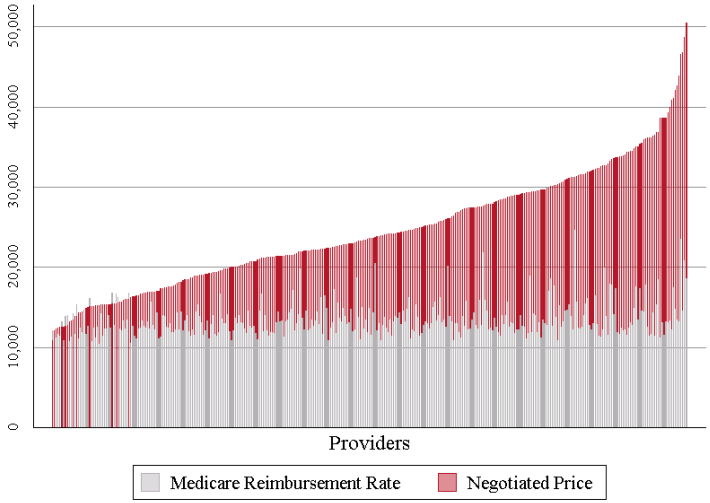


Mean	SD	Min	Max
$4,430	$759	$3,076	$8,394

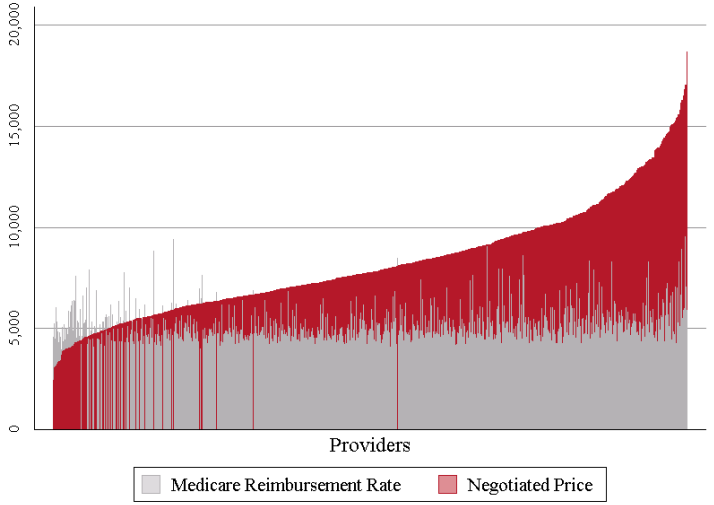
Notes: Medicare data are drawn from the Dartmouth Atlas (dartmouthatlas.org). Private data are risk-adjusted for age and sex using indirect standardization. Spending data do not include prescription drug spending.

Appendix Figure 5: National Variation in Hospital Prices for All Procedures, 2011

Panel A: Hip Replacement Prices



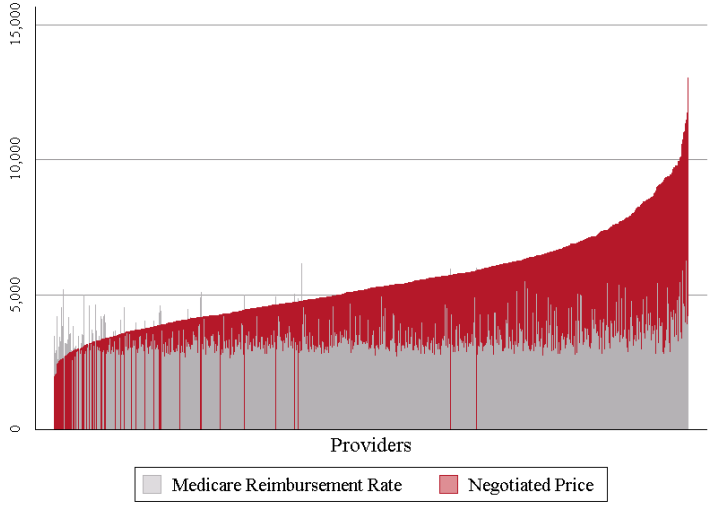
Panel B: Cesarean Section Prices



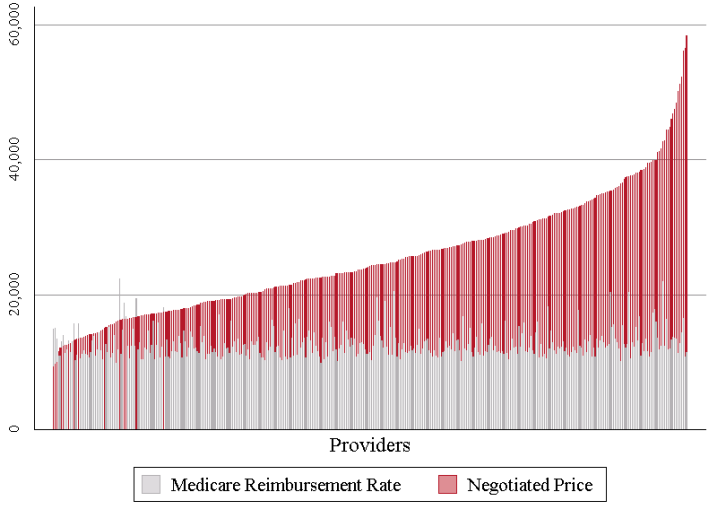
$24,565	**Mean**	$8,258
$10,894 – $50,476	**Min - Max**	$2,424 – $18,679
$15,501 – $33,933	**p10 - p90**	$5,154 – $12,109
$19,231 – $29,319	**IQR**	$6,317 – $9,815
2.19	**p90/10 ratio**	2.35
0.29	**Coefficient of Variation**	0.33
0.16	**Gini Coefficient**	0.18
341	**Number of Hospitals**	926

Appendix Figure 5: National Variation in Hospital Prices for All Procedures, continued

Panel C: Vaginal Delivery Prices



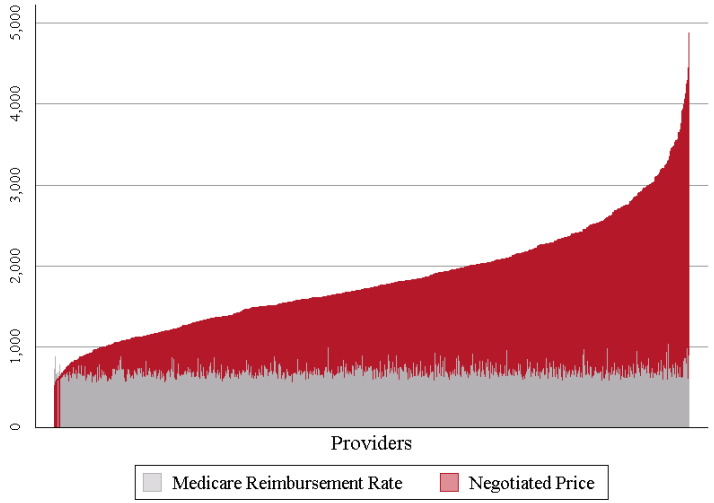
Panel D: PTCA Prices



$5,465	**Mean**	$25,395
$1,944 – $13,039	**Min - Max**	$9,293 – $58,433
$3,486 – $7,814	**p10 - p90**	$15,965 – $37,097
$4,218 – $6,387	**IQR**	$19,034 – $30,528
2.24	**p90/10 ratio**	2.32
0.32	**Coefficient of Variation**	0.34
0.17	**Gini Coefficient**	0.19
1,022	**Number of Hospitals**	375

Appendix Figure 5: National Variation in Hospital Prices for All Procedures, continued

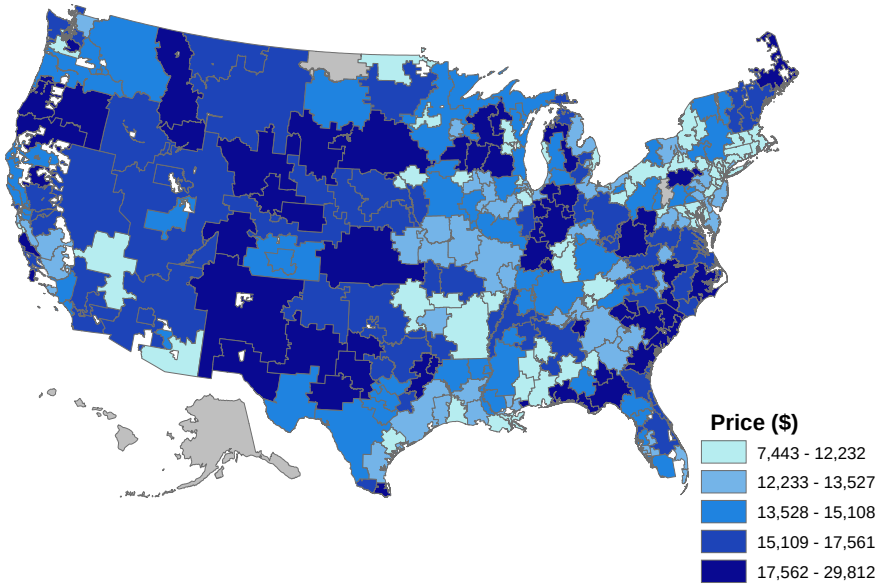
Panel E: Colonoscopy Prices



$1,834	**Mean**
$520 – $4,878	**Min - Max**
$1,056 – $2,747	**p10 - p90**
$1,357 – $2,197	**IQR**
2.6	**p90/10 ratio**
0.37	**Coefficient of Variation**
0.2	**Gini Coefficient**
844	**Number of Hospitals**

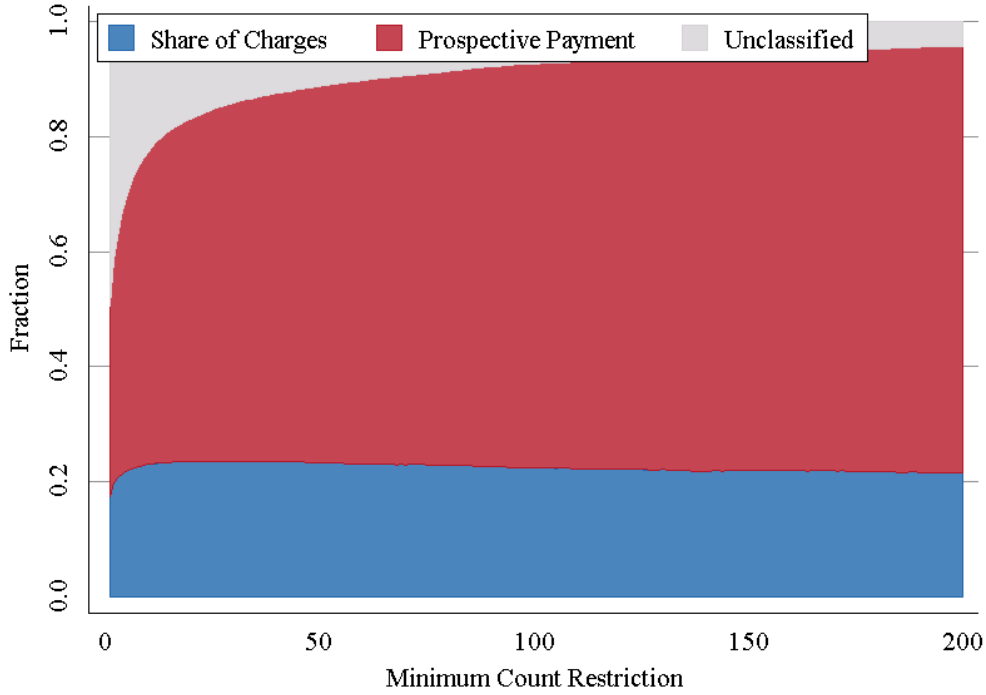
Notes: Each bar represents a single hospital's regression-adjusted transaction price based on hospital cases from 2011. The Medicare payment is based on the PPS fee schedule described in Appendix B4 and excludes outlier adjustments. The bars are ordered by private price.

Appendix Figure 6: Regression Adjusted HRR-Level Inpatient Hospital Prices Normalized Using the Medicare Wage Index



Notes: This figure presents coverage hospital regression adjusted inpatient prices per HRR, weighted by hospital activity, using data from 2011 and normalized prices using the Medicare 2011 wage index. This therefore captures price after adjusting for the cost of care in each HRR. Prices are risk-adjusted for DRG, age, and sex.

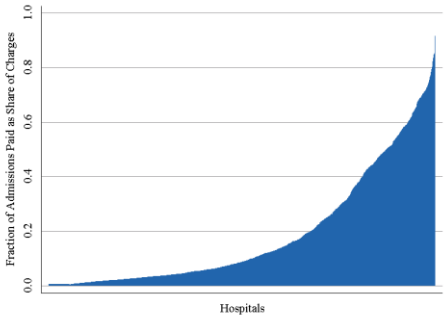
Appendix Figure 7: Contract Classification Rates by Minimum Case Count



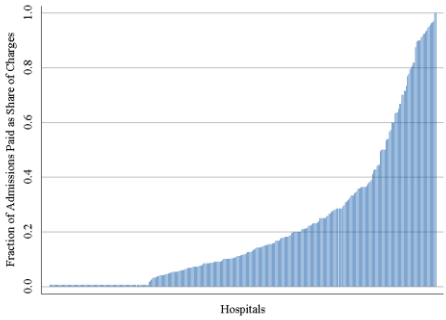
Notes: This figure presents fraction of cases classified as either prospective payment or paid as a percent markup over Medicare. Data is at the case level in the Inpatient sample in 2010 and 2011. The data include all hospital-DRG combinations for which there are at least x-observations (the value on the x-axis).

Appendix Figure 8: Percent of Hospital Cases Paid as Share of Charges, 2011

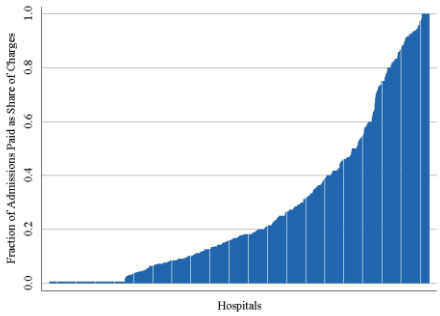
Inpatient



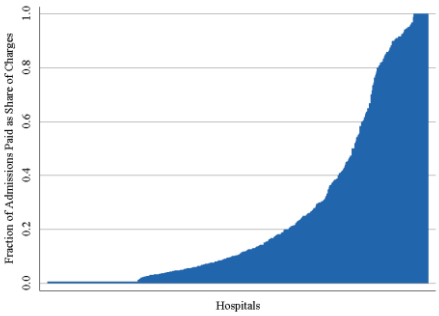
Hip Replacement



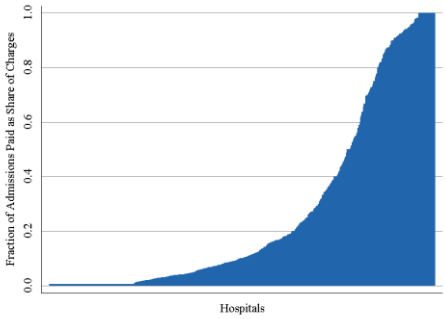
Knee Replacement



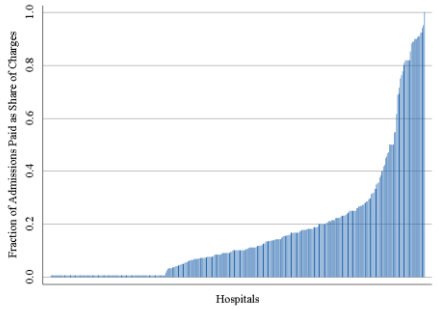
Cesarean Section



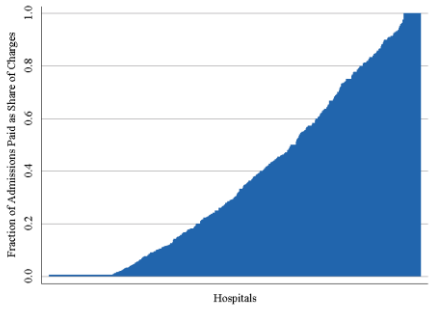
Vaginal Delivery



PTCA

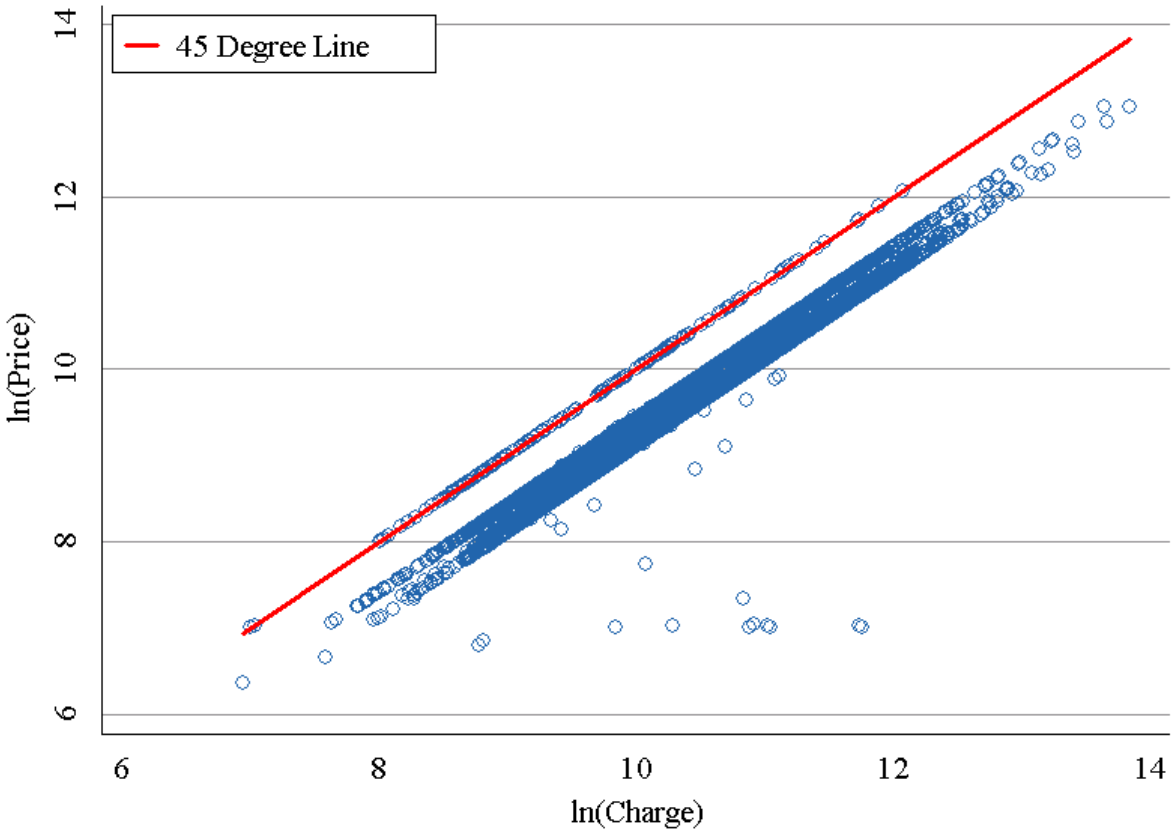


Colonoscopy



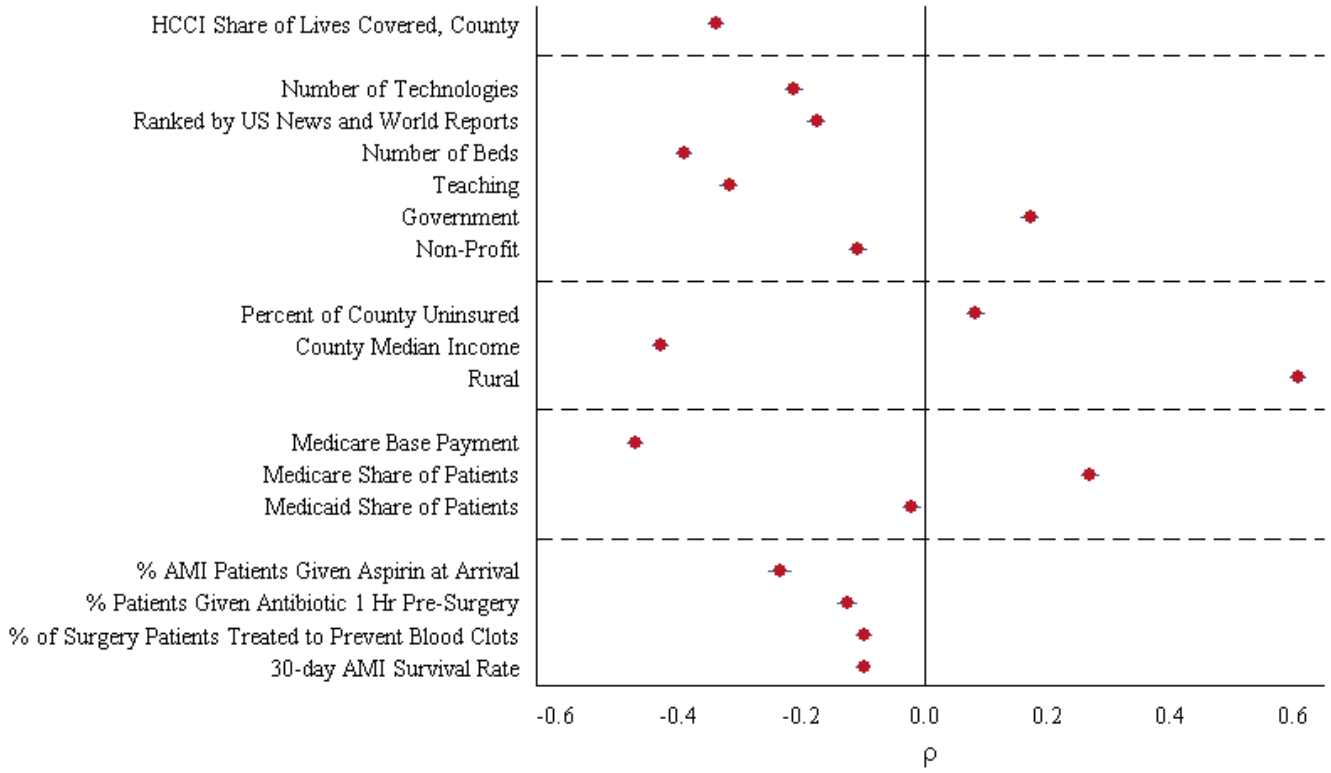
Notes: These are bar graphs of the percent of a hospital's cases paid as a share of charges for our main procedures. We include providers who deliver ten or more of the specific procedure per year (50 for inpatient). We include prices from 2011. The figures contain bars for each unique hospital, where the height indicates the percent of that hospital's cases that were paid as share of charges. For more detail on how we identify method of payment, see Appendix B3.

Appendix Figure 9: Correlation between Prices Paid as Share of Charges and Charges across DRGs at a High Volume Hospital, 2011



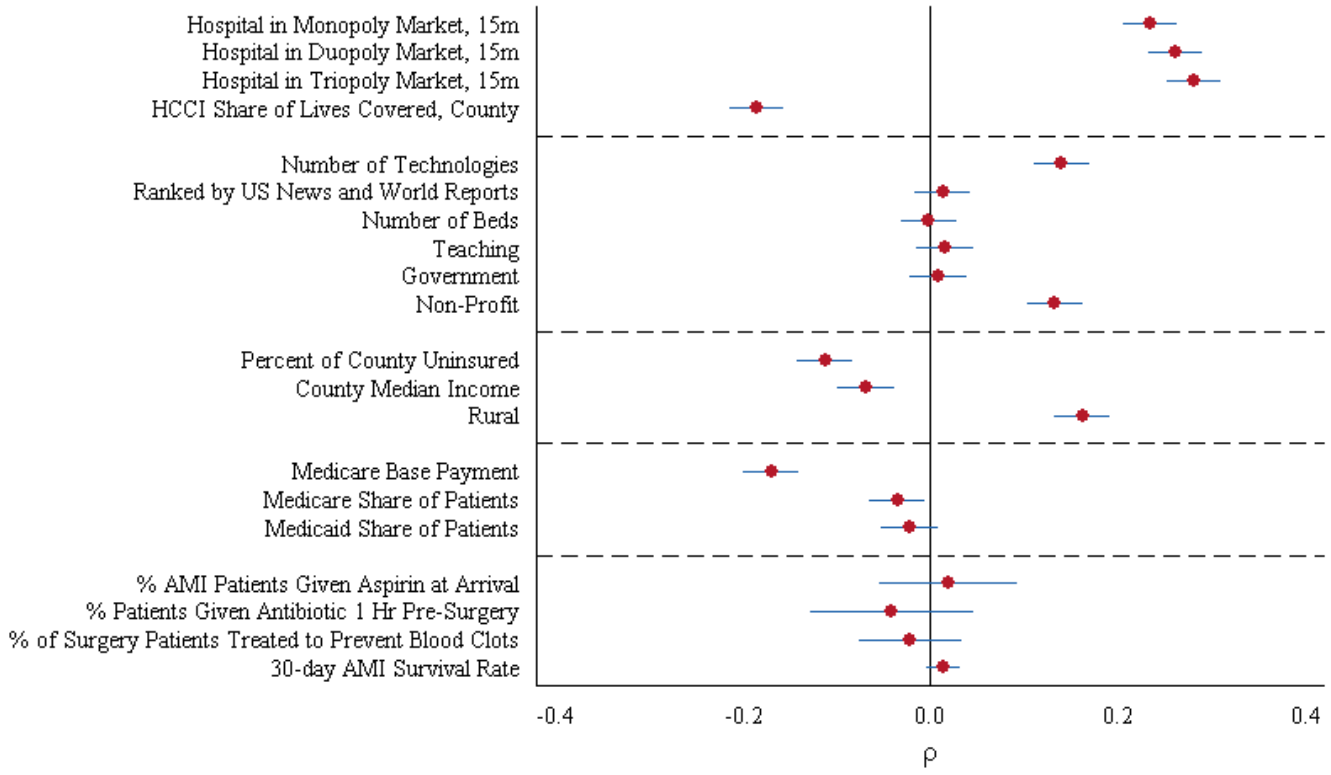
Notes: The y-axis presents logged, DRG-level prices and the x-axis presents logged, DRG-level charges within a high volume hospital for inpatient cases which occurred in 2011.

Appendix Figure 10: Bivariate Correlations of Hospital HHI with Observable Factors, 2008-2011



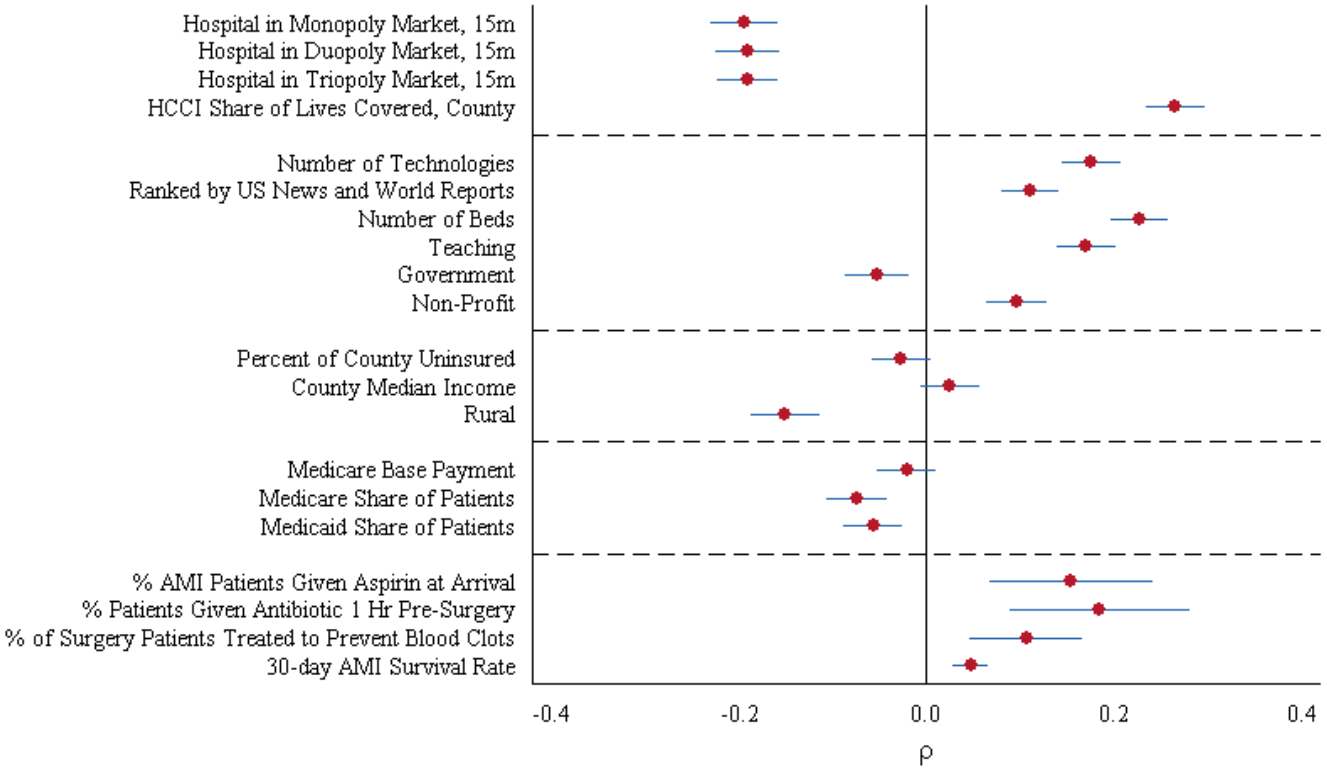
Notes: The x-axis captures the bivariate correlations between key variables featured in our regressions and our HHI. The bars capture the 95 percent confidence intervals surrounding the correlations. For government and non-profit, the omitted category is private for-profit hospital.

Appendix Figure 11: Bivariate Correlations of Hospital Percent Paid as Share of Charges with Observable Factors, 2010-2011



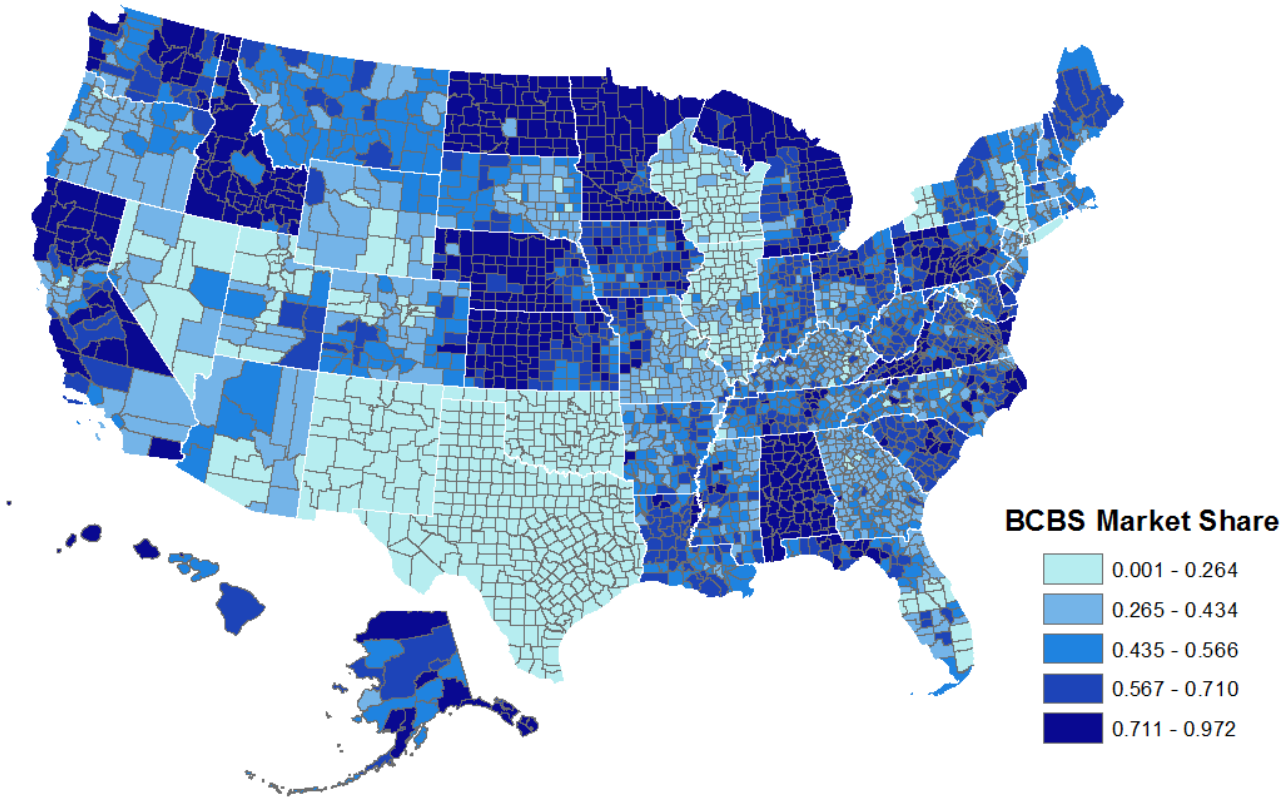
Notes: The x-axis captures the bivariate correlations between key variables featured in our regressions and our hospitals' share of cases at a hospital paid as a fraction of a hospitals' charges. The bars capture the 95 percent confidence intervals surrounding the correlations. Since these are bivariate correlations "Duopoly" is duopoly or monopoly and the implicit omitted category is triopoly or greater. "Triopoly" is triopoly, duopoly or monopoly. For government and non-profit, the omitted category is private for-profit hospital.

Appendix Figure 12: Bivariate Correlations of Percent of Prospective Payment Paid as a Share of Medicare with Observable Factors, 2010-2011



Notes: The x-axis captures the bivariate correlations between key variables featured in our regressions and our hospitals' share of fixed-price cases linked to the Medicare payment rate. The bars capture the 95 percent confidence intervals surrounding the correlations. Since these are bivariate correlations "Duopoly" is duopoly or monopoly and the implicit omitted category is triopoly or greater. "Triopoly" is triopoly, duopoly or monopoly. For government and non-profit, the omitted category is private for-profit hospital.

Appendix Figure 13: BCBS Market Share



Notes: These are estimates of the share of covered lives by county covered by BCBS using HealthLeaders Interstudy coupled with Census data.