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:

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

where *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

Appendix Figure XI 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).

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measured 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.