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ECON 372 – Final Project

May 12th, 2021

Section 1: Description of selected market and hospitals (Q1)

Market: Chicago, IL

Rush University Medical Center (Rush University System for Health, #140119)

> Rush University Medical Center is a general medical and surgical facility and primary teaching hospital affiliated with Rush University. It is nationally ranked in 11 adult specialties and specializes in psychiatry, oncology, and orthopedics. It is part of the Rush health system that includes Rush University, Rush-Copley Medical Center, Rush Oak Park Hospital, and additional outpatient care facilities.

AMITA Health Saint Joseph Hospital (Ascension Healthcare, #140224)

> Amita St. Joseph Chicago is a Catholic general medical and surgical hospital rated high performing in 1 adult procedure/condition. It hosts several nationally recognized centers and is known for advanced care in cardiology, oncology, plastic surgery, neonatal care, and HIV treatment. It is part of the AMITA Health network and larger Ascension system.

Northwestern Memorial Hospital (Northwestern Memorial HealthCare, #140281)

> Northwestern Memorial Hospital is an academic medical center and primary teaching hospital in downtown Chicago partnered with Northwestern University's Feinberg School of Medicine. It is ranked the top hospital in Illinois, in the top 10 hospitals in the US, and is nationally ranked in 11 adult specialties, including being No. 5 in Neurology & Neurosurgery.

Section 2: Hospital prices, charges, and Medicare payments

2.1 – Hospital Summary Tables (Q5)

There are 213 rows (DRG codes) for Rush University Medical Center, 60 for St. Joseph, and 245 for Northwestern. Figure 1 shows summary statistics for each hospital's gross charges, average negotiated payments, and average medicare payments across all available DRG codes. Figure 2 shows a summary table of only the means of the gross charge, negotiated payments and medicare payments for easier comparison.

```
market$Provider_ID: 140119
  Provider_ID      Gross_Charge    Avg_Negotiated_Rate Mean_Medicare_Payments
 Min.   :140119   Min.   : 15642   Min.   :  9776      Min.   :  6875
 1st Qu.:140119   1st Qu.: 36937   1st Qu.: 23113      1st Qu.: 13367
 Median :140119   Median : 58140   Median : 35681      Median : 19857
 Mean   :140119   Mean   : 78854   Mean   : 48171      Mean   : 27947
 3rd Qu.:140119   3rd Qu.: 90613   3rd Qu.: 55529      3rd Qu.: 35040
 Max.   :140119   Max.   :949571   Max.   :530572      Max.   :193638
------------------------------------------------------------------------------
market$Provider_ID: 140224
  Provider_ID      Gross_Charge    Avg_Negotiated_Rate Mean_Medicare_Payments
 Min.   :140224   Min.   : 23080   Min.   : 9366       Min.   : 6274
 1st Qu.:140224   1st Qu.: 32708   1st Qu.:12998       1st Qu.: 8913
 Median :140224   Median : 42737   Median :17118       Median :10997
 Mean   :140224   Mean   : 58049   Mean   :21952       Mean   :14481
 3rd Qu.:140224   3rd Qu.: 62446   3rd Qu.:24692       3rd Qu.:14449
 Max.   :140224   Max.   :221758   Max.   :69644       Max.   :57945
------------------------------------------------------------------------------
market$Provider_ID: 140281
  Provider_ID      Gross_Charge    Avg_Negotiated_Rate Mean_Medicare_Payments
 Min.   :140281   Min.   : 23894   Min.   :  7515      Min.   :  5563
 1st Qu.:140281   1st Qu.: 46700   1st Qu.: 15251      1st Qu.: 10839
 Median :140281   Median : 82077   Median : 24014      Median : 17087
 Mean   :140281   Mean   :114980   Mean   : 35953      Mean   : 24237
 3rd Qu.:140281   3rd Qu.:141295   3rd Qu.: 41810      3rd Qu.: 30172
 Max.   :140281   Max.   :978843   Max.   :239227      Max.   :203091
```

Figure 1. Summary statistics by hospital

Provider_ID <int>	Hospital_Name <fctr>	Mean_Gross_Charge <dbl>	Mean_Neg_Price <dbl>	Mean_Med_Payments <dbl>
140119	RUSH UNIVERSITY MEDICAL CENTER	78854.07	48170.94	27946.52
140224	PRESENCE SAINT JOSEPH HOSPITAL - CHICAGO	58049.17	21952.28	14481.28
140281	NORTHWESTERN MEMORIAL HOSPITAL	114979.89	35953.20	24236.92

Figure 2. Mean gross charge, negotiated price, and Medicare payment

2.2 – Market Ranges (Q6)

Figure 3 shows the ranges of the negotiated and Medicare payments for each hospital.

Figure 4 shows the ranges across all three hospitals in the market.

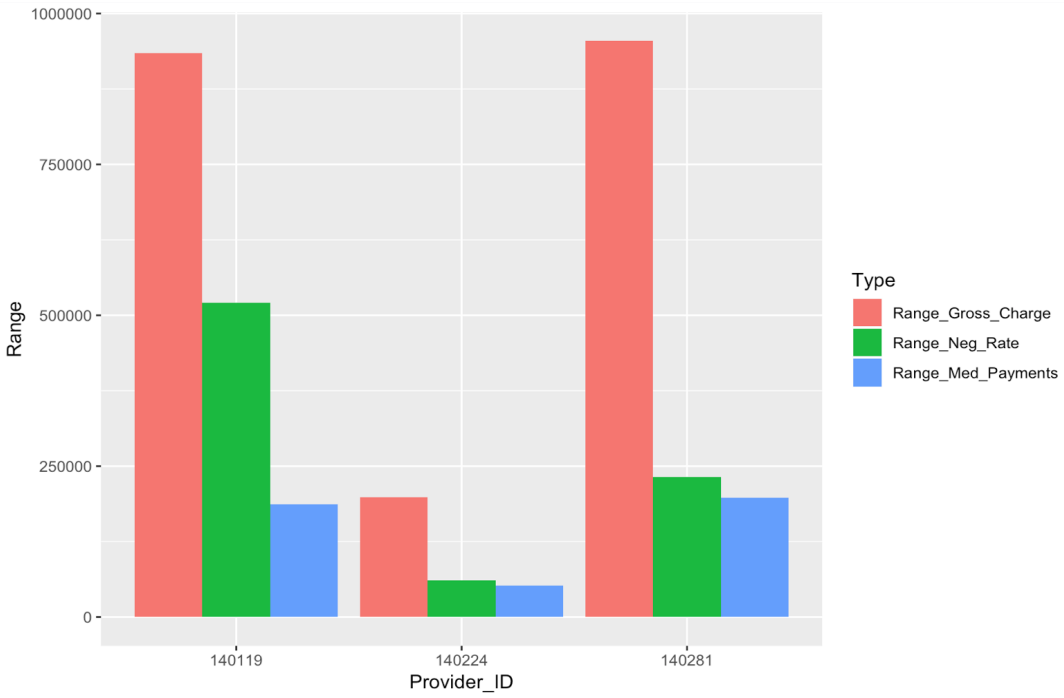

Figure 3. Ranges by hospital and payment type

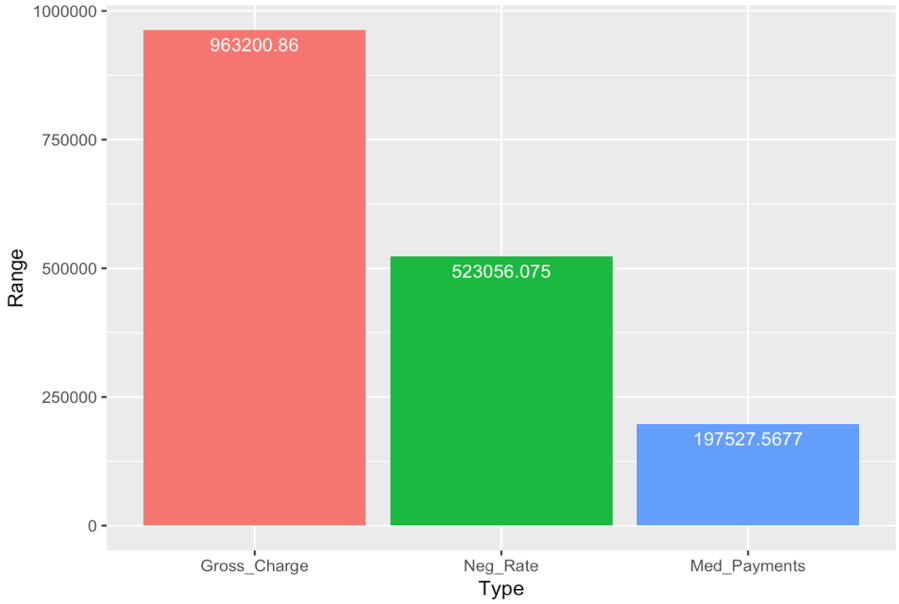

Figure 4. Market ranges

2.3 – Discussion of payments (Q7)

The wide range of prices and charges across the hospitals is interesting as it shows that there is no system of standardized pricing. The boxplots in Figure 5 below have 31 high outliers removed (all from Rush and Northwestern) and help to visualize the section 2.1 summary statistics in Figure 1. Saint Joseph (Provider ID: 140224) has lower averages across all three categories and has a significantly smaller range of values (Figure 3). These prices vary greatly, and of course the average negotiated rates are much lower than the average gross charges, and the mean Medicare payments are lower than both charge and negotiated price for all three hospitals. This is in line with research that shows negotiated rates between private insurers and hospitals generally exceed Medicare prices and hospitals' costs (White et al., 2014). Another interesting aspect is that the distribution and range of Medicare payments is greater for Rush and Northwestern, which both have higher gross charges and negotiated rates than St. Joseph. White et al. also found similar results in their analysis where high-price hospitals received larger Medicare outlier payments than low-price hospitals. They attributed this to high-price hospitals tending to have more expensive cost structures and larger high-risk patient populations.

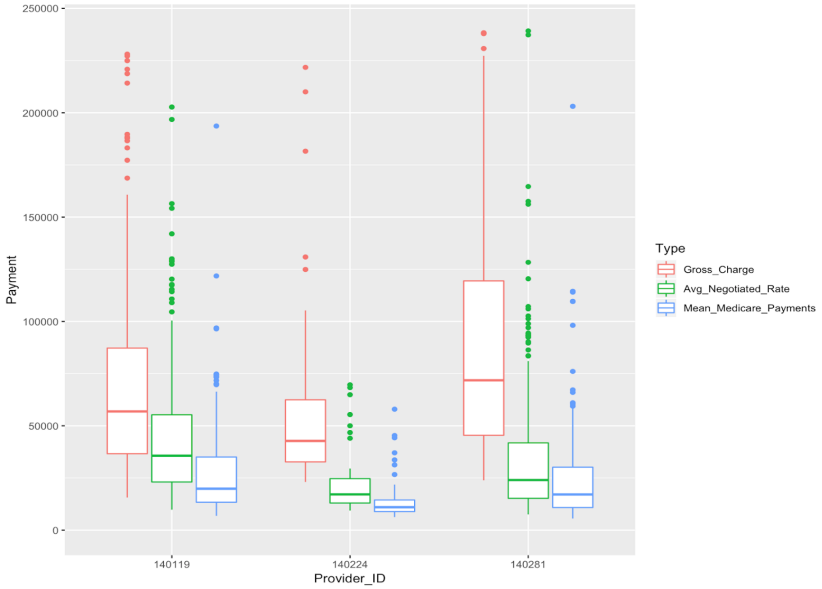

Figure 5. Hospital boxplots

Section 3: Pricing and competition

3.1 – Competition and Market Share Data (Q8)

Since each of the three hospitals had data for different DRG codes, I selected only the procedures that are present across all 3 hospitals in the market (there were 174 DRG codes that all 3 hospitals had data on). The standard charges data from each hospital included many more data points than the CMS data on discharges and Medicare payment rates, so I filtered the data in this way to prevent misattribution of market share due to lack of data from the CMS files.

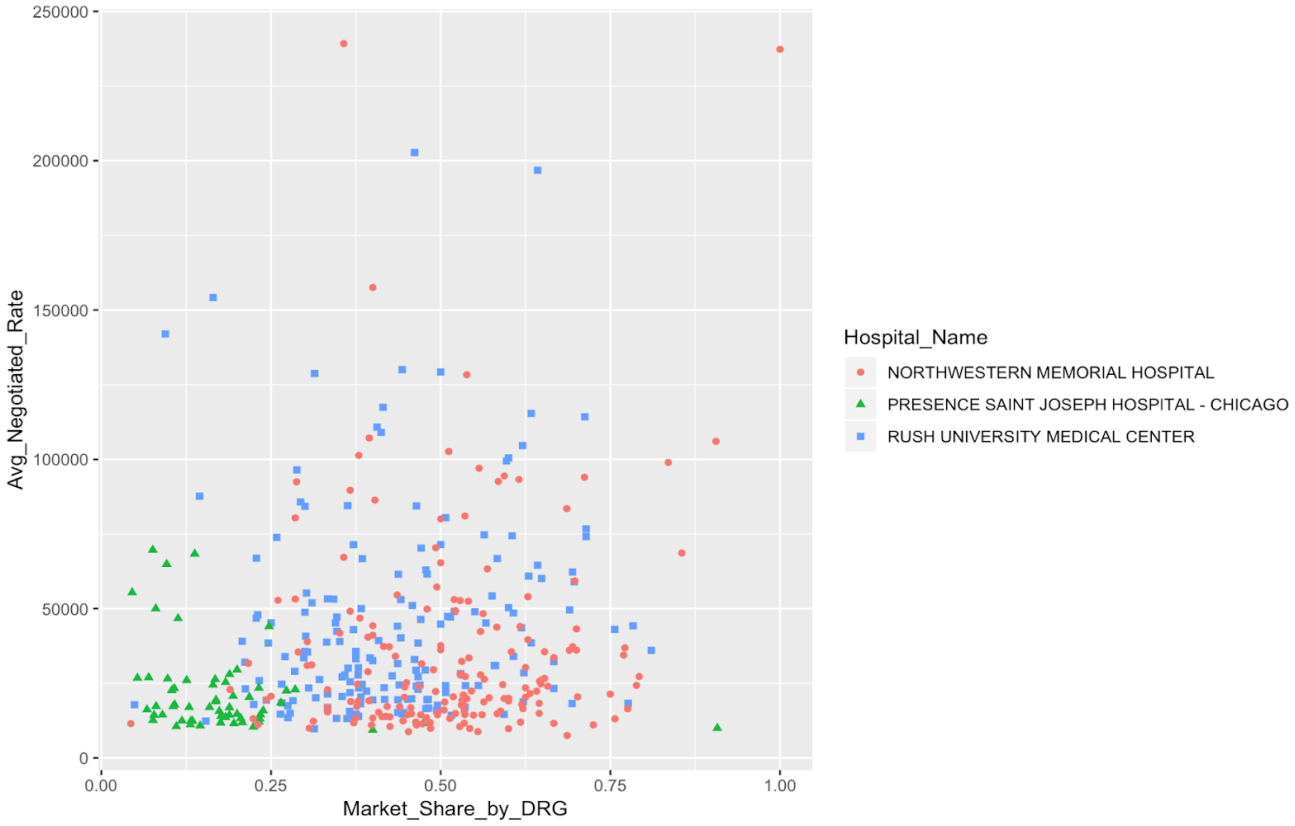

Figure 6. Market share and negotiated rates by DRG

3.2 – Discussion of competition (Q9)

Overall it seems like Northwestern and Rush had similar market shares across the DRG codes followed by St. Joseph which had considerably less. There is also a greater distribution of higher negotiated payment rates for Northwestern and Rush and overall lower average negotiated rates for St. Joseph. The congregation of St. Joseph's data points in the bottom left of the scatterplot and the larger spread of negotiated rates for the other two hospitals with higher market shares suggest that increased competition (lower market share) is associated with lower pricing while less competition (higher market share) allows larger/more powerful hospitals to set higher prices. This is similar to our in-class Nash bargaining model, where the player with an outside option receives a higher quantity (in this hospital situation, the insurer can negotiate a lower price with a hospital if there are other hospital options) because they can always go elsewhere. In the case of hospitals having high market shares, however, there are more limited outside options for the insurer and thus the hospitals have more bargaining power and can set a higher negotiated price. Likewise, if the insurer has a high market share, the hospital has less bargaining power since they have less outside options for insurance.

This conclusion is also supported by Cooper et al.'s analysis which found that both hospitals and insurers with fewer competitors had greater bargaining power and could negotiate higher or lower prices, respectively–monopoly hospitals prices were 12 percent higher than those in markets with at least 4 other hospitals and a 10% increase in the insurers' market share saw prices that were 7% lower (Cooper et al., 2018). Thus, this project's findings are consistent with results from academic literature that show concentrated hospitals markets are strongly associated with higher price levels.

3.3 – Competition and contracts (Q10)

Figure 8 shows two density plots based on negotiated payments as percentages of gross charge and as markups over Medicare payments per DRG. I only included the DRG codes that were used in the market share calculation in section 3.1 (the DRG codes for which all 3 hospitals had discharge data). From the plots, Rush most likely used a percentage of charges pricing method while St. Joseph (lowest market share) likely used markup over Medicare. Unlike the other two hospitals, there is not a clear peak for Northwestern but markup seems more likely. Rush and St. Joseph's results suggest that hospitals in more concentrated markets (Rush) have more market power and thus tend to negotiate percentage of charge payments, while markup over Medicare payments are more likely for hospitals with less market share (St. Joseph).

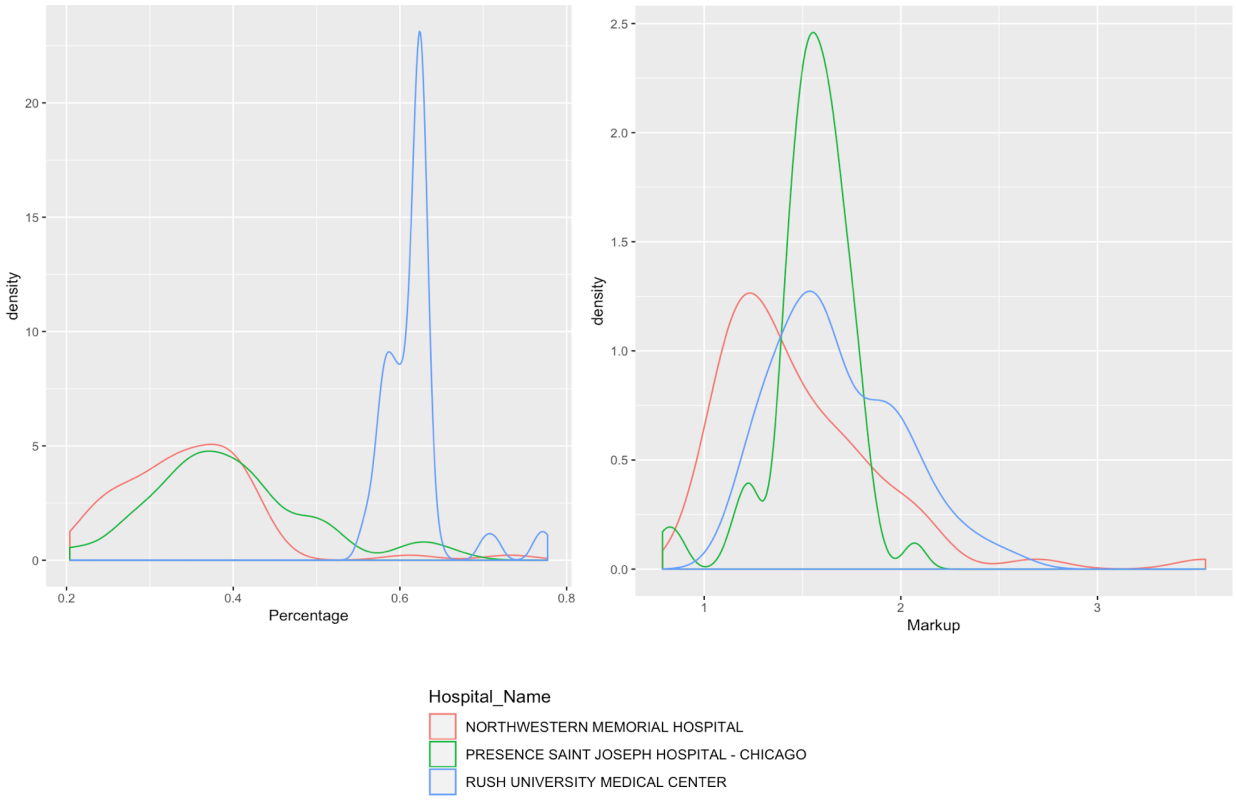

Figure 8. Density plots by percentage of charge (L) and markup over Medicare (R)

Section 4: Pricing and quality (Q11)

Quality measure data was taken from the CMS Patient Survey (HCAHPS) dataset, which provides hospital ratings based on the national Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey taken by patients about their inpatient hospital experience. Figure 7 (below) shows the average patient ratings and linear mean values. St. Joseph had both the lowest average patient rating and lowest mean LMV. Rush University and Northwestern had the same mean patient ratings but Rush had the higher mean LMV. This was supported by patient survey star ratings from the US Medicare.gov site where St. Joseph has 3 stars and the other two hospitals have 4. From Figures 2 and 6, St. Joseph had the lowest prices and market shares while Rush and Northwestern had similar market share vs negotiated price distributions, but Rush had the highest mean negotiated price and Northwestern had the highest mean gross charge. It seems like rating and price are positively correlated for these three hospitals which is in line with typical consumer expectations. However, it is surprising as recent literature on the health price-quality relationship has found that they tend to be negatively correlated or unrelated (Beauvais et al., 2020). Our conclusion may be partially supported by White et al.'s study which found that hospitals with higher pricing outperformed lower-priced hospitals on reputation-based quality measures. Given that Northwestern and Rush both have multiple nationally ranked specialties while St. Joseph is less well-known, perhaps the positive correlation between quality and price was related to reputation confounding.

Facility.ID <fctr>	Facility.Name <fctr>	Mean_Patient_Rating <dbl>	Mean_LMV <dbl>
140119	RUSH UNIVERSITY MEDICAL CENTER	3.636364	88.4
140224	PRESENCE SAINT JOSEPH HOSPITAL - CHICAGO	3.000000	85.4
140281	NORTHWESTERN MEMORIAL HOSPITAL	3.636364	87.6

Figure 7. Hospital quality measures

Section 5: Summary and conclusions

5.1 – Conclusion (Q12)

I think that while it's good that patients now have the ability to compare prices for procedures across hospitals, the hospital price transparency mandate will likely not make a big difference for the average customer as the data is still very difficult to find and access. In terms of lowering hospital prices, I also don't think having this data available would contribute much to hospitals changing their payment charges and negotiated prices unless there is more government regulation or a significant push for change leads to increased price competition. From this project's findings, it seems that market share plays a large role in shaping price and having transparent price data most likely won't affect the market structure. Especially in markets that are more concentrated, there is less incentive for hospitals to lower their prices even with their data open to the public, and because there are such huge ranges in charges, lower-priced hospitals may potentially raise their prices seeing that other hospitals are charging more. However, I do think this is a beneficial step towards greater transparency but more progress needs to be made. This data may be especially helpful for health economics scholars and policymakers who have greater incentive and expertise in finding, navigating, analyzing, and interpreting this pricing data and whose works may potentially help shape future policy changes.

5.2 – Reflection (Q13)

One of the main challenges of this project was finding the proper data. I had originally planned to do a different market, but it was very difficult to find suitable hospitals with the necessary data (DRG codes, negotiated payments, etc). I also had to change the original hospitals I was going to use for this Chicago market because some of them didn't

have much data on Medicare payments from the Centers for Medicare & Medicaid Services data files. I had gone into this project expecting the process of finding and cleaning data to be difficult, but I was still surprised by the level to which hospitals are able to hide their data. It was a good learning experience to go through this process and work with real-world data, and I have a much better understanding of many of the concepts we discussed in class. It was really interesting to look at how wide the variation in prices were, both across the market and in terms of the negotiated payments, charges, and Medicare rates within each hospital. I'm still wondering about Northwestern's contract and market share as it seems to have the largest market shares (or at least is on the same level as Rush), but its density plots suggest it is more likely to have a markup over Medicare contract. My data also pointed at a positive relationship between price and quality which other literature has challenged, but it may be due to the small sample size of just three hospitals.

References

Beauvais, B., Gilson, G., Schwab, S., Jaccaud, B., Pearce, T., & Holmes, T. (2020). Overpriced? Are Hospital Prices Associated with the Quality of Care? *Healthcare*, 8(2), 135. https://doi.org/10.3390/healthcare8020135

Cooper, Z., Craig, S. V., Gaynor, M., & Van Reenen, J. (2018). The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured. *The Quarterly Journal of Economics*, 134(1), 51–107. https://doi.org/10.1093/qje/qjy020

White, C., Reschovsky, J. D., & Bond, A. M. (2014). Understanding Differences Between High- And Low-Price Hospitals: Implications For Efforts To Rein In Costs. *Health Affairs*, 33(2), 324–331. https://doi.org/10.1377/hlthaff.2013.0747