Six Stylized Facts from Ten Years of Vertical Market Contract Data

Jacob Dorn*

April 9, 2024

LATEST VERSION HERE.

Abstract

This paper investigates vertical market contract dynamics by analyzing a novel panel dataset of hospital–insurer contracts in West Virginia. Typically, contracts between downstream retailers and upstream suppliers in vertical markets are closely guarded trade secrets. West Virginia's policy of making hospital–insurer public records until 2016 provided an unprecedented opportunity to study vertical market contracts over time. This work documents the West Virginia context and provides descriptive evidence from the novel dataset. The largest insurer typically formed three-year and five-year contracts. In contrast, smaller insurers generally formed auto-renew contracts, which initially commit to only one year but typically renew for a decade or longer, generally accompanied by rapid price growth. Further, contract formation was staggered, introducing subtle dynamics of internalized contract spillovers. These findings underscore the need to consider dynamics to accurately capture some markets and some questions, a nuance that is overlooked by the literature's prevailing static approach. By documenting this unique dataset and stark dynamic implications, this research contributes to a larger understanding of vertical market dynamics and helps set the stage for future work.

*This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-2039656. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. I am indebted to conversations with my advisors, Kate Ho, Alessandro Lizzeri, and Ulrich Müller; the exceeding generosity of Barbara Skeen; and helpful conversations with Nick Buchholz, Colleen Carey, Janet Currie, Esmée Zwiers, and many others. ChatGPT was used for assistance in editing. All errors are my own.

1 Introduction

Hospital–insurer contracts in the United States are important both independently and as examples of vertical market contracting. Vertical markets, characterized by oligopolistic downstream retailers obtaining inputs from oligopolistic upstream suppliers, often rely on confidential contracts to govern the supply chain. Firms protect the confidentiality of these agreements, even going to court to prevent disclosure. A powerful empirical literature has emerged to study crucial questions in these markets such as the effects of proposed telecommunications unbundling, constraints on hospital out-of-network pricing, and mergers between suppliers or between retailers. However, the confidential nature of these contracts has limited empirical analysis to data on short-term measures of contract outcomes such as payments.

I study the provision of hospital care in the United States, a setting in which more than $400 billion is spent annually under contracts negotiated between hospitals and private insurers. The scale of the market and existence of large government insurers has led to unusually good disclosures of contract outcomes: data on claims by state or by insurer, and recent reports on negotiated prices by hospital and by insurer. However, these sources have generally been short-term and unable to speak to dynamics like contract expiration, age, and timing.

This paper leverages a novel panel dataset on hospital–insurer contracts to enrich our understanding of vertical market contract dynamics. West Virginia made hospital–insurer contracts public records as a byproduct of a system regulating list prices. Although the contracts themselves were destroyed when the regulation ended in 2016, the state retained scans of hospital contract reports beginning in 2005 and ending in 2015. The data includes valuable information on payment rates, contract formation, and scale. The reports are public records, enabling me to present statistics on individual hospitals and insurers and enabling any researcher to adapt the data for their own work. By leveraging the data, I aim to shed

light on contract dynamics that were previously secret.

The paper documents the public record contract data and presents stylized facts on contract dynamics. The data was made public as part of a "corridor" regulation system that capped list prices and imposes an average-cost floor on private insurer payments. The regulator in charge of ascertaining that average contract payments were above average hospital costs made the contracts public records. The reports include information on auto-renew contracts: contracts that have a formal term of only one year, but which automatically renew until one side gives notice that they prefer the contract terminate.

I document several stylized facts based on the contract data. In particular:

1. West Virginia's largest insurer, Highmark BCBS, generally paid less than other insurers. This is consistent with various stories, such as market power leading to discounts and discounts leading to reduced premium costs.

2. Highmark BCBS generally formed contracts that would expire after three or five years. There is some suggestion longer contracts were associated with larger hospitals.

3. For West Virginia's other, smaller, insurers, auto-renew contracts were a pervasive feature of contracting. The auto-renew contracts can generate price dynamics that are driven by renewal decisions rather than initial contract terms.

4. The smaller insurers' auto-renew contracts generally renewed, often remaining in place for a decade or more. As a result, current prices were not representative of small insurers' negotiated prices.

5. Both contract lengths and price dynamics were associated with insurer size. Short-term data on contract outcomes would give a misleading impression of insurer bargaining power.

6. Contracts were formed at different times, even looking within a given year. The staggered formation means that models of bargaining that account for contract age must

also account for internalized contract effects that the literature has previously abstracted from.

Each stylized fact is consistent with conventional wisdom. It is unsurprising that larger insurers pay lower prices, contracts remain in place for multiple years, auto-renew contracts are more typical of smaller insurers, auto-renew contracts can remain in place for many years, smaller insurers are more likely to agree to contracts with payments calculated as multiples of fast-growing hospital list prices rather than slow-growing Medicare formulas, and contracts can be formed at different times. In my view, the most figures I present are the realized contract lengths: Highmark BCBS formed both three- and five-year contracts with different hospitals and the frequency with which auto-renew contracts would renew.

Yet, taken together, the stylized facts motivate a new bargaining model. The long-lived nature of contracts formed by every insurer but Highmark BCBS yields the fifth stylized fact: short-term data on contract outcomes can lead to underestimating small insurers' bargaining power. At any given moment, Highmark BCBS paid rates based on recent negotiations, while smaller insurers often paid rates based on long-ago negotiations of discounts relative to fast-growing list prices that presumably placed limited weight on the current moment. As a result, accurate estimation of bargaining power requires a model that acknowledges different insurers form contracts with different lengths.

The sixth stylized fact makes forming such a new bargaining model difficult. Contracts were formed at different times. As a result of the staggered nature of contracting, a given negotiation could have a subtle effect on the subsequent market equilibrium. These spillovers introduce new methodological challenges that are addressed in Dorn (2024). That work comes to a surprising conclusion: even though Highmark BCBS, in fact, paid less than other insurers in practice, at the moment of negotiation, Highmark BCBS received essentially the same share of gains from trade as smaller insurers.

The remainder of this work is as follows. The rest of Section 1 discusses key related work. Section 2 describes the West Virginia setting, the public record contract data I leverage, and

key variable definitions. Section 3 presents stylized facts based on the West Virginia contract data. Section 4 concludes.

Related Work

The West Virginia setting represents an unusual opportunity. In many settings, it is rare to even see data on the outcomes of contracting (Yürükoğlu, 2022). The exceptions are rare: Sorensen (2003) studies four years of contract data from 32 hospitals after the introduction of hospital–insurer negotiations in Connecticut in 1994 and Hermo (2024) studies multiunit collective bargaining using administrative data from Argentina. In healthcare, researchers increasingly use insurer claims data to infer contract outcomes (Gowrisankaran et al., 2015, Cooper et al., 2019, Weber et al., 2019, Craig et al., 2021, Ho and Lee, 2017, 2019, Liebman, 2022, Ghili et al., 2023, Prager and Tilipman, 2022, Liu, 2021, Whaley et al., 2022). In recent years, hospitals and insurers have been subject to price disclosure rules that should enable inference of contract structure. Other examples of data on vertical market contract outcomes includes hospital supply purchases (Grennan and Swanson, 2020), NFL broadcasting agreements (Blochowicz, 2023), and accounting data from illicit drug suppliers (Leong et al., 2022). Some work simply uses the existence of ties (Crawford et al., 2018).

West Virginia's data emerged from an understudied list price regulation system. The United States has a history of hospital price regulations that, with the exception of Maryland and West Virginia, ended by 1997 (McDonough, 1997, Murray and Berenson, 2015). Maryland has a price-setting system, and much of the literature on rate reviewed centers on changes to Maryland's system in 2014 (Pauly and Town, 2012, Cromwell, 1987, Atkinson, 2009, Diebel and Diebel, 2017, Sharfstein et al., 2018a,b, Roberts et al., 2018a,b,c, Clemens and Ippolito, 2019). West Virginia had a price-constraining system that is often either omitted or misunderstood, which Sommers et al. (2012) attributes to the state's "later adoption." The state's system was historically unusual, and provides public records on vertical market contract data that can be replicated in future healthcare price disclosures. I often reference

the fast growth in list prices, which is a topic of regulatory interest (Brown, 2014, Liu et al., 2021, Chernew et al., 2020, Berenson and Murray, 2022). Even with the state's list price caps, West Virginia list prices grew roughly three percentage points faster than reported costs. Work on the effects of West Virginia's system is limited, but Atkinson (2009) finds that the state's spending per admission increased three-tenths of a percentage point more slowly per year than the national average in the period running through 2007. Murray and Berenson (2015) argue that in the later era that I study, the state's system failed to constrain per-capita hospital spending or charge-to-cost ratios.

I find larger firms have more favorable payment rates (Sorensen, 2003), which is consistent with work studying the associations of market concentration (Cooper et al., 2019, Whaley et al., 2022); contracts are consistently multiyear (Brickley et al., 2006, Gorovaia and Windsperger, 2018, Perdreau and Fréchet, 2022); and smaller insurers are more likely to pay share of charges contracts (Abbey, 2012, Cooper et al., 2019, Bogart, 2020, Reinhardt, 2006, Brown, 2014), all of which are consistent with prior work. There is limited academic work on auto-renew contracts with "evergreen" clauses (Dutta, 2021). Trade publications suggest these contracts are common for smaller firms and can be long-lived in practice (Abbey, 2012, Prives, 2013). There is little empirical work on vertical market bargaining with staggered contracts, presumably due to the lack of data on contract formation and methodological difficulty, but Cooper et al. (2019) and Hermo (2024) show that vertical market contracting is staggered. Staggered contracting is included in some theoretical models of triangular markets (De Fraja, 1993, Bárcena-Ruiz and Casado-Izaga, 2008, Do and Miklós-Thal, 2022) and in macroeconomic work (Taylor, 1980, Calvo, 1983, Gertler and Trigari, 2009).

2 Setting and Definitions

West Virginia made hospital–insurer contracts public records as a byproduct of "corridor" system regulating hospital list prices.

In the United States, health care providers and insurers (also called managed care organizations) engage in bilateral bargaining to determine payment rates. A provider agrees to accept payments below list prices in exchange for the insurer steering consumers toward the provider.

Insurers offer consumers access to cost-sharing and their negotiated discounts with providers in exchange for premiums. Insurers with more hospital agreements are able to sell more insurance for a given premium, and insurers with more favorable hospital agreements are able to charge lower premiums. Insurers also provide these discounts to self-insuring employers in a self-funded market (Craig et al., 2021) I abstract from.

Commercially insured patients are a key component of hospital care and profits. In 2019, 36% of hospital expenditures came through private health insurance (CMS, 2022). The next-largest segment was Medicare (27%). Medicare makes take-it-or-leave-it offers based on Diagnosis-Related Group (DRG) codes and that attempt to track the costs that an efficient hospital would incur to provide care. Commercial insurers generally pay far more than Medicare (Whaley et al., 2022) and far less than list prices (Brown, 2014). A small share of care is received by patients that do not have access to a discount at the hospital they visit. The list prices that are billed to patients without such a discount contract are referred to as *charges*.

From 1993 to 2016, West Virginia had a "corridor" regulation system on payments from private insurers to hospitals. Starting in 2000, small rural hospitals designated as Critical Access Hospitals (CAHs) were exempted from this system, and so not incorporated in this paper's analysis of data generated by the system.[1] While full description of the West Virginia rate regulation system is outside the scope of this work, I provide a quick overview of some key characteristics. Murray and Berenson (2015) provide more substantial background.

The ceiling of the corridor system was a hospital-specific cap on list price increases. Hospitals with lower list prices and lower costs could obtain larger approved list price increases.

[1] CAHs made up as much as 40% of West Virginia hospitals but only a small fraction of care (Appendix Figure 16).

Excessive list prices that could not be justified by a hospital's patient mix resulting in reductions of future approved list prices. Until 2015, the system included an abeyance process for hospitals that exceeded their approved increase. The list price ceiling was viewed by advocates as constraining hospital payments (Eyre, 2016) but by anonymous participants as having a limited effect (Murray and Berenson, 2015).

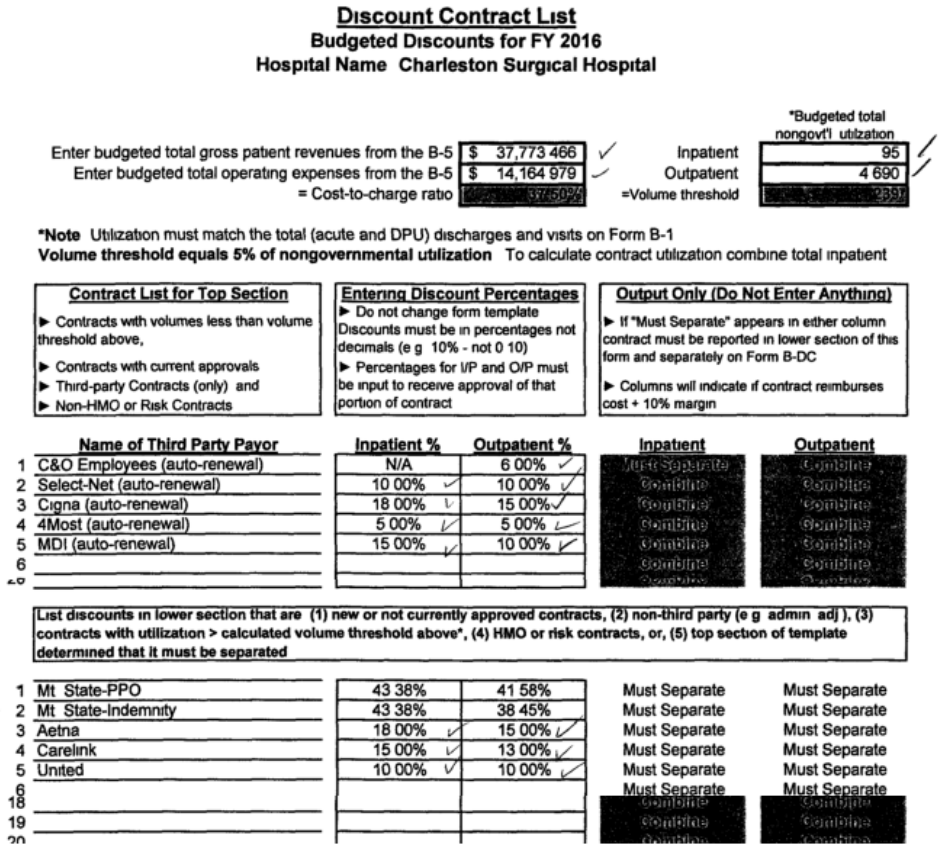
The floor of West Virginia's system led the state to make hospital–insurer contracts public records. The state required that all private insurer contracts pay more than the hospital's average costs. The profitability floor was essentially nonbinding: private insurers consistently paid far more than hospital average costs. However, the state required its Health Care Authority (HCA) to approve all regulated contracts before the contract could be used (Murray and Berenson, 2015). The HCA made those contracts public records.

The West Virginia corridor system made the state unrepresentative along a few dimensions. The list price capping system was associated with lower list prices and incentivized a shift to outpatient costs (Murray and Berenson, 2015). It is not clear the West Virginia system reduced hospital costs (Atkinson, 2009). I find that list price contracts were more common in West Virginia than Weber et al. (2019) find in Colorado. The public record nature of contracting was historically unusual. In most vertical markets, contracts are explicit or implicit trade secrets (Reinhardt, 2006, Gudiksen et al., 2019). In West Virginia, market participants actively looked at competitors' payment rates (Murray and Berenson, 2015). More recent hospital and insurer price disclosure requirements make West Virginia a useful proof of concept for modern American healthcare markets and a rare chance to see vertical market contracts over time.

When the state's system ended in 2016, the state destroyed the actual contracts. As a result, I see summary statistics from annual hospital reports rather than the contracts themselves.

2.1 The West Virginia Contract Data

This paper leverages a novel panel dataset on hospital—insurer contracts. The data includes ten years of annual payment rates as a function of list prices and five years of more detailed data on larger contracts.



Discount Contract List
Budgeted Discounts for FY 2016
Hospital Name Charleston Surgical Hospital

			*Budgeted total nongovt'l utilization
Enter budgeted total gross patient revenues from the B-5	$ 37,773 466	Inpatient	95
Enter budgeted total operating expenses from the B-5	$ 14,164 979	Outpatient	4 690
= Cost-to-charge ratio	[redacted]	=Volume threshold	[redacted]

***Note** Utilization must match the total (acute and DPU) discharges and visits on Form B-1
Volume threshold equals 5% of nongovernmental utilization To calculate contract utilization combine total inpatient

Contract List for Top Section	Entering Discount Percentages	Output Only (Do Not Enter Anything)
► Contracts with volumes less than volume threshold above, ► Contracts with current approvals ► Third-party Contracts (only) and ► Non-HMO or Risk Contracts	► Do not change form template Discounts must be in percentages not decimals (e g 10% - not 0 10) ► Percentages for I/P and O/P must be input to receive approval of that portion of contract	► If "Must Separate" appears in either column contract must be reported in lower section of this form and separately on Form B-DC ► Columns will indicate if contract reimburses cost + 10% margin

	Name of Third Party Payor	Inpatient %	Outpatient %	Inpatient	Outpatient
1	C&O Employees (auto-renewal)	N/A	6 00%	[redacted]	[redacted]
2	Select-Net (auto-renewal)	10 00%	10 00%		
3	Cigna (auto-renewal)	18 00%	15 00%		
4	4Most (auto-renewal)	5 00%	5 00%		
5	MDI (auto-renewal)	15 00%	10 00%		
6					

List discounts in lower section that are (1) new or not currently approved contracts, (2) non-third party (e g admin adj), (3) contracts with utilization > calculated volume threshold above*, (4) HMO or risk contracts, or, (5) top section of template determined that it must be separated

1	Mt State-PPO	43 38%	41 58%	Must Separate	Must Separate
2	Mt State-Indemnity	43 38%	38 45%	Must Separate	Must Separate
3	Aetna	18 00%	15 00%	Must Separate	Must Separate
4	Carelink	15 00%	13 00%	Must Separate	Must Separate
5	United	10 00%	10 00%	Must Separate	Must Separate
6				Must Separate	Must Separate
18				[redacted]	[redacted]
19					
20					

Figure 1: Discount Contract List scan for Charleston Surgical Hospital in fiscal year 2016. The top panel of contracts lists smaller contracts that do not fall in any of a set of special exceptions. I omit white space and a handwritten note reading, "New contract is Highmark, not Mt State," which reflects the 2011 renaming of Mountain State Blue Cross Blue Shield to Highmark Blue Cross Blue Shield West Virginia to reflect an ongoing affiliation with Pittsburgh-based Highmark.

The core contract data consists Discount Contract Lists (DCLs): annual hospital reports on the projected discount off list prices by contract. Figure 1 gives one example. The reports exclude Medicare Advantage contracts. Medicare Advantage is a large and ostensibly commercial insurance product that is funded by Medicare and often included with traditional

Medicare (CMS, 2022). The calculations were verified by state analysts. These reports are available for 2006 through 2015.

The top rows of a DCL are used to calculate a cost-to-charge ratio and utilization threshold. The top rows include the budgeted total gross patient revenues (incurred list prices, also known as charges) and the budgeted operating expenses across all payors (including government programs) to yield a cost-to-charge ratio; the budgeted (next fiscal year) or projected (year to date plus projections for remaining fiscal year) nongovernmental utilization (inpatient discharges and outpatient visits) including self-pay patients; and a volume threshold of 5% of the count of nongovernmental utilization that would lead to a hospital reporting more detailed data on the contract.[2] On average, 75% of reported nongovernmental usage was accounted for by reported contracts, which would correspond to a threshold of 6.7% of a hospital's reported usage.

The unusual information in the DCLs are two panels of annual discount rates by contract. Hospitals reported each commercial insurer's projected percentage discount of list prices based on the current contracts and previous year's claims. For example, if an insurer agreed to pay 80% of a hospital's list price, the associated contract would have a reported discount of 20.00%. If an insurer agreed to pay 150% of Medicare payments and Medicare would pay 57% of list prices for the hospital's patients, then the reported discount would be 14.50%.

The DCL annual discount rates are separated into two panels. The top panel of discounts correspond to standard contracts with small payors. The contracts in the top panel are aggregated in detailed contract reports. The bottom panel of discounts correspond to contracts that either had projected utilization above the volume threshold or which fell into certain rare exceptions. Contracts in the bottom panel were separately reported in detailed scans.

Starting in 2010, the retained scans also include Discount Contract (DC) forms: detailed information for contracts reported in the lower panel of the DCLs. Figure 2 presents the first page of Charleston Surgical Hospital's DC report for fiscal year 2016. The "Total"

[2]Definitions are adapted from HCA (2004) and correspondence with regulators.

Summary Information of Discount Contracts
Total - FY 2016 Budget
Hospital Name ___ Charleston Surgical Hospital

Fiscal Year Ending 12/31/2016
Submission Date 11/2/2015

1	Name of Purchaser or Third Party Payor	Total	=	Combined Contracts	+	Mt State-PPO	Mt State-Indemnity	Aetna
2	Date of Contract					8/1/2015	8/1/2015	11/1/1994
3	Date Contract Expires					12/31/2018	12/31/2018	Auto Renewal
4	Projected Inpatient Discharges	92		16		50	2	17
5	Projected Gross Inpatient Revenue	2 878 926		417 403		1 627 278	65 091	567 464
6	Inpatient Discount Percent	31 54%		12 00%		43 38%	43 38%	18 00%
7	Projected Amount of Inpatient Discount	908 049		50 088		705 865	28 235	102 144
8	Projected Net Inpatient Revenue	1 970 877		367 315		921 413	36 857	465 320
9	Projected Inpatient Cost	1 079 592		156 525		610 226	24 409	212 798
10	Projected Inpatient Charge per Discharge					32 545 55	32 545 55	33 380 24
11	Projected Inpatient Cost per Discharge					12 204 52	12 204 52	12 517 53
12	**Projected Cost to Charge Ratio**	37 50%				37 50%	37 50%	37 50%
13	Projected Outpatient Visits	3 985		619		2 594	136	388
14	Projected Gross Outpatient Revenue	12 312 629		1 276 012		8 755 454	459 037	1 162 818
15	Outpatient Discount Percent	34 27%		12 00%		41 58%	38 45%	15 00%
16	Projected Amount of Outpatient Discount	4 219 778		153 121		3 640 518	176 500	174 423
17	Projected Net Outpatient Revenue	8 092 852		1 122 890		5 114 936	282 537	988 395
18	Projected Outpatient Cost	4 617 213		478 502		3 283 279	172 138	436 055
19	Projected Outpatient Charge Per Visit					3 375 27	3 375 27	2 996 95
20	Projected Outpatient Cost Per Visit					1 265 72	1 265 72	1 123 85
21	**Projected Cost to Charge Ratio**	37 50%				37 50%	37 50%	37 50%
22	Uncompensated Care Percent of Gross Patient Revenue							
23	Will Contract(s) Provide a Quantifiable Economic Benefit to the Hospital? *Circle*			Yes		Yes	Yes	Yes
24	Is the Discount Amount Below Actual Cost of Service? *Circle*			No		No	No	No
25	Will Cost Be Shifted to Any Other Purchaser of Third Party Payor as a Result of this Contract? *Circle*			No		No	No	No
26	Date contract submitted to HCA					7/8/2015	7/8/2015	10/31/2014
27	the Authority? (If yes please submit revised contracts) *Circle*			No		No	No	No

NOTE This page should include only the total combined and **3 (three)** separate contract columns Use this form in its current version only **Any modifications will be returned**

Figure 2: The first page of detailed contract data for Charleston Surgical Hospital in fiscal year 2016. (A second page reports data for Carelink and UnitedHealth.) The data includes unusual information on contract formation and scale. The existence of cross-column totals and cross-row formulas imply valuable restrictions for data cleaning.

column summarizes all third-party contracts. The "Combined Contracts" column combines contracts from the top panel of the DCL. For the contracts from the bottom panel of the DCL, the later scans include the date the HCA accepted the contract, contract expiration (or renewable) date, and sometimes contract submission date,[3] as well as projected utilization, gross revenue (charges), discount percent (as a percentage of charges), discount amount (the difference between charges and real payments), net revenue (real payments), cost, charge per discharge, and cost per discharge separately for inpatient and outpatient care. The DC scans also typically include the fiscal year end date and the report's submission date.

I leverage implied totals across columns and ratios across rows to verify and clean the data. For an example of a check across columns, the "Total" revenue must be the sum of

[3]In this paper, I use contract approval date as a measure of contract start date because approval was generally quick, while contract submission date is sometimes used to refer to a recent resubmission of an extant contract.

revenue across third-party contracts. For two examples of checks across rows, the projected inpatient discount must be both the difference between gross (list price) and net (real) revenue and the inpatient discount rate multiplied by gross revenue. After correction of likely typos identified through this process, I am left with only 11 (of 259) hospital-year pairs for which I cannot fully verify the discount data.

2.2 Definitions and Other Data Sources

I often refer to six relatively large "modeled" insurers: the largest insurer, Highmark BCBS; a regional insurer, HPUOV; and the four largest for-profit firms, Aetna, Carelink, Cigna, and UnitedHealth. I refer to these insurers as "modeled" because they are included in model estimation in Dorn (2024). Carelink was a regional subsidiary of Coventry during most of the period I study. Aetna acquired Coventry at the end of 2014, but many hospitals continued to report separate Carelink contracts after 2014. I group the other, smaller, insurers into a category of "other" insurers.

I rely on substantial manual data cleaning to standardize insurer names and identify hospital systems. Hospitals reported payors in different ways. For example, Charleston Surgical Hospital reported separate contracts with Highmark BCBS for "Mt State-PPO" and "Mt State-Indemnity" (Figure 1). Pleasant Valley Hospital might simply report a single contract with "BCBS." I refer to a name as a "payor" and aggregate these payors into insurers (which I sometimes call "MCOs") by manual cleaning. To align with Dorn (2024)'s analysis of networks, I include First Health contracts as HPUOV contracts based on HPUOV's description of First Health as a "strategic partner" (Wayback Machine, 2021). I refer to hospitals by a single name in this text, even though some hospitals were renamed during their history. I aggregate hospitals into hospital bargaining systems by year based on contract report availability and qualitative research.

I describe contract expiration starting in fiscal year 2011. I aggregate the data by fiscal year, so this generally corresponds to calendar year 2010, when detailed scans begin being

available. This measure loses the first detailed report for Ohio Valley Medical Center. I differentiate between "fixed-length" contracts with a reported expiration date and "auto-renew" contracts that explicitly or implicitly were auto-renew. The auto-renew category includes some contracts that had language indicating the contract would remain in place until a party fulfilled some nonstandard termination requirement (Skeen, 2021).

Most contract statistics presented here include only contracts starting in fiscal year 2011, which enable data cleaning based on the detailed contract scans. Table 1, Figure 4, Figure 9, Figure 10, Figure 11, Table 5, and Table 13 include earlier contract data as well. In many statistics in this paper, I present payment shares. These payment shares are estimated by first taking the detailed report projected revenue by payor in the detailed contract reports and splitting the remaining revenue evenly among the combined contracts. These statistics do not account for inflation. Statistics that reflect a demand system estimated on inpatient visit data and with payments adjusted for inflation are available in Dorn (2024).

Hospital–insurer contracts generally express prices as fixed multiples of prices that I call benchmarks (Cooper et al., 2019). It would be impractical to negotiate a separate price for each of the thousands of services a hospital offers (Brill, 2013). Instead, the firms generally split care into aggregate categories (in West Virginia, most commonly outpatient and inpatient care) and negotiate prices as fixed multiples of benchmark prices that already calculate payments for each instance of care. The most common benchmark prices in contracts are *share of charges* prices that are a fixed discount off list prices and *prospective* prices that are fixed payments based on the diagnosis code Medicare would use in payments. There are also outlier payments for expensive care and some older *per diem* contracts (Cooper et al., 2019).

I infer contract benchmarks based on the contract data. I infer that a payor with the same reported discount of list prices (or a difference of 0.01% after rounding) in consecutive hospital reports was a share of charges (list-price-benchmarked) contract that paid as a fixed discount of list prices. For the first observation of a hospital–payor pair, I infer that a round-

number discount followed by a change of payor or a new share of charges contract was the final year of an expiring share of charges contract. I infer all other contracts were prospective and used Medicare as the benchmark.[4]

The contract lengths summarized here reflect only moderate cleaning. Contract formation and expiration dates are generally taken from the contract reports where available. The reported dates can shift between annual reports, generating the potential for superfluous contract contracts. For example, a hospital that revises their payment rate with an insurer could report new discounts but the same formation date, which would result in one reported contract length; or could report incorrectly report a contract start date in one year, which would result in two reported contract lengths. Auto-renew share of charges renewal decisions are inferred from changes in contract terms for auto-renew share of charges contracts. In Dorn (2024), I model contract formation based on hand-collected start and end dates that allow me to infer pre-2010 contract changes. I refer to the contracts used in estimation there due to available reliable start and end dates as "Estimation Bargains."

The contract reports only identify hospital list prices per utilization beginning in 2010. To identify earlier list prices in Tables 5 and 13, I leverage scans of annual rate review decisions. The state's annual decisions on each hospital's list price ceiling included a report of projected list prices per inpatient discharge or outpatient discharge. I use the Tesseract OCR engine in R to obtain a panel of projected list prices. Some reports are missing, so I infer missing values from a regression of log list prices per case on fiscal year by hospital.

A cleaned version of the West Virginia contract data is available at `https://jacobdorn.info/files/ContractData/ContractData.zip`.

I present some contract count statistics in Table 1. There are 5,108 hospital system-insurer-year tuples after cleaning, including an estimated 168 insurers. Only 5.7% of the insurers are modeled,[5] but those insurers represent 29% of hospital system-insurer-year observations. In the fiscal year 2011-16 data, the modeled insurers represent an estimated 77%

[4] I discuss some limitations of this calculation in Dorn (2024).

[5] Some UnitedHealth contracts are treated as separate insurers in this exercise.

Table 1: Count statistics for all hospital–insurer years (All Contracts), hospital-insurer-years with modeled insurers (Modeled Contracts), and hospital-insure-years used in bargaining estimation (Estimation Bargains).

Data	Hospitals	Hosp. Systems	MCOs	System-MCO Pairs	System-MCO Years	Bargain Count
All Contracts	38	33	168	613	5108	
Modeled Contracts	35	30	6	159	1482	
Estimation Bargains	32	27	6	53	289	63

of net revenue. The modeled contracts analyzed in Dorn (2024) also drops three hospitals: CAMC Teays Valley (which was in the process of integrating with Charleston Area Medical Center, which I abbreviate to CAMC, during the era I study), Saint Joseph's Hospital of Parkersburg (which closed in 2014 before the start of the inpatient data used in Dorn (2024)), and Saint Luke's Hospital (which closed in 2007).

I present further contract descriptive statistics in Appendix Tables 7, 8, and 9. Appendix Table 7 presents summary statistics on the reported fractions of list prices paid. The average contract paid around 88% of list prices for inpatient care and around 89% for outpatient care, and the distribution was right-tailed. Modeled insurers, as I find later, generally obtained more favorable discounts. As Appendix Table 8 shows, contract date information is sporadic but more available for the modeled (larger) insurers. Appendix Table 9 presents data on reported and estimated scale beginning in fiscal year 2011. I estimate the average contract involved $1.4 million in inpatient payments and $2.7 million in outpatient payments, but there was significant heterogeneity.

3 Six Stylized Facts About Hospital–Insurer Contracts

In this section, I present stylized facts from the contract data.

3.1 The Largest Insurer Generally Paid Lower Prices

I find that larger insurers paid lower prices.

Table 2 presents insurer sizes. Highmark BCBS was the largest insurer at the state level,

	Highmark BCBS	Aetna	HPUOV	Carelink	UnitedHealth	Cigna	Nonmodeled
Inpatient	58.4%	6.1%	3.2%	3%	3.3%	2.5%	23.5%
Outpatient	58.5%	6.2%	4%	3.2%	2.6%	2.8%	22.8%
Total	58.5%	6.1%	3.8%	3.1%	2.9%	2.7%	23%

Table 2: Estimated hospital–insurer payment market shares for fiscal year 2011 and later.

accounting for 58.5% of inpatient and outpatient payments. The other insurers modeled in Dorn (2024) accounted for between 2.7% (Cigna) and 6.1% (Aetna) of spending. HPUOV was quite regional, accounting for only 3.8% of state spending but more than 10% of spending at Wetzel County Hospital, Reynolds Memorial Hospital, Wheeling Hospital, and Ohio Valley Medical Center, all of which are in or near the state's northern panhandle. Note that these numbers are likely to underrate the size of medium-sized insurers, because I will fail to infer their larger size when aggregated among the combined contracts due to being below the 5% utilization threshold.

Figure 3 presents the frequency of contract payment rates, as a fraction of list prices. Each point within a bar represents a single estimated hospital system–insurer–year dollar paid. Points to the right correspond to contracts that paid a higher fraction of the hospital's list prices on average. There are three panels for three groups of insurers: Highmark BCBS, the largest insurer; the other medium-sized insurers included in the model in Dorn (2024); and the small insurers not modeled in Dorn (2024). Highmark BCBS generally paid substantially lower shares of payments than the other insurers. The other modeled insurers paid larger shares of list prices, but generally slightly lower shares than the smaller nonmodeled insurers. There is also variation between the non-Highmark modeled insurers: HPUOV, the regional insurer, had a substantial mass of payments far below list prices, mostly payments to hospitals in Wheeling in the state's northern panhandle. While Figure 3 suggests larger insurers paid lower prices, it does not control for hospital mix. Perhaps Highmark BCBS simply does more business with hospitals with excessive list prices. I therefore present regression results that adjust for hospital mix by controlling for hospital fixed effects.

I regress payment rates on insurer, hospital, and year fixed effects. The regression model

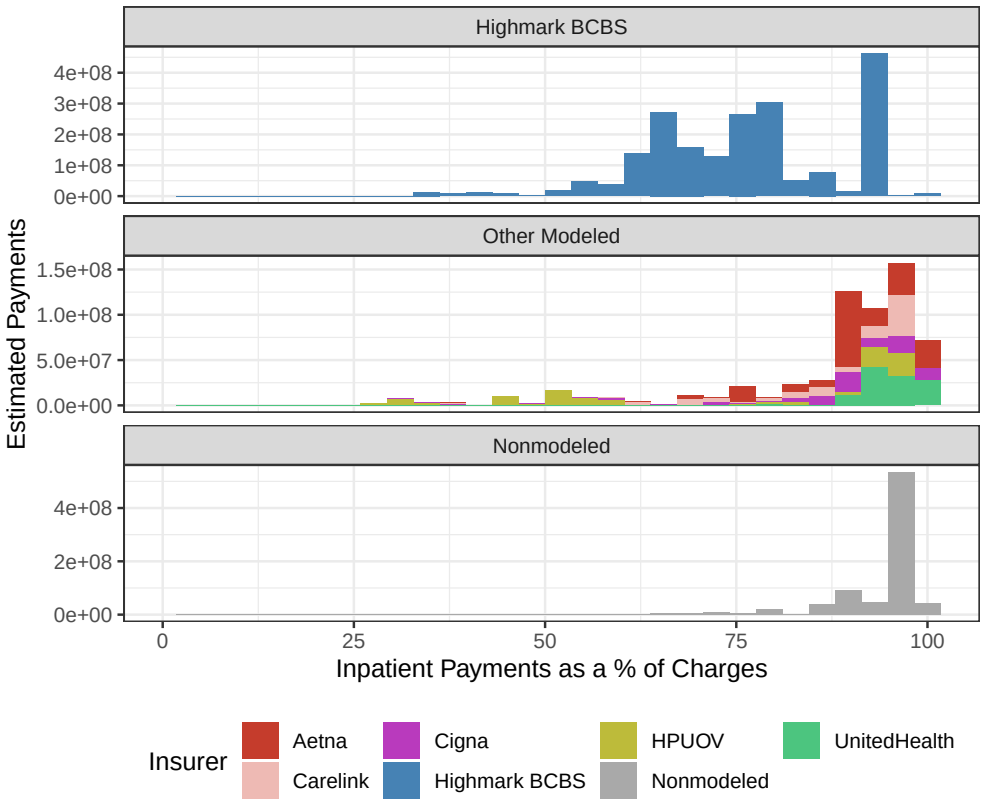


Figure 3: Histogram of negotiated payments as a fraction of list prices for inpatient care under contracts beginning in fiscal year 2011, weighted by estimated payments. Higher rows correspond to larger insurers and, typically, lower rates. Appendix Figure 17 shows that similar patterns hold for outpatient care.

for hospital i and insurer j in fiscal year t is:

$$Y_{ijt} = \delta_j^{Insurer} + \delta_i^{Hosp} + \delta_t^{FY} + \varepsilon_{ijt}, \tag{1}$$

where $Y_{ijt} = \frac{Pay_{ijt}}{ListPrice_{ijt}}$ for payment-to-list-price regressions and $Y_{ijt} = \frac{Pay_{ijt}}{ListPrice_{ijt}} * ChargeToCost_{it}$ for payment-to-cost regressions, where $ChargeToCost_{it}$ is hospital i's reported aggregate list price-to-cost ratio for the fiscal year. The payment-to-cost regressions make units roughly comparable across hospitals, but leverage Medicare and Medicaid reported costs in calculating the private insurer outcome. The hospital fixed effects control for general variation in hospital markups or cost reporting. I present both unweighted and payment size-weighted regression results. Standard errors are clustered by hospital.

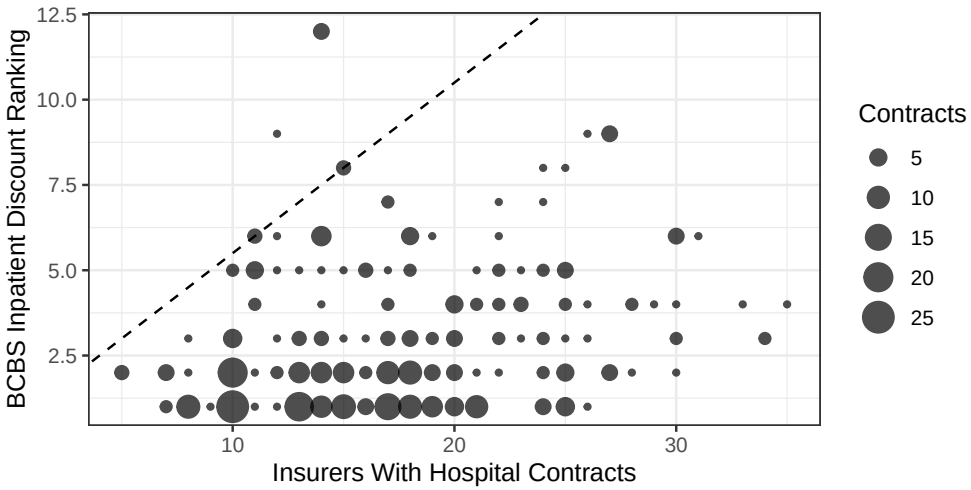


Figure 4: Relative positioning of Highmark BCBS's best contract by hospital-year across fiscal years. A dot indicates the number of insurers the hospital contracted with (x-axis) and Highmark BCBS's relative positioning within payment rates (y-axis). The dashed line indicates median performance ($y = (1+x)/2$). Highmark BCBS obtained favorable payment rates.

Table 3 presents the regression results. Highmark BCBS consistently paid less than the other modeled insurers. HPUOV paid less than Cigna and United, and paid less than Aetna and Carelink when weighting contracts by payments. This reflects HPUOV's regional nature: it obtained favorable payment rates in the regions in which it was more competitive and had greater size. Cigna and UnitedHealth (the latter is the omitted category) paid more than other modeled insurers. Appendix Table 10 shows that similar patterns held for outpatient care.

Figure 4 shows that Highmark BCBS consistently paid highly favorable rates within a hospital. That figure presents a scatterplot of Highmark BCBS's payment ranking across insurers (y axis) and the number of insurers each hospital contracted with (x axis). Hospitals that contract with more insurers have more opportunities to reach even more favorable payment rates. The scatterplot shows that Highmark BCBS consistently obtained one of the top two most favorable rates, and almost never paid more than the median insurer.

3.2 The Largest Insurer Generally Formed Multiyear Contracts

The largest insurer in West Virginia, Highmark Blue Cross, generally formed contracts that would expire after three years or five years. The five-year contracts were associated with smaller hospitals.

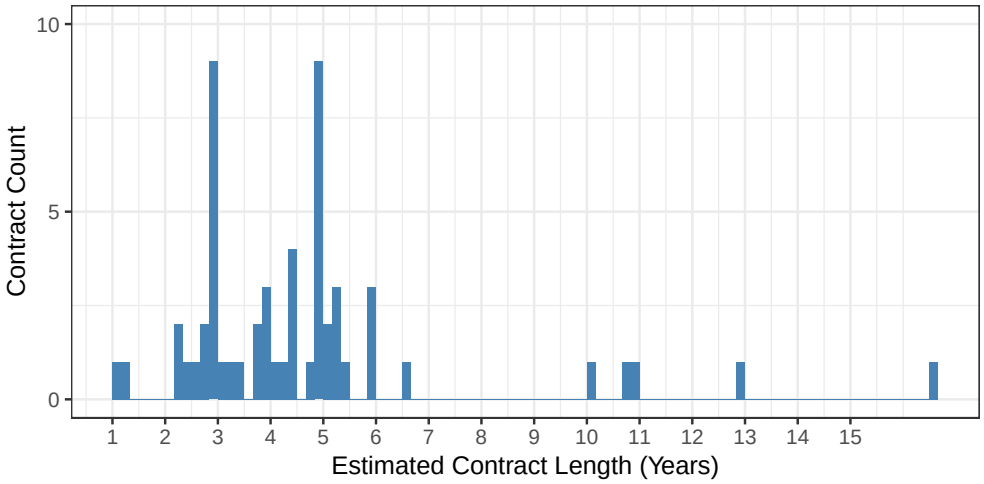


Figure 5: Distribution of reported contract term lengths (hospital-insurer-start-end tuples) for contracts with fixed expiration dates for Highmark BCBS. Ten hospitals' auto-renew contracts with reported formation dates are not contained in this figure.

The simplest measure of contract length is reported length. Figure 5 presents retrospective contract length for fixed-length BCBS contracts. A given observation is a hospital-payor-start-end tuple. Large spikes are visible at three years and five years, indicating that these were standard Highmark BCBS contract lengths. There is a right tail of extreme lengths, which reflect either expired contracts that were extended or data reporting issues.

I analyze the choice of contract length in Figure 6. It is clear from the repeated observations that Highmark would often use the same contract length for multiple contracts formed with a given hospital. The figure is a histogram of fiscal year 2011 Highmark BCBS spending for hospitals that always report one of three-year or five-year contracts with BCBS. The five-year hospitals are consistently relatively large contracts. The three-year hospitals are often small. One important exception is the WVU Health System, which was relatively large and formed three-year contracts. The largest hospital, CAMC, is not on the graph. In

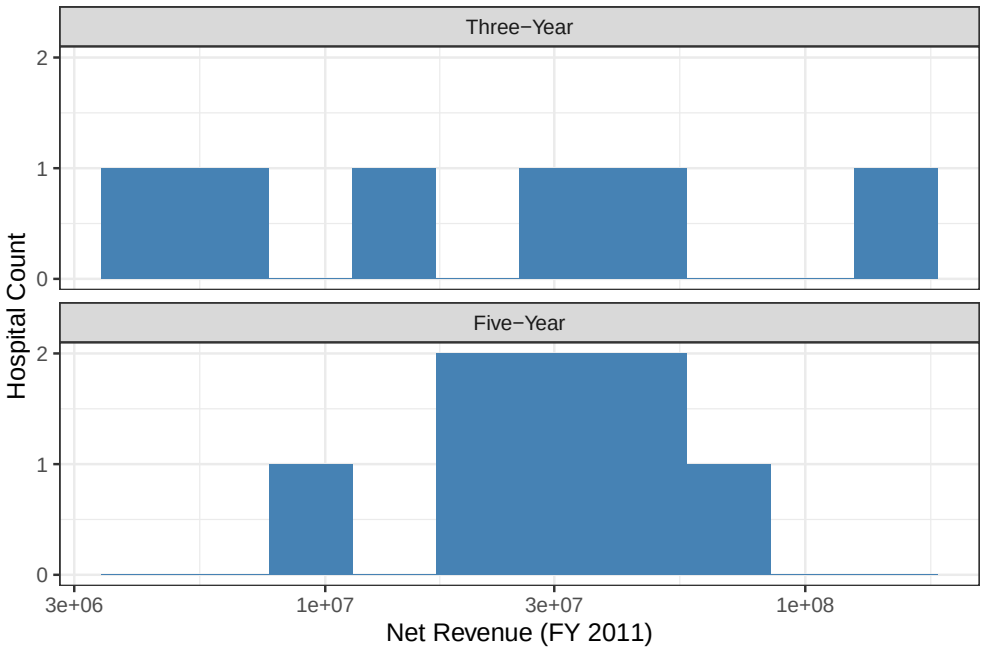


Figure 6: Distribution of projected BCBS spending in fiscal year 2011 at the 14 hospitals that always reported three-year or five-year contracts with Highmark BCBS. Five-year contracts were associated with larger hospitals for BCBS, with the exception of the West Virginia University (WVU) Health System.

early years, CAMC reported a five-year share of charges contract with Highmark BCBS, but in later years, changes to reported expiration with the same reported payment rates suggest the Highmark BCBS-CAMC contract was extended by three years and then five years.

Highmark BCBS formed sufficiently few auto-renew contracts that the auto-renew contracts can be studied individually. A fair number of the auto-renew contracts were contracts specifically for Highmark BCBS indemnity plans, which were a small share of care in the era I study. Some contracts were auto-renew share of charges contracts at the relatively small Davis Medical Center, Fairmont Regional Medical Center, and Summersville Memorial Hospital. Many Highmark BCBS auto-renew contracts appear to have been short-term extensions of nominally expired contracts with Beckley ARH Hospital, Camden Clark Medical Center, Jackson General Hospital, Princeton Community Hospital, Saint Joseph's Hospital of Buckhannon, and Wheeling Hospital. The ability to extend expired contracts while negotiations continue is a feature of bargaining that represents an interesting direction for future work.

3.3 Smaller Insurers Generally Formed Auto-Renew Contracts

Smaller insurers generally formed auto-renew contracts.

Table 4 presents the frequency of auto-renew contracts by insurer. Auto-renew contracts were used for an estimated 43% of inpatient payments. However, Highmark BCBS only used such contracts for an estimated 6% of payments. Aetna and Carelink used some fixed-length contracts but more commonly paid under auto-renew contracts. I find essentially no other fixed-length contracts.

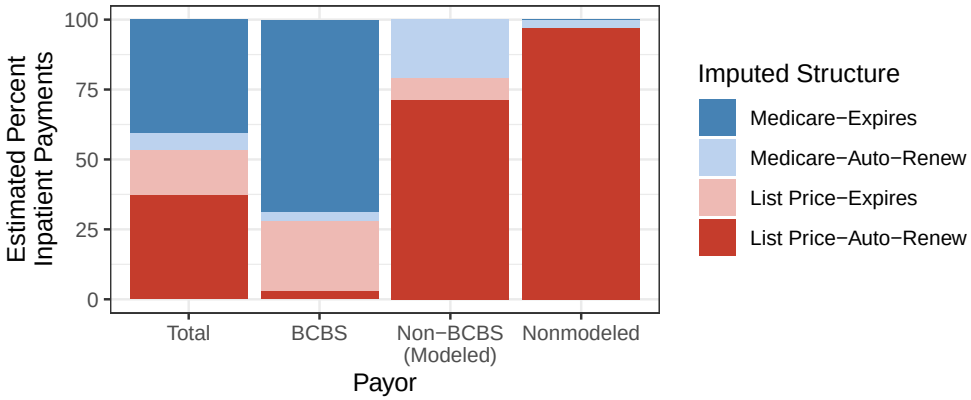


Figure 7: Estimated percentage of inpatient payments accounted for by imputed contract structure by insurer. Color indicates inferred payment benchmark. Transparency indicates contract expiration type. Highmark Blue Cross, the largest insurer, generally used prospective ("Medicare") diagnosis weights in contracts with fixed expiration dates. Smaller insurers generally used list price-based formulas under auto-renew contracts.

The auto-renew contracts were generally benchmarked to list prices. Figure 7 presents the usage rates of different contract types by insurer. Highmark BCBS had some list price-benchmarked contracts with fixed expiration dates, but was more likely to use prospective payment structures. Conversely, the other modeled insurers and nonmodeled insurers generally used auto-renew share of charges contracts that were benchmarked to list prices. The main exceptions were a few prospective auto-renew contracts for HPUOV (especially with Wheeling Hospital, Ohio Valley Medical Center, Reynolds Memorial Hospital, and Mon Health Medical Center), Carelink (especially with Wheeling Hospital and Mon Health Medical Center), and UnitedHealth (especially with WVU Health System).

The fixed-length contracts formed by the non-BCBS modeled insurers were rare enough to be studied individually. One was Carelink's earliest reported contract with Beckley ARH Hospital, which expired on June 30, 2007. The others were a contract formed between Aetna and Camden Clark Medical Center, a medium-sized hospital in Parkersburg, which expired September 30, 2014, and CAMC contracts with Carelink and Aetna which expired in 2012. Both the Carelink and Aetna contracts shifted to auto-renew after the expiration date, with Aetna's contracted discount increasing from one percentage point to two percentage points one year later. (Carelink was acquired by Aetna in 2014, but CAMC continued to report a Carelink contract with a two percentage point discount.)

3.4 Auto-Renew Contracts Generally Renewed

Smaller insurers' auto-renew contracts renewed in more than 90% of years. I find some suggestion that non-renewal decisions were associated with extreme changes to list prices, though the association explains only a small amount of variation.

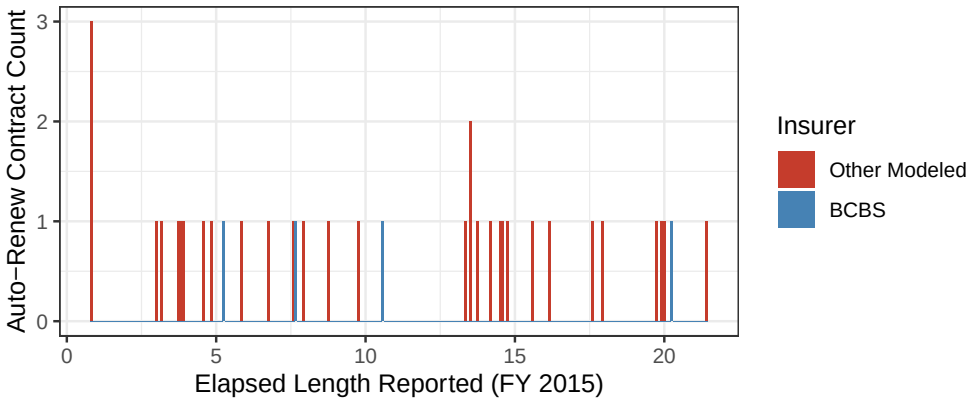


Figure 8: Reported elapsed contract length as of report submission date for fiscal year 2015 auto-renew contracts with modeled insurers with reported formation date, including the small number of prospective auto-renew contracts (see Figure 7). Only a few contracts were formed by Blue Cross (blue) rather than the other insurers (red). Many contracts had remained in place for a decade or more.

I present retrospective contract length data for auto-renew contracts in Figure 8. The graph takes auto-renew contracts that had detailed data reported in fiscal year 2015. (Fiscal

year 2016 was interrupted by the end of the West Virginia rate review system.) It then looks retrospectively at the length elapsed between the contract list submission date and contract formation. Some auto-renew contracts had been in place less than one year. Many auto-renew contracts had been in place for a decade or longer. The median reported formation date was just over 10 years earlier. (A cluster around 15 years partially reflects contracts with January 1, 2000, reported start dates.) Few Highmark BCBS contracts were auto-renew, but the Highmark BCBS auto-renew contracts with reported formation date in fiscal year 2015 had been in place for at least five years.

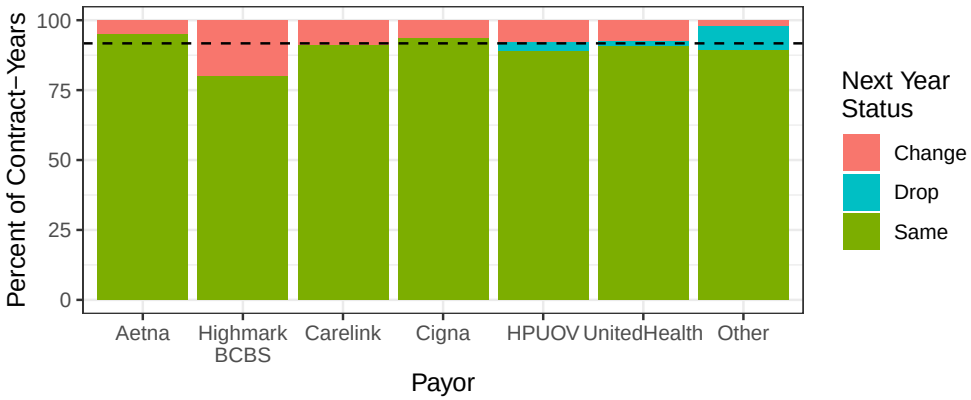


Figure 9: Percentage of auto-renew share of charges contract-years that remained in place (green), were renegotiated (red), or were dropped (blue) for each insurer. The insurers all generally allowed auto-renew contracts to renew, with the average renewal probability of 93.4% indicated by dashed line.

As Figure 9 shows, auto-renew contracts consistently renewed. The figure shows the one-year-ahead probability of contract changes by insurer for auto-renew share of charges contracts. The probability of an auto-renew contract being renewed in the contract panel data was 91.7% for the modeled insurers and 93.9% for the nonmodeled insurers. Under a Bernoulli trial model, these would correspond to expected lengths of roughly 12 and 16 years, respectively. When a contract did not rnew, the other modeled insurers generally formed an auto-renew share of charges contract with different payment rates. When a nonmodeled insurer contract did not renew, the contract was generally dropped, likely reflecting cleaning of dormant contracts.

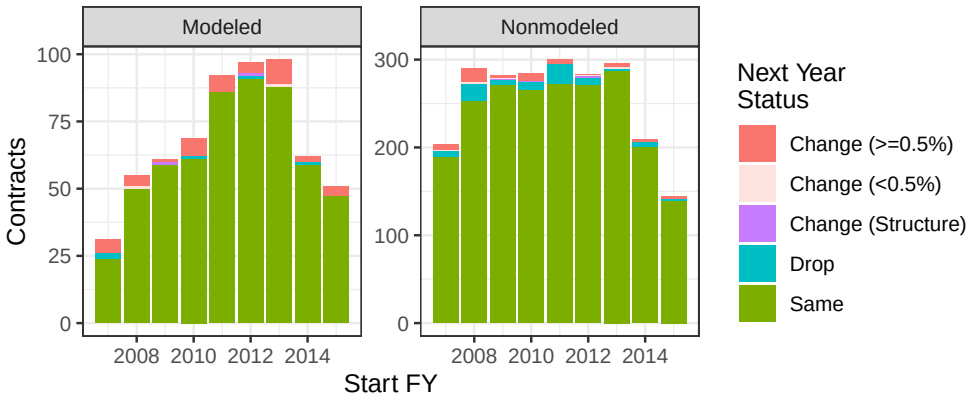


Figure 10: The number of hospital–insurer auto-renew share of charges contracts being renewed (green), dropped (blue), changed to fixed length (purple), renegotiated with a small change to discount (light red), or renegotiated with a large change to discount (dark red) by fiscal year for modeled (left) and nonmodeled (right) insurers.

I find that auto-renew contracts consistently renewed at all times. Figure 10 graphs the one-year-ahead change in status for auto-renew contracts by fiscal year. The bar for modeled insurers is tallest around 2011, when detailed contract scans were retained and I can reliably differentiate between auto-renew and fixed-length contracts for larger contracts. In all years, most auto-renew contracts were renewed. In essentially all years, the most common result of a non-renewed auto-renew contract among the modeled insurers was a new auto-renew contract with different payment rates.

There is some indication that auto-renew strategy was associated with insurer. Figure 11 presents a Kaplan-Meier survival plot for a new auto-renew contract. The non-renewal rates are higher than the average rates in Figure 10, presumably because these pairs are selected on negotiating at least once. Highmark BCBS had few auto-renew contracts, and its auto-renew contracts generally ended quickly. (As mentioned in Section 3.2, many Highmark BCBS auto-renew contracts were likely fixed-length contracts that were allowed to remain in place after expiration.) Carelink and the smallest insurers generally allowed contracts to renew. The other, medium-sized, insurers still typically allowed these contracts to continue to renew.

The consistent use of the same list price benchmark by multiple small and medium-sized

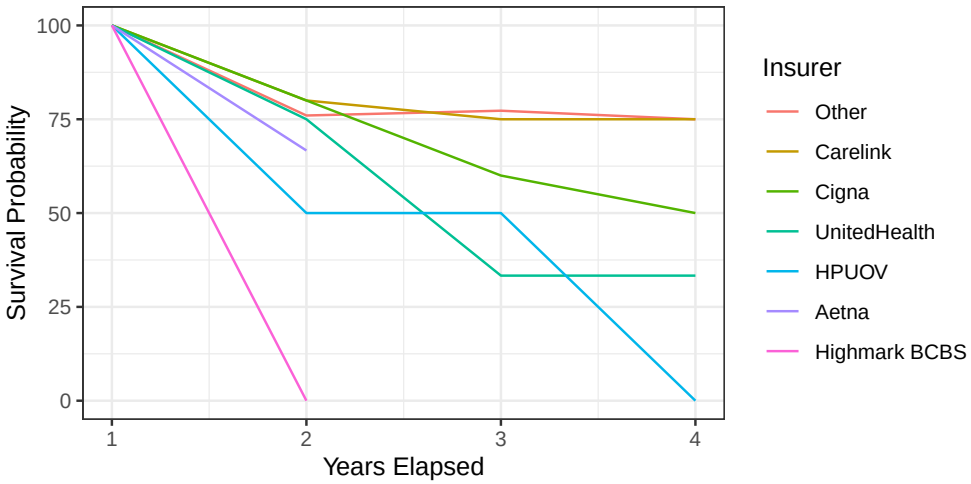


Figure 11: Probability of a new auto-renew share of charges contract remaining in place after a given number of fiscal years of contract data elapsed by insurer. The smaller insurers in the "Other" category were more likely to see contracts renew than the larger insurers, especially Highmark BCBS which rarely used auto-renew contracts in this era.

insurers is consistent with substantial bargaining frictions. Imagine a stylized model wherein insurer A and insurer B have auto-renew contracts in place with the same hospital. In period t, hospital i or insurer j can allow the ij contract to renew at price $\alpha_{j,t_0}p_{b,t}$ or give notice and renegotiate to a perfectly foreseeable new starting price of $p^*_{j,t}$. For simplicity, suppose all pairs allow contracts to renew if and only if $|\alpha_{j,t_0}p_{b,t} - p^*_{j,t}| \leq u$. If, as typically happens in practice, both contracts renew, then $|p^*_{A,t} - p^*_{B,t}| \leq 2u$. The common renewal of share of charges contracts means either the disparate insurers must remain in the small region that enables the hospital to avoid renegotiating with any insurer ($|p^*_{A,t} - p^*_{B,t}|$ is small) or the range of acceptable prices must be large (u is large). I take the rare renegotiation as suggestive evidence that perceived bargaining frictions are high.

I next use a regression strategy to assess the drivers of nonrenewal decisions. Auto-renew contracts were generally benchmarked to a hospital's list prices (Figure 7). As a result, changes in hospital list prices would directly contribute to changes in payments while a contract remained in place. To roughly assess the magnitude of the resulting incentive's effect, I regress the existence of one-year-ahead auto-renew share of charges contract changes on changes in projected charged list prices. The regression is exploratory and descriptive.

The outcome Y_{ijt} is an indicator for hospital i and insurer j having an auto-renew contract in place in the contract report for year $t-1$, and either a different contract or dropped contract in the report for fiscal year t. This measure allows me to include renegotiated auto-renew contracts that also led to a change in reported insurer name. The association of interest is the change in log projected list prices per case. Define $p_{ht,c}$ as the projected list price per case for care type c (inpatient per discharge or outpatient per visit) at hospital h in the state's rate review decision for fiscal year t. Also define the change in percent charges as $\Delta^{\tau}_{ht,c} = log(p_{ht,c}) - log(p_{ht-\tau,c})$ with Winsorization at the 5% and 95% level. The regression specification is

$$Y_{ijt} = \beta \Delta^{(\tau)}_{hj,c} + \delta_h + \delta_j + \delta_t + \varepsilon_{ijt},$$

where δ_h are hospital fixed effects, δ_j are insurer fixed effects, and δ_t are fiscal year fixed effects that control for system-wide inflation. I estimate the regression with ordinary least squares and cluster the standard errors by insurer. I emphasize that the estimated coefficient β is a residual correlation, and should not be interpreted as a meaningful causal parameter.

The main regression results are in Table 5. I find that increases in list prices are associated with contract renegotiation. This pattern holds across inpatient care and outpatient care. The association is particularly strong for one-period changes in charges and carries more statistical evidence against a null of zero residual correlation for inpatient care. In Table 13 (Page 44), I estimate separate coefficients for the negative- and positive-part of list price changes. I find stronger statistical evidence that larger increases in list prices are associated with contract renegotiation. There is some indication that for decreases in list prices, larger *decreases* are associated with contract changes, but those estimates are statistically imprecise. That said, this association only explains a very small amount of the variation in contract changes: the largest within R^2 across all specifications is 0.00462. The association also becomes more muted if the prior fiscal year's list price change is used to purge issues of reverse causality.

3.5 Short-Term Data May Underestimate Small Insurer Bargaining Power

At any given moment, most contracts in place were a mix of Highmark BCBS's recent Medicare-linked contracts and smaller insurers' old list price-linked contracts. As a result, the inclusion of old contracts in bargaining estimation could lead to underestimates of small insurers' bargaining power.

Table 6 and Figure 7 above present the distribution of estimated inpatient spending across inferred contract benchmark by insurer. I estimate 53.3% of payments were paid as a share of charges, and infer the remaining payments were paid based on DRG-based weights.[6] I find that Highmark BCBS likely used Medicare DRG codes to calculate most payments, whereas smaller insurers generally used hospital list prices. List price-based payments were more frequent for smaller insurers: 79.1% for the other medium-sized insurers I model in Dorn (2024) and 97% for the remaining small nonmodeled insurers. The regional HPUOV was small at the state level (3.8% to 11.7% of estimated sales), relatively large in the regions in which it actively competed (more than 27% of estimated 2016 sales in the northern panhandle), and paid prospectively for an estimated 56.2% of payments (more than three-quarters from two hospitals in Wheeling in the state's northern panhandle).

These correlations of payment basis with insurer size are consistent with larger insurers obtaining slower-growing prospective payments where they have greater bargaining power. A natural question is where Highmark BCBS pays prospectively. As Appendix Table 11 demonstrates, the largest hospital, CAMC, obtained share of charges payments from Highmark BCBS. After removing CAMC, an estimated 92% of Highmark BCBS payments were prospective. Further detail on contract structure is available in Appendix Table 12.

The patterns in Table 6 suggest that Medicare-based Highmark BCBS payments should

[6] I observe that in some hospital 2023 price reports, Highmark BCBS payments are benchmarked to DRG-based weights that are not equal to Medicare's DRG weights. The differences are small (R^2 of 0.92 between the weights). See Dorn (2024) for further discussion.

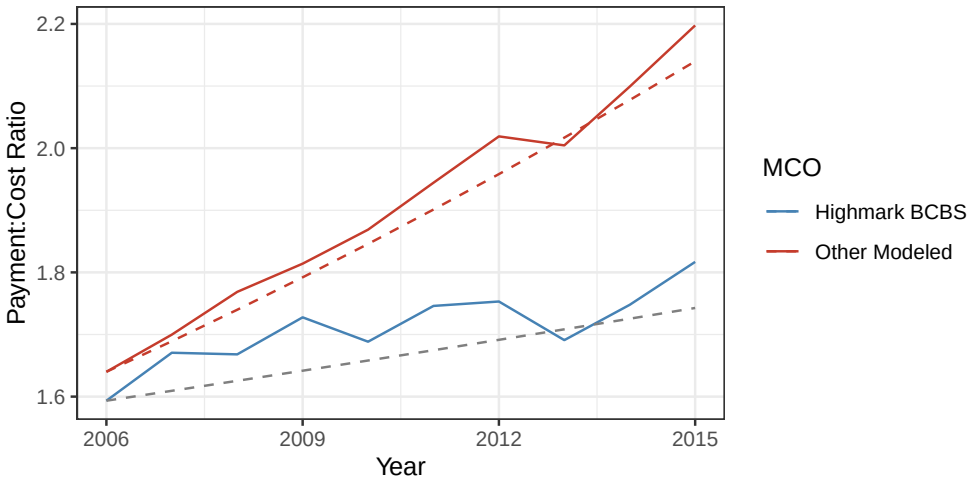


Figure 12: The ratio of payments to reported costs over time for Highmark BCBS (blue) and the other, small and medium-sized, insurers I model (red). Dashed lines indicate one percentage point and three percentage point annual increases, respectively.

go up more slowly over time than list price-based payments used by other insurers. Figure 12 shows that such a pattern held. In that figure, I plot the ratio of payments to reported hospital costs over time for Highmark BCBS and the other modeled insurers. Other modeled insurers' payments generally went up around three percentage points faster than costs, similar to the list prices they typically used as benchmarks. Highmark BCBS payments went up much more slowly, roughly increasing one percentage point more quickly than costs annually. As a result, whereas Highmark BCBS markups were close to the rest of the market in 2006, by 2015 Highmark BCBS was paying far less than the other insurers for care. I decompose the change in payments in Appendix Figure 18 and find that 31.6% of the divergence is explained by the slower rate at which Highmark BCBS prices increased between negotiations.

Moreover, Highmark BCBS's contracts were newer than the other insurers. Figure 13 displays the reported start dates for contracts reported in fiscal year 2011. For Highmark BCBS (left panel), most contracts had been formed within the previous five years and I infer that most inpatient payments were linked to diagnosis weights (blue). As I show in Appendix Figure 19, the list prices used by smaller insurers grew faster than Medicare payment rates For the other insurers in the data (right panel), even among these larger contracts, many

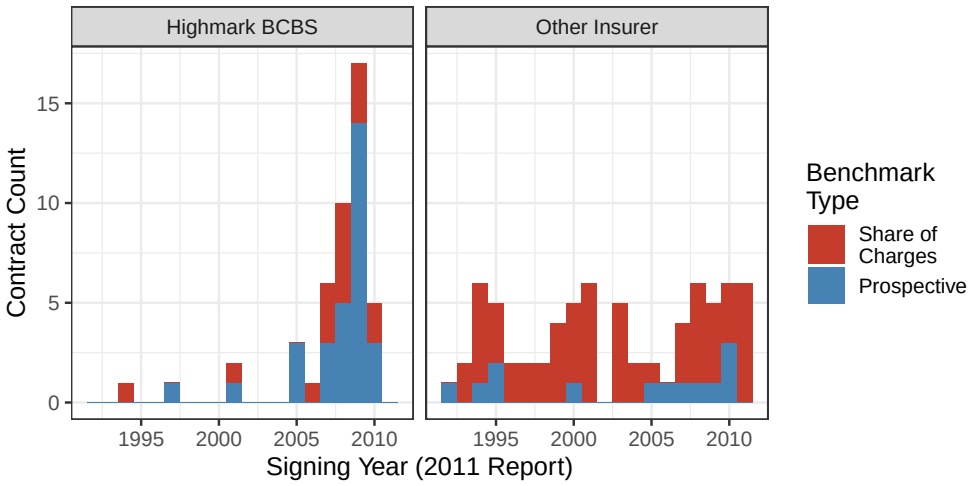


Figure 13: Histogram of reported elapsed contract lengths for contracts with detailed information available in fiscal year 2011 for Highmark BCBS (left) and other insurers (right). Colors represent inferred payment benchmark of list prices (red) or diagnosis weights (right). Highmark BCBS contracts were shorter-lived and more likely to be linked to slow-growing diagnosis weights.

contracts had been in place for a decade or more and the negotiated payment rates were generally linked to hospital charges (red). The smaller insurers' contracts without reported formation date were generally linked to list prices and would, if anything, be even older.

These results suggest that empirical work must account for different contract ages to accurately gauge insurer bargaining power. For the largest insurer, contracts were generally adjusted every three or five years. For the smaller insurers, prices increased quickly under contracts that remained in place for a decade or more. A researcher with only access to short-term contract outcomes might conclude small insurers' high prices reflect poor bargaining, when in fact the high payments reflect many years of compounding list price growth on a long-ago negotiated rate.

Accurate estimation of insurer bargaining power requires a bargaining model with accurate contract timing. The next subsection shows that contracts timing is staggered. Dorn (2024) points out that staggered contract formation introduces new methodological challenges, and proposes an empirically extension of the usual static approach that includes staggered contract formation.

3.6 Contract Formation Was Staggered

In West Virginia, contract formation was staggered: contracts were formed all throughout each year and did not exhibit clustering across insurers.

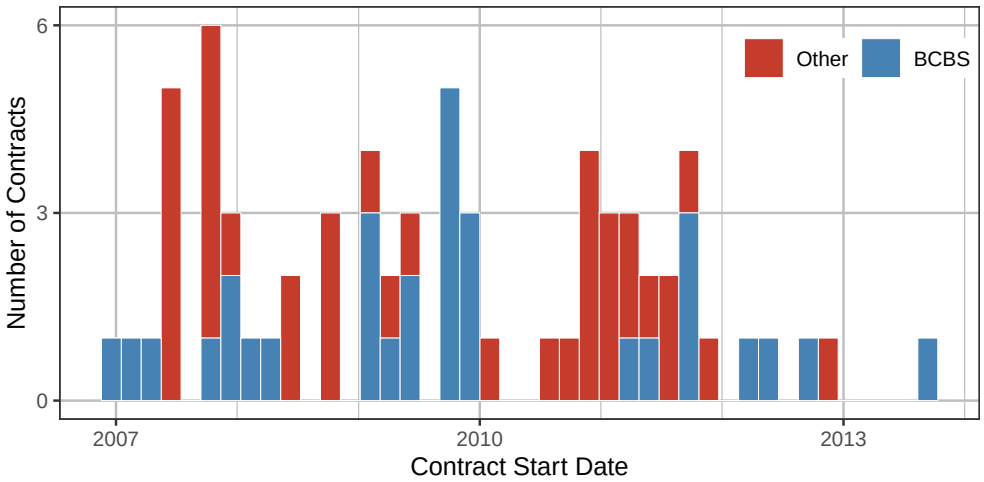


Figure 14: Histogram of contract start dates for contracts used in the estimation sample in Dorn (2024) and introduced 2007–2014 for Highmark BCBS (blue) and other modeled insurers (red). Vertical lines indicate January 1 of a given year. Contracts were not systematically introduced on the same dates.

Contracts could be introduced at many dates within a year. Figure 14 plots the contract start dates for contracts used in the estimation sample in Dorn (2024). (These are contracts with a modeled insurers that had reliable start and end dates.) Contracts are introduced in many months within a given year. This pattern of staggered formation held even within Highmark BCBS contracts. Further, the market did not follow a follow-the-leader strategy: the smaller modeled insurers formed contracts at different times from Highmark BCBS.

Contract negotiations were separated by idiosyncratic gaps. Figure 15 plots the time between a given modeled Highmark BCBS negotiation and the next time the insurer would negotiate with a hospital located within 50 miles. This measure proxies for the duration until the current negotiation could plausibly affect the terms under which Highmark BCBS negotiated with another hospital. The median wait time was 163 days (BCBS's contract with WVU Health System starting June 8, 2009) and there was substantial variation, indicating

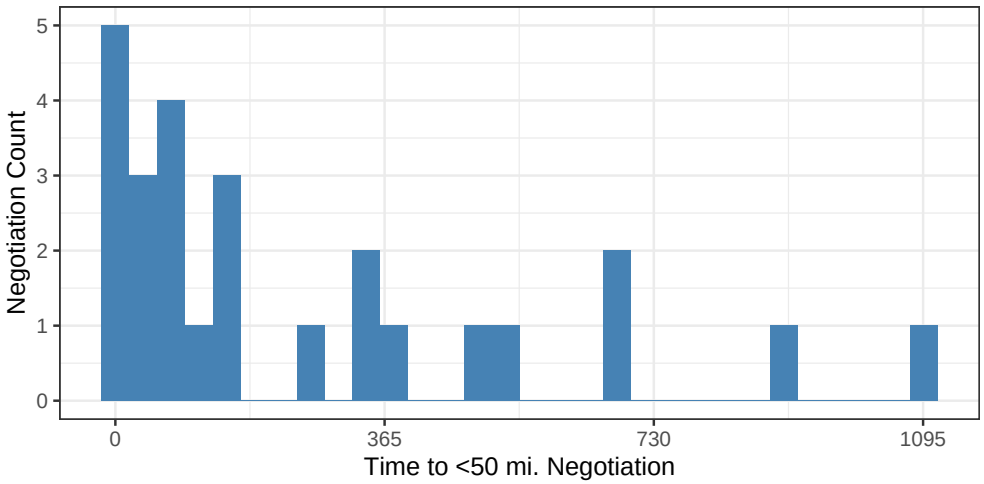


Figure 15: Time to next negotiation with a hospital within fifty miles among Highmark BCBS negotiations used in estimation in Dorn (2024). Three of the 29 contracts with no such neighbor negotiation in the sample are excluded from the plot.

that contract formation was a staggered and idiosyncratic process.

No simple model of timing could accurately capture which contracts affected the terms of which other negotiations. Once could easily imagine a contract formed between Wheeling Hospital and Highmark BCBS in January could feasibly have an effect on how Wheeling Hospital negotiated with Aetna in May and how Blue Cross negotiated with the neighboring Ohio Valley Medical Center in July, and both could have an effect on how Aetna negotiated with Ohio Valley Medical Center in September. Typically, the empirical literature models contract formation as being conducted simultaneously, so that resulting contract spillovers are not internalized (Lee et al., 2021). As Dorn (2024) discusses, such contract spillovers across time introduce new methodological challenges that the literature has not previously had to grapple with.

4 Conclusion

This paper presents a description of hospital–insurer bargaining in West Virginia and some stylized facts on contract dynamics. I find that the largest insurer paid lower prices

under three- or five-year contracts, smaller insurers agreed to auto-renew contracts with fast price growth, and contract formation was staggered. The combined picture of these stylized facts is surprisingly stark: small insurers formed contracts that often remained in place for a decade or longer. As a result of the long contract length, short-term prices were unrepresentative of smaller insurers' negotiated prices. Accurately capturing small insurer bargaining requires a model that takes into account the staggered nature of contract formation.

The results here point to exciting directions for future work. The existence of both three- and five-year Highmark BCBS contracts raises the question of the drivers of contract length. The pervasiveness of auto-renew contracts with prices calculated as a fixed fraction of list prices raises questions about auto-renew dynamics and how renewal decisions interacted with hospital list prices. In Dorn (2024), I study one question motivated by these stylized facts: how to build an empirically tractable model of vertical market bargaining that can accommodate these contract dynamics.

References

Abbey, D. C. (2012). *Cost-Based, Charge-Based, and Contractual Payment Systems*. Productivity Press Inc., 1st edition.

Atkinson, G. (2009). State hospital rate-setting revisited. *Commonwealth Fund*, 69(1332).

Berenson, R. A. and Murray, R. B. (2022). How price regulation is needed to advance market competition. *Health Affairs*, 41(1):26–34. PMID: 34982623.

Blochowicz, J. M. (2023). Bargaining for exclusive rights in two-sided markets: The case of the NFL and broadcast channels.

Bogart, T. (2020). The ultimate guide to your next chargemaster review.

Brickley, J. A., Misra, S., and Horn, R. L. V. (2006). Contract duration: Evidence from franchising. *The Journal of Law and Economics*, 49(1):173–196.

Brill, S. (2013). Bitter pill: Why medical bills are killing us. *Time*.

Brown, E. C. F. (2014). Irrational hospital pricing. *Houston Journal of Health Law & Policy*, 14:11–58.

Bárcena-Ruiz, J. C. and Casado-Izaga, F. J. (2008). Timing of endogenous bargaining over costs and firms' locations. *Journal of Economics*, 95(2):149–166.

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics*, 12(3):383–398.

Chernew, M. E., Dafny, L. S., and Pany, M. J. (2020). A proposal to cap provider prices and price growth in the commercial health-care market. Technical Report 2020-08, Hamilton Project.

Clemens, J. and Ippolito, B. (2019). Uncompensated care and the collapse of hospital payment regulation: An illustration of the Tinbergen Rule. *Public Finance Review*, 47(6):1002–1041.

CMS (2022). National health expenditure data: Historical.

Cooper, Z., Craig, S. V., Gaynor, M., and Reenen, J. V. (2019). The price ain't right? Hospital prices and health spending on the privately insured. *Quarterly Journal of Economics*, 134(1):51–107.

Craig, S. V., Ericson, K. M., and Starc, A. (2021). How important is price variation between health insurers? *Journal of Health Economics*, 77:102423.

Crawford, G. S., Lee, R. S., Whinston, M. D., and Yurukoglu, A. (2018). The welfare effects of vertical integration in multichannel television markets. *Econometrica*, 86(3):891–954.

Cromwell, J. (1987). Impact of state hospital rate setting on capital formation. *Health Care Financing Review*, 8(3):69–82.

De Fraja, G. (1993). Staggered vs. synchronised wage setting in oligopoly. *European Economic Review*, 37(8):1507–1522.

Diebel, A. S. and Diebel, N. (2017). Welfare effects of using hospital rate setting as an alternative to bargaining.

Do, J. and Miklós-Thal, J. (2022). Opportunism in vertical contracting: A dynamic perspective. Technical Report DP16951, CEPR Press Discussion Paper.

Dorn, J. (2024). Dynamic bargaining between hospitals and insurers.

Dutta, P. K. (2021). Compromise is key in infinitely repeated bargaining with an evergreen clause. *Journal of Economic Theory*, 193:105170.

Eyre, E. (2016). Hospital rate review repeal bill advancing. *Charleston Gazette-Mail*.

Gertler, M. and Trigari, A. (2009). Unemployment fluctuations with staggered Nash wage bargaining. *Journal of Political Economy*, 117(1):38–86.

Ghili, S., Handel, B., Hendel, I., and Whinston, M. D. (2023). Optimal long-term health insurance contracts: Characterization, computation, and welfare effects. *The Review of Economic Studies*.

Gorovaia, N. and Windsperger, J. (2018). The choice of contract duration in franchising networks: A transaction cost and resource-based view. *Industrial Marketing Management*, 75:125–133.

Gowrisankaran, G., Nevo, A., and Town, R. (2015). Mergers when prices are negotiated: Evidence from the hospital industry. *American Economic Review*, 105(1):172–203.

Grennan, M. and Swanson, A. (2020). Transparency and negotiated prices: The value of information in hospital-supplier bargaining. *Journal of Public Economics*, 128(4).

Gudiksen, K. L., Chang, S. M., and King, J. S. (2019). The secret of health care prices: Why transparency is in the public interest.

HCA (2004). Benchmarking forms: Instructions: B-DC and B-DCL forms: Discount contracts.

Hermo, S. (2024). Collective bargaining networks, rent-sharing, and the propagation of shocks.

Ho, K. and Lee, R. S. (2017). Insurer competition in health care markets. *Econometrica*, 85(2):379–417.

Ho, K. and Lee, R. S. (2019). Equilibrium provider networks: Bargaining and exclusion in health care markets. *American Economic Review*, 109(2):473–522.

Lee, R. S., Whinston, M. D., and Yurukoglu, A. (2021). Chapter 9 - structural empirical analysis of contracting in vertical markets. In Ho, K., Hortaçsu, A., and Lizzeri, A., editors, *Handbook of Industrial Organization, Volume 4*, Handbook of Industrial Organization, pages 673–742. Elsevier.

Leong, K., Li, H., Rysman, M., and Walsh, C. (2022). Law Enforcement and Bargaining over Illicit Drug Prices: Structural Evidence from a Gang's Ledger. *Journal of the European Economic Association*, 20(3):1198–1230.

Liebman, E. (2022). Bargaining in markets with exclusion: An analysis of health insurance networks.

Liu, J. L., Levinson, Z. M., Qureshi, N. S., and Whaley, C. M. (2021). *Impact of Policy Options for Reducing Hospital Prices Paid by Private Health Plans*. RAND Corporation, Santa Monica, CA.

Liu, T. (2021). Bargaining with private equity: Implications for hospital prices and patient welfare. SSRN 3896410.

McDonough, J. E. (1997). Tracking the demise of state hospital rate setting. *Health Affairs*, 16(1):142–149. PMID: 9018951.

Murray, R. and Berenson, R. A. (2015). *Hospital Rate Setting Revisited: Dumb Price Fixing or a Smart Solution to Provider Pricing Power and Delivery Reform?* Urban Insitute, Washington, DC.

Pauly, M. and Town, R. (2012). Maryland exceptionalism? All-payers regulation and health care system efficiency. *Journal of Health Politics, Policy and Law*, 37(4):697–707.

Perdreau, F. and Fréchet, M. (2022). Learning, contractual capabilities, and contract duration changes in franchise networks. *Journal of Retailing and Consumer Services*, 64:102777.

Prager, E. and Tilipman, N. (2022). Regulating out-of-network hospital payments: Disagreement payoffs, negotiated prices, and access.

Prives, G. P. (2013). Evergreen clauses: Be aware of the pitfalls. *Business Law & Governance*, 6(1).

Reinhardt, U. E. (2006). The pricing of U.S. hospital services: Chaos behind a veil of secrecy. *Health Affairs*, 25(1):57–69. PMID: 16403745.

Roberts, E. T., Hatfield, L. A., McWilliams, J. M., Chernew, M. E., Done, N., Gerovich, S., Gilstrap, L., and Mehrotra, A. (2018a). Changes in hospital utilization three years into Maryland's global budget program for rural hospitals. *Health Affairs*, 37(4):644–653.

Roberts, E. T., McWilliams, J. M., Hatfield, L. A., Gerovich, S., Chernew, M. E., Gilstrap, L. G., and Mehrotra, A. (2018b). Changes in health care use associated with the introduction of hospital global budgets in Maryland. *JAMA Internal Medicine*, 178(2):260–268.

Roberts, E. T., Mehrotra, A., and Chernew, M. E. (2018c). Maryland's hospital global budget program. *JAMA*, 320(19):2040–2040.

Sharfstein, J. M., Stuart, E. A., and Antos, J. (2018a). Global budgets in Maryland: Assessing results to date. *JAMA*, 319(24):2475–2476.

Sharfstein, J. M., Stuart, E. A., and Antos, J. (2018b). Maryland's all-payer health reform—a promising work in progress. *JAMA Internal Medicine*, 178(2):269–270.

Skeen, B. (2021). private communication.

Sommers, A. S., White, C., and Ginsburg, P. R. (2012). Addressing hospital pricing leverage through regulation: State rate setting. *NIHCR Policy Analysis*, 9.

Sorensen, A. T. (2003). Insurer-hospital bargaining: Negotiated discounts in post-deregulation Connecticut. *The Journal of Industrial Economics*, 51(4):469–490.

Taylor, J. B. (1980). Aggregate dynamics and staggered contracts. *Journal of Political Economy*, 88(1):1–23.

Wayback Machine (2021). The Health Plan: Strategic partners. June 23, 2021.

Weber, E., Floyd, E., Kim, Y., and White, C. (2019). Peering behind the veil: Trends in types of contracts between private health plans and hospitals. *Medical Care Research and Review*.

Whaley, C. M., Briscombe, B., Kerber, R., O'Neill, B., and Kofner, A. (2022). *Prices Paid to Hospitals by Private Health Plans: Findings from Round 4 of an Employer-Led Transparency Initiative*. RAND Corporation, Santa Monica, CA.

Yürükoğlu, A. (2022). Empirical models of bargaining with externalities in IO and trade. In Karagözoğlu, E. and Hyndman, K. B., editors, *Bargaining: Current Research and Future Directions*, pages 227–247. Springer International Publishing, Cham.

A Additional Tables and Figures

Variable	Mean	Min	P50	Max	% Missing
	Panel C: Contract Dates — DCL				
Contract Date	07/17/2005	01/01/1985	01/01/2008	08/01/2015	86.9
Expiration Date	11/29/2014	07/31/2009	09/30/2014	12/31/2022	95.4
Submission Date	04/28/2011	05/01/2000	07/22/2011	07/08/2015	90.5
	Panel D: Contract Dates — DCL (Modeled Insurers)				
Contract Date	04/27/2006	10/01/1992	05/02/2008	08/01/2015	71
Expiration Date	11/25/2014	07/31/2009	09/30/2014	12/31/2022	88.1
Submission Date	03/14/2011	05/01/2000	07/22/2011	07/08/2015	78.3

Table 8: Descriptive statistics for reported contract date information across all years. Contract expiration dates include occasional dates on DC reports, but do not include dates for auto-renew contracts.

Variable	Mean	SD	Min	P05	P25	P50	P75	P95	Max	% Missing
	Panel E: Contract Scale — FY 2011+ (2434 Obs.), Inpatient									
Discharges	276.2	562.1	0	1	17	60	261.5	1336.3	4050	77.9
Discharges (+Impute)	80.2	285.1	0	2.9	7.2	19.4	44.4	296.8	4050	0
Inpat. Discount (%)	12.6	13.7	0	2	5	7	15	45.2	76.8	0
Discount Amount ($m)	1.6	4	0	0.003	0.1	0.2	0.8	8.7	33.2	78.6
Net Revenue ($m)	5	13.6	0	0.015	0.2	0.9	3.5	21.5	122.9	78.6
Net Revenue ($m, +Impute)	1.4	6.6	0	0.029	0.1	0.3	0.8	4.1	122.9	0.8
Cost ($m)	2.6	6.9	0	0.006	0.1	0.5	1.7	11.7	65	78.6
Cost (+Impute, $m)	0.7	3.4	0	0.016	0.038	0.1	0.4	2.2	65	1.5
Charge/Discharge ($100s)	196.5	88.4	25.5	84.3	127.9	177.8	255.3	360.1	566.2	78.6
Cost/Discharge ($100s)	74.8	33.1	11.1	31.1	51.3	67	101.3	132.6	197.9	78.6
	Panel F: Contract Scale — FY 2011+ (2434 Obs.), Outpatient									
Visits (100s)	111.9	208.5	0	0.1	8.8	32.2	124.2	495	1388.6	77.9
Visits (100s, +Impute)	35.9	107.6	0	1.5	4.6	9	20.4	145.5	1388.6	0
Outpat. Discount (%)	10.6	9.5	0	3	5	7	13	30.3	85.2	0
Discount Amount ($m)	2.4	4.5	0	0.002	0.1	0.4	2	12.8	26.9	78.2
Net Revenue ($m)	9.1	17.1	0	0.014	1	2.6	9.2	41	138.7	78.2
Net Revenue ($m, +Impute)	2.7	8.7	0	0.1	0.3	0.7	1.6	10.2	138.7	0
Cost ($m)	4.4	8	0	0.006	0.4	1.2	4.6	22.8	53.9	78.2
Cost ($m, +Impute)	1.3	4.1	0	0.1	0.2	0.3	0.7	5.1	53.9	0.4
Charge/Visit ($100s)	12.5	20.1	1.2	5.2	7.9	10.1	13.2	30.4	449.5	78.3
Cost/Visit ($100s)	4.7	9.3	0.6	2.2	3.2	3.8	4.7	10	211.7	78.3

Table 9: Descriptive statistics for reported (most rows) and reported or imputed (where noted) scale for contracts reported in fiscal year 2011 or later.

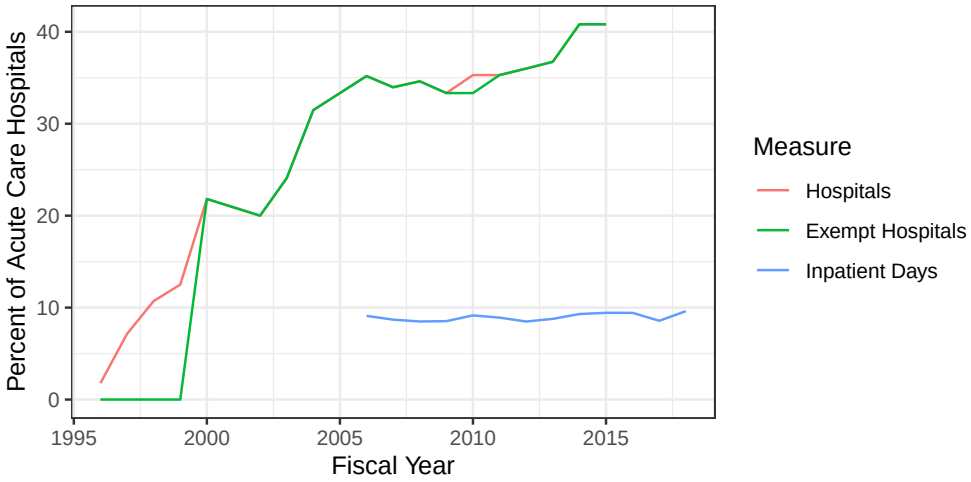


Figure 16: Percentage of West Virginia hospitals that were designated as Critical Access Hospitals (CAHs) by CMS (red), percentage of CAHs that were exempted from the rate regulation system starting in 2000 (green), and the estimated percentage of inpatient days accounted for by CAHs (blue). West Virginia had many CAHs that did not report prices (green line), but by construction those hospitals were small (blue line) and generally far from modeled hospitals.

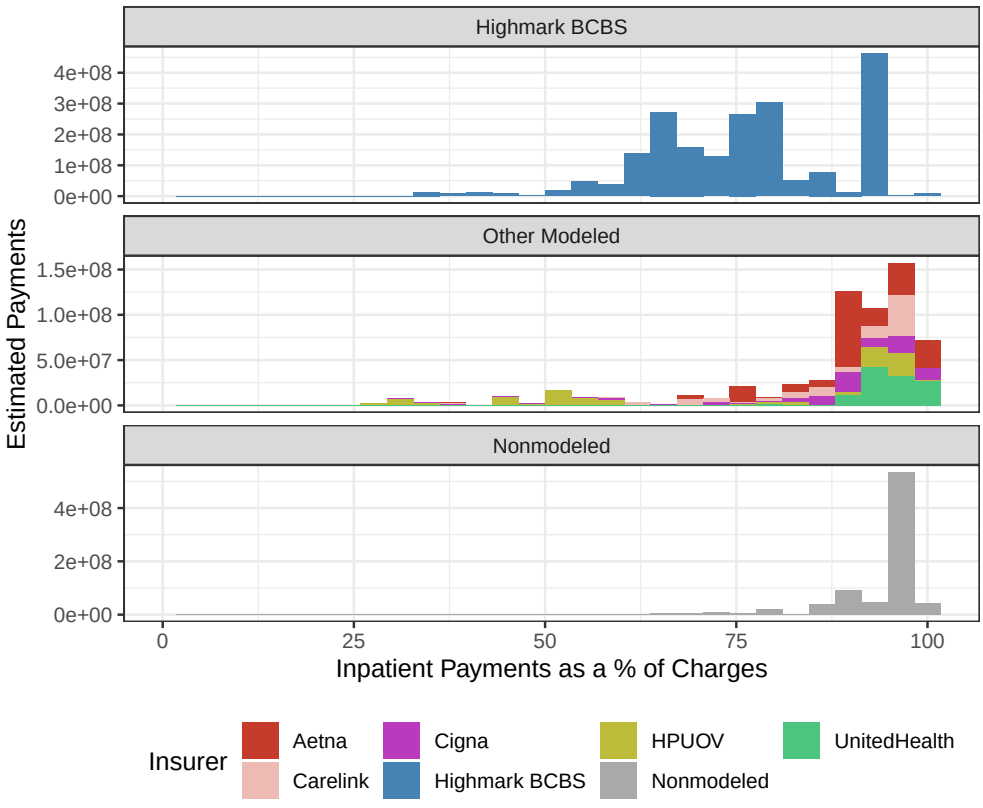


Figure 17: Analog of Figure 3 for outpatient care.

Dependent Variables:	Payment as a % of List Price		Payment as a % of Cost	
Weight:	None	Payments	None	Payments
Model:	(1)	(2)	(3)	(4)
Variables				
Highmark BCBS	-21.39***	-17.32***	-46.04***	-38.33***
	(2.063)	(3.552)	(6.176)	(7.798)
HPUOV	-10.70***	-14.37**	-16.99***	-24.73*
	(2.370)	(6.292)	(5.432)	(12.91)
Aetna	-7.299***	-4.002**	-14.52***	-4.625
	(2.421)	(1.882)	(4.842)	(4.143)
Carelink	-9.639***	-5.631**	-12.83*	-6.303*
	(2.575)	(2.349)	(6.354)	(3.625)
Cigna	-3.338	-2.723	-5.562	-0.1479
	(2.612)	(2.647)	(5.139)	(4.777)
Fixed-effects				
Hospital	Yes	Yes	Yes	Yes
FY	Yes	Yes	Yes	Yes
Fit statistics				
Observations	2,434	2,396	2,396	2,396
R^2	0.57937	0.77396	0.69120	0.80935
Within R^2	0.47903	0.63007	0.24474	0.54058

Clustered (Hospital) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 3: Coefficients on modeled insurers in the payment regressions represented in Equation (1) below for inpatient care for payment rates as a fraction of list prices (left) and reported cost (right). Coefficients are expressed relative to UnitedHealth. Coefficients on nonmodeled insurers are omitted for space. Appendix Table 10 presents the analogous table for outpatient care.

All	UnitedHealth	Highmark BCBS	Aetna	Carelink	HPUOV	Cigna	Nonmodeled
43.3%	100%	5.6%	89.2%	74.5%	100%	100%	99.8%

Table 4: Estimated percentage of inpatient payments accounted for by auto-renew contracts by insurer. Auto-renew contrats were rare for Highmark BCBS, the largest insurer, and more common for smaller insurers.

Dependent Variable:	Any Change					
	Inpatient			Outpatient		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\Delta^{(1)}$	0.2661**			0.2687*		
	(0.1043)			(0.1450)		
$\Delta^{(2)}$		0.1502**			0.1521*	
		(0.0645)			(0.0914)	
$\Delta^{(3)}$			0.1839***			0.1395*
			(0.0510)			(0.0720)
Fixed-effects						
Insurer	Yes	Yes	Yes	Yes	Yes	Yes
Hospital	Yes	Yes	Yes	Yes	Yes	Yes
FY	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	2,813	2,554	2,225	2,813	2,554	2,225
R^2	0.14927	0.18172	0.18753	0.14819	0.18117	0.18532
Within R^2	0.00327	0.00221	0.00439	0.00201	0.00154	0.00168

Clustered (Insurer) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 5: Regression of the existence of changes to previous-year auto-renew share of charges contracts on log list prices over the previous one ($\Delta^{(1)}$), two ($\Delta^{(2)}$), or three ($\Delta^{(3)}$) years. Increases in list prices are consistently associated with contract changes after controlling for hospital, insurer, and fiscal year fixed effects. Results with heterogeneity between list price increases and decreases are available in Table 13 (Page 44).

MCO	Prospective	Share of Charges
All	46.74	53.26
Modeled MCOs	60.20	39.80
Highmark BCBS	72.27	27.73
HPUOV	56.24	43.76
Other Modeled	13.14	86.86
Nonmodeled	3.03	96.97

Table 6: The estimated share of inpatient payments by benchmark type for fiscal years 2011–16. Prospective contracts were common, especially for Highmark BCBS.

Variable	Mean	SD	Min	P05	P25	P50	P75	P95	Max	% Missing
	Panel A: Descriptive Statistics — DCL (4717 Obs.)									
Inpat. Discount (%)	12	13.7	0	0	5	7	15	43.6	96	0
Outpat. Discount (%)	10.9	10.2	0	2	5	7	13.6	32.5	100	0
	Panel B: Descriptive Statistics — DCL (Modeled Insurers, 1762 Obs.)									
Inpat. Discount (%)	16.5	16.7	0	0	5	10	23	55.5	78.7	0
Outpat. Discount (%)	14	11.5	0	2	5	10	17.8	39.7	63.5	0

Table 7: Descriptive statistics for reported discounts for all insurers (top panel) and modeled insurers (bottom panel). The extreme high discounts for nonmodeled insurers reflect very small contracts.

Dependent Variables:	Payment as a % of List Price		Payment as a % of Cost	
Weight:	None	Payments	None	Payments
Model:	(1)	(2)	(3)	(4)
Variables				
Highmark BCBS	-12.69***	-13.50***	-19.37***	-24.10***
	(1.415)	(2.119)	(5.508)	(5.119)
HPUOV	-7.735***	-15.82***	-7.494**	-23.48***
	(1.911)	(5.105)	(3.121)	(6.012)
Aetna	-5.906***	-5.996***	-8.404**	-8.551**
	(1.772)	(1.743)	(3.383)	(3.722)
Carelink	-6.760***	-6.322**	-6.423**	-4.639
	(2.104)	(2.497)	(2.790)	(4.233)
Cigna	-2.114*	-0.7340	-0.3319	2.341
	(1.225)	(1.949)	(1.392)	(4.903)
Fixed-effects				
Hospital	Yes	Yes	Yes	Yes
FY	Yes	Yes	Yes	Yes
Fit statistics				
Observations	2,434	2,424	2,424	2,424
R^2	0.60458	0.77758	0.75014	0.83548
Within R^2	0.48802	0.60303	0.10963	0.30561

Clustered (Hospital) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 10: Equivalent of Table 3 but for outpatient care.

MCO	CAMC		Other Hospital	
	Prospective	Share of Charges	Prospective	Share of Charges
All	0.00	100.00	58.10	41.90
Modeled MCOs	0.00	100.00	76.61	23.39
Highmark BCBS	0.00	100.00	91.98	8.02
HPUOV	0.00	100.00	59.44	40.56
Other Modeled	0.00	100.00	17.49	82.51
Nonmodeled	0.00	100.00	3.50	96.50

Table 11: The estimated share of inpatient CAMC (left) and other hospital (right) payments by benchmark type for fiscal years 2011–16. CAMC was the largest hospital in West Virginia and received share of charges payments from even Highmark BCBS.

Weight	Payor	Prospective		Share-of-Charges	
		Auto-Renew	Expires	Auto-Renew	Expires
Payments (Inpatient)	Total	6.24	40.50	37.09	16.17
Payments (Inpatient)	Non-BCBS	10.69		85.88	3.43
Payments (Inpatient)	BCBS	3.11	69.01	2.75	25.14
Payments (Outpatient)	Total	9.65	40.47	37.76	12.12
Payments (Outpatient)	Non-BCBS	12.79	0.18	85.18	1.85
Payments (Outpatient)	BCBS	7.45	68.80	4.41	19.34
Contract-Years (Inpatient)	Total	6.33	6.50	85.58	1.59
Contract-Years (Inpatient)	Non-BCBS	6.17		93.55	0.28
Contract-Years (Inpatient)	BCBS	7.76	66.81	11.64	13.79
Contract-Years (Outpatient)	Total	6.37	6.71	85.54	1.38
Contract-Years (Outpatient)	Non-BCBS	6.04	0.05	93.69	0.23
Contract-Years (Outpatient)	BCBS	9.48	68.53	9.91	12.07

Table 12: Percentage of payments and contract years by expiration type and inferred contract benchmark, where BCBS includes non-Highmark BCBS. Share of charges contracts were likely benchmarked to hospital list prices. Prospective contracts were likely benchmarked to something else, most typically based on Medicare diagnosis weights.

Dependent Variable:	Any Change					
	Inpatient			Outpatient		
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$\{\Delta^{(1)}\}_-$	0.1897			-1.406*		
	(0.6355)			(0.7866)		
$\{\Delta^{(1)}\}_+$	0.2720**			0.4432***		
	(0.1188)			(0.1304)		
$\{\Delta^{(2)}\}_-$		-2.604**			-0.9289*	
		(1.132)			(0.4764)	
$\{\Delta^{(2)}\}_+$		0.2476***			0.2282**	
		(0.0745)			(0.1017)	
$\{\Delta^{(3)}\}_-$			-119.1			
			(287.8)			
$\{\Delta^{(3)}\}_+$			0.1959***			0.1395*
			(0.0686)			(0.0720)
Fixed-effects						
Insurer	Yes	Yes	Yes	Yes	Yes	Yes
Hospital	Yes	Yes	Yes	Yes	Yes	Yes
FY	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	2,813	2,554	2,225	2,813	2,554	2,225
R^2	0.14928	0.18381	0.18758	0.15010	0.18196	0.18532
Within R^2	0.00327	0.00476	0.00445	0.00424	0.00251	0.00168

Clustered (Insurer) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 13: A version of Table 5 (Page 41) that includes heterogeneity between relative increases in list prices for list price reductions ($\{\ \Delta\}_- = \min\{\Delta, 0\}$) and list price increases ($\{\Delta\}_+ = \max\{\Delta, 0\}$). When list prices increased, larger list price increases (increases in $\{\Delta\}_+$) were associated with auto-renew contract changes. When list prices decreased, there is some indication that larger decreases (decreases in $\{\Delta\}_-$) were associated with contract changes.

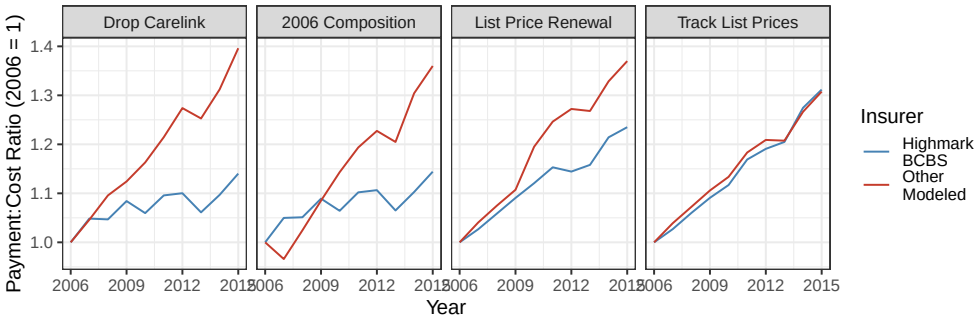


Figure 18: Analog to Figure 12 but decomposing the difference in payment-to-cost ratios by (from left to right) removing Carelink, which was acquired at the end of 2014; consistently applying the 2006 hospital–insurer care composition; imposing that prices increase proportionally to list prices outside of years with a new inferred negotiation; and imposing that new negotiations update prices proportionally to list prices. The remaining difference is any correlation of care composition with list price increases.

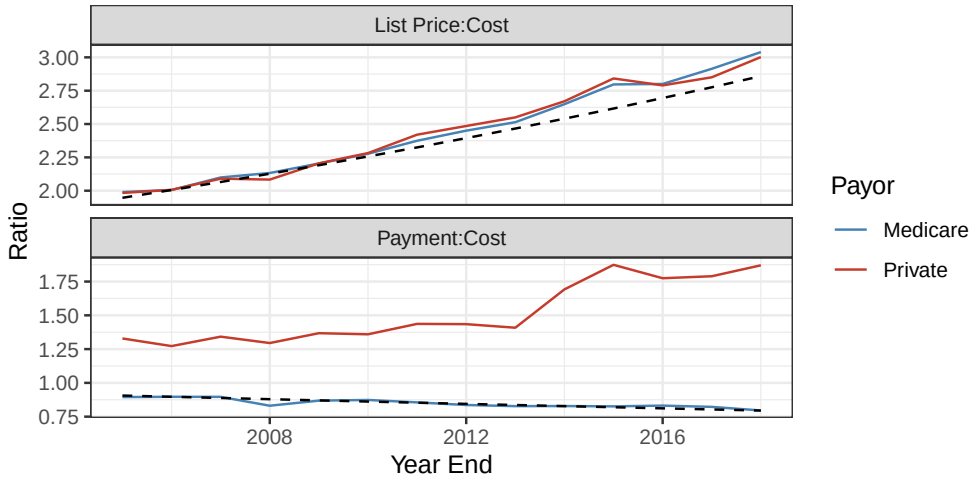


Figure 19: The ratio of list price charges (top) and real payments (bottom) to reported costs by Medicare (red) and private payors (blue) for West Virginia hospitals by year from hospital reports. Dashed lines represent Medicare 2006 values extrapolated based on 103% and 99% annual changes, respectively.