Dynamic Bargaining between Hospitals and Insurers

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Motivation: Medicare Benchmark Dynamic Effect

- Massive debate on Medicare rate dynamics (AHA, 2022)
- Medicare rates have overlooked effect on \$400b+ private spend
  - Large chunk of payments **benchmarked** to Medicare
  - E.g. "insurer + patient will pay 150% of amount Medicare would pay"

How would private insurer spending have changed if Medicare benchmark rates went up faster?

Preview: Medicare Has Real Effects on Private Spend

1. Framework: multiyear, staggered, & time discounted $\Rightarrow$ LR effects
   - Conventional wisdom of static or short-term contracts $\Rightarrow$ no effect
   - Simultaneous contracts $\Rightarrow$ long-run **neutral** in NPV terms
   - Staggering + time discounting $\Rightarrow$ no long-run NPV neutrality
2. Data: contracts are multiyear & staggered
   - Public record data on hospital–insurer contracts from West Virginia
   - One "contract:" an agreement from start to end
   - Potential for real effects: agreements 3+ years and staggered
3. Structural model: time discounting β & real effects
   - Dynamic extension of Ho and Lee (2017), estimate annual $\hat{\beta} = 0.899$
   - Counterfactual: rough offset of Medicare depreciation relative to reported costs
   - Static model would miss real effects (year-nine extrapolated effect of \$5b), but need to capture forward-looking response (payments in one year go down)

Forward-Looking Response to Future Increase

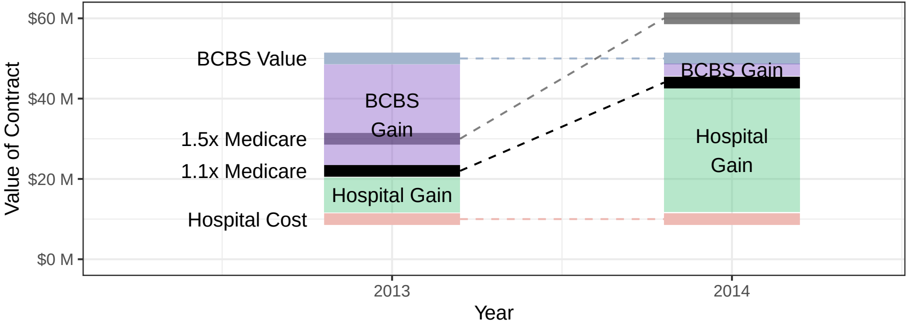


Figure: Illustration of forward-looking response: Large General Hospital negotiates a two-year Medicare-benchmarked contract with BCBS in 2013. The response to a future benchmark-driven payment increase (Δ) is a starting payment decrease ($\beta\Delta$).

Staggering + Discounting Breaks Market NPV Neutrality

- Two hospitals form two-year contracts, $P_{New} = \$30m - \beta\Delta$, $P_{Old} = \$30m + \Delta$
- Simultaneous contracts: path changes, but market NPV neutrality in long run

$$P_{New} + P_{New} + \beta(P_{Old} + P_{Old}) = \$60m(1+\beta) - 2\beta\Delta + \beta 2\Delta$$

- Staggered contracts: no NPV neutrality in long run

$$P_{New} + P_{Old} + \beta(P_{Old} + P_{New}) = \$60m(1+\beta) + \Delta(1-\beta^2)$$

  - Advanced announcements add subtlety, but same sign from competitive interactions

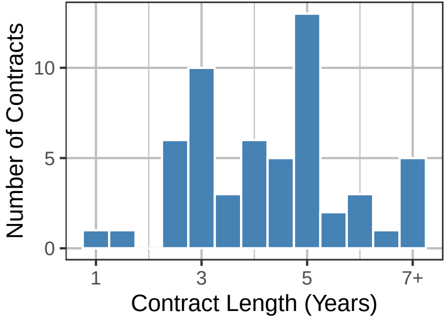
- Next: Are contracts multiyear & staggered? Then, do negotiators time-discount?

Are Contracts Multiyear and Staggered? Novel Data to See

Public record contract report panel

- Data from 2006–15 West Virginia
- Scans of annual hospital reports Other Data
- Use for payment rates, networks, benchmarks, timing, ...

Multiyear and formed at different times



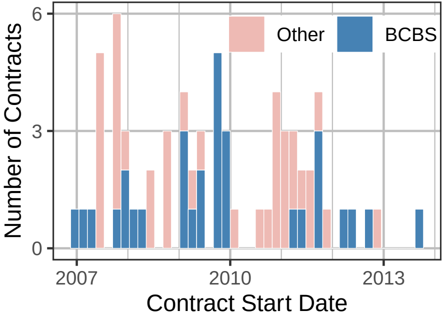


Figure: Contracts were multiyear for BCBS ▸ and others and were staggered, leaving scope for benchmark dynamic effects. Next: do negotiators discount future profits?

Model Overview

- Ho and Lee (2017) + Staggered Contracts
  - Consumers choose insurance plans, then hospitals if sick
  - Insurers and hospitals negotiate over benchmark multiple
- Key parameter: annual discounting rate β
- Extend static Nash with Kalai model (Dorn, 2025)

Estimation Overview

1. Hospital demand: BCBS choices
2. Insurer demand: insurer choice within ACA rating area
3. Bargaining: predictable benchmark choice (hospital/insurer IV)
4. Benchmark dynamics: take from data ▸ More

Estimates: Negotiators Are (Mostly) Forward-Looking

Key parameter drives forward-looking offset: discounting β

Parameter	Myopic	Forward-Looking
β	0	0.899***
	$(\cdot)$	(0.03)

*p<0.1; **p<0.05; ***p<0.01

GFT Shares · Bargaining Weights · Other Parameters · Other Models · Moment

Counterfactual: Medicare Rate Increase

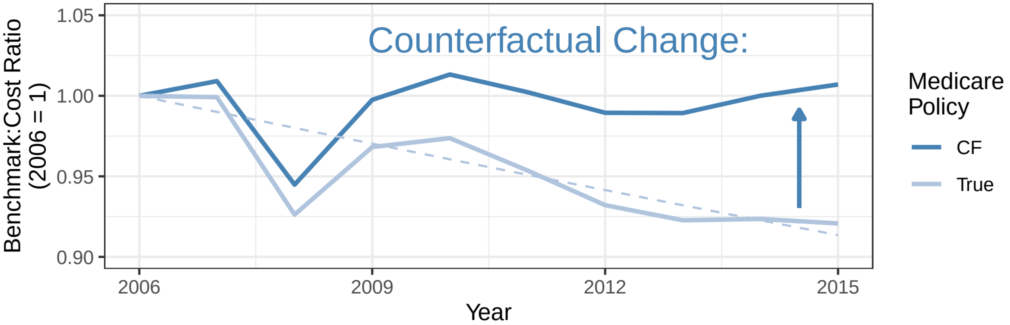


Figure: Medicare payments decreased relative to reported costs by $\approx$ one percentage point annually (dashed line). How would one ppt annual increases have affected spending? ▸ Payments ▸ Frequency

Counterfactual and Core Mechanisms

- Surprise Medicare announcement at end of 2006
  - Counterfactual Medicare will counteract depreciation relative to hospital reported costs
  - One percentage point annual price increase going forward (relative to actual)
  - Will hold expiration and benchmark choice (+ choice set) fixed Details
- Conventional static view: no effect
- **Mechanical**: future prices increase
- **Quantify**: starting prices decrease ($\beta > 0$ but $\beta < 1$)

Counterfactual: Meaningful Effects + Meaningful Response

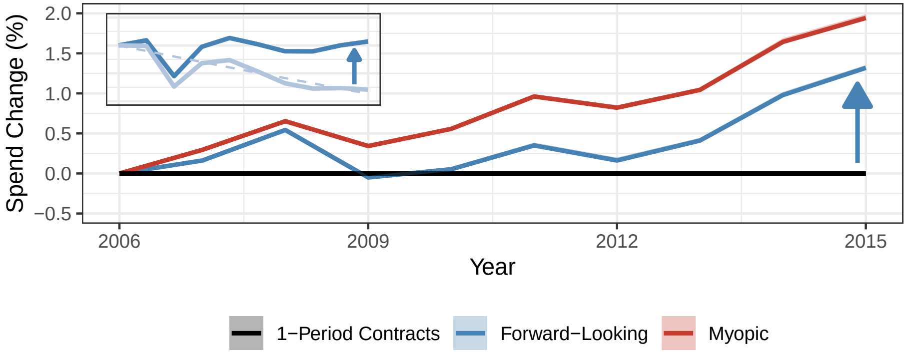


Figure: Counterfactual 2015 payments increase by an estimated 1.319%. Missing dynamic response would overestimate effect on spending by 45%+.

45%+ Overestimate | Construction (Time Series-Adjacent)
Decomposition | Timing | By Insurer | By Hospital | $\beta = 0.97$ | Premiums | Drop CAMC | List Price Caps | Limitations

This Paper

- Benchmark dynamics can have real effects on spending
  - Raw data: contracts are multiyear and staggered
  - Need a dynamic model, or else miss real effects
- These firms are not dummies
  - Structural model: negotiators value, but discount, future profits
  - Need forward-looking response, or else miss unexpected consequences
- Broader work: when do contract dynamics matter?

Feedback welcome! `jdorn@upenn.edu`

Bibliography I

AHA. Fact sheet: Majority of hospital payments dependent on Medicare or Medicaid, 2022.

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

Jacob Dorn. The Nash-in-Kalai model for estimation with dynamic bargaining and nontransferable utility, 2025.

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

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

Bibliography II

Katherine Ho. The welfare effects of restricted hospital choice in the US medical care market. *Journal of Applied Econometrics*, 21(7):1039–1079, 2006.

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

William Thomson. Cooperative models of bargaining. In *Handbook of Game Theory with Economic Applications, Volume 2*, volume 2 of *Handbook of Game Theory with Economic Applications*, chapter 35, pages 1237–1284. Elsevier, 1994.

Ellerie Weber, Eric Floyd, Youngran Kim, and Chapin White. Peering behind the veil: Trends in types of contracts between private health plans and hospitals. *Medical Care Research and Review*, 2019.

(Non)Neutrality, Formalized

Proposition 1

Suppose firms 1 and 2 reach two-period agreements to target a time-weighted average payment P^*. Let t_0 be a period in which an agreement is reached, let $k \geq 0$, and let the inflation rate be ϕ. Then if contracting is simultaneous, $\sum_{t=t_0}^{t_0+1+2k} \beta^t (p_t^{(1)} + p_t^{(2)}) = \sum_{t=t_0}^{t_0+1+2k} \beta^t 2P^*$. *But if contracting is alternating, then* $\sum_{t=t_0}^{t_0+1+2k} \beta^t (p_t^{(1)} + p_t^{(2)}) = \sum_{t=t_0}^{t_0+1+2k} \beta^t \left(2 + \frac{(1-\beta)\phi}{1+\beta(1+\phi)}\right) P^*$

Example West Virginia Contract Report Scan

Discount Contract List

Budgeted Discounts for FY 2016

Hospital Name Charleston Surgical Hospital

	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%	[redacted]	[redacted]
3	Cigna (auto-renewal)	18 00%	15 00%	[redacted]	[redacted]
4	4Most (auto-renewal)	5 00%	5 00%	[redacted]	[redacted]
5	MDI (auto-renewal)	15 00%	10 00%	[redacted]	[redacted]
6				[redacted]	[redacted]

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

Figure: Charleston Surgical Hospital report, fiscal year 2016. Mountain State/Highmark BCBS generally used Medicare as a benchmark (non-round numbers) while other smaller insurers generally used list prices. Was WV Unrepresentative?

West Virginia Rate Regulation

- From 1993-2016, West Virginia:
    1. Capped hospital charge increases
    2. Required all hospital–insurer contracts to cover average costs
    3. Approved hospital–insurer contracts and made them public records
- Does this make West Virginia unrepresentative?
    - 1 & 2: Caps "too generous" as of Murray and Berenson (2015) and contracts easily covered costs, though may have been associated with lower list prices and more outpatient care
    - 3: disclosure unusual at time — may be more representative of where the US is going

Network Strength

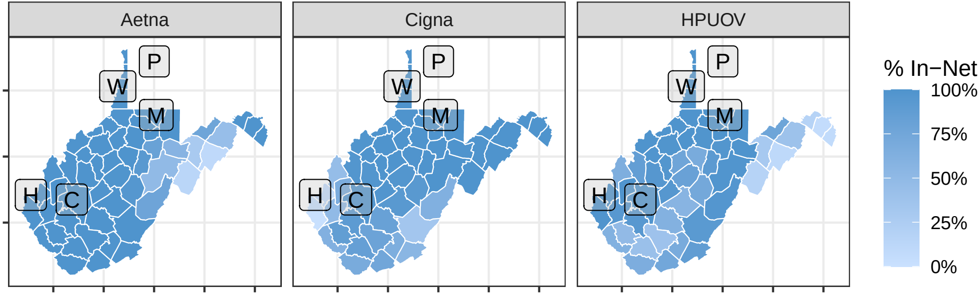


Figure: Network quality (large cities overlaid), measured as a percentage of 2016 inpatient discharges in a given insurer's 2015 network.

Histogram: Negotiated Payments, as a Fraction of Charges

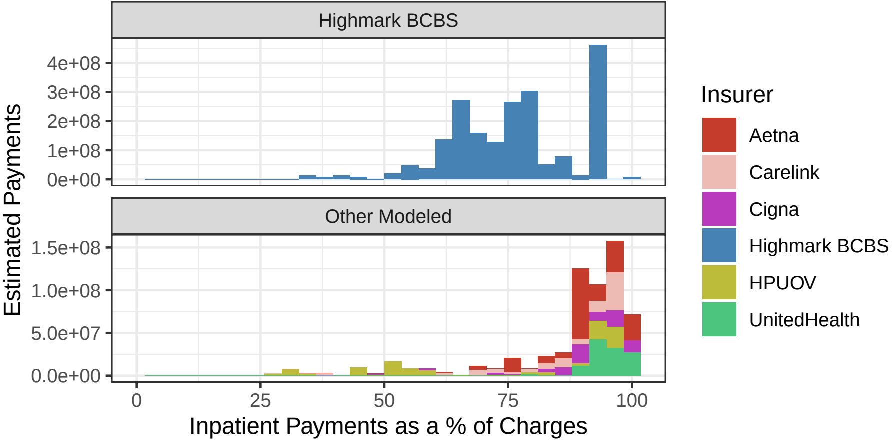


Figure: Bars are weighted by estimated payments.

Key Other Data Sources

- Hospital inpatient discharges
  - Demographics, diagnosis, major insurance, ... (2016)
  - Use for hospital demand and insurer demand
- State fully insured premiums & sales
  - Annual data by insurer (2006-16)
  - Use for pre-2016 insurer demand

Non-BCBS Contract Lengths (Auto-Renew)

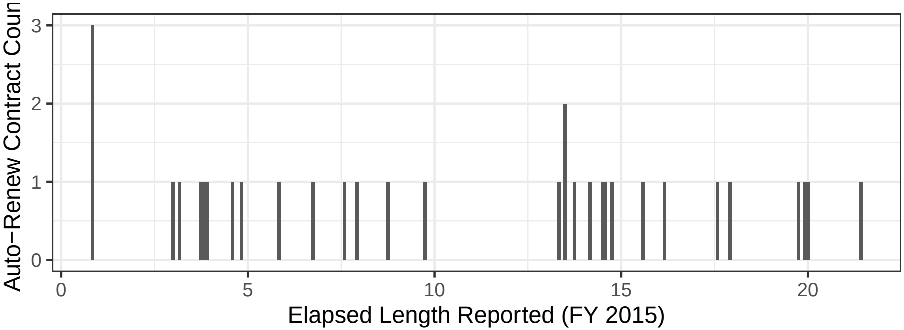


Figure: Retrospective length for non-BCBS modeled insurer auto-renew contracts (where available) as of fiscal year 2015.

Benchmark Price vs. Payment Increases

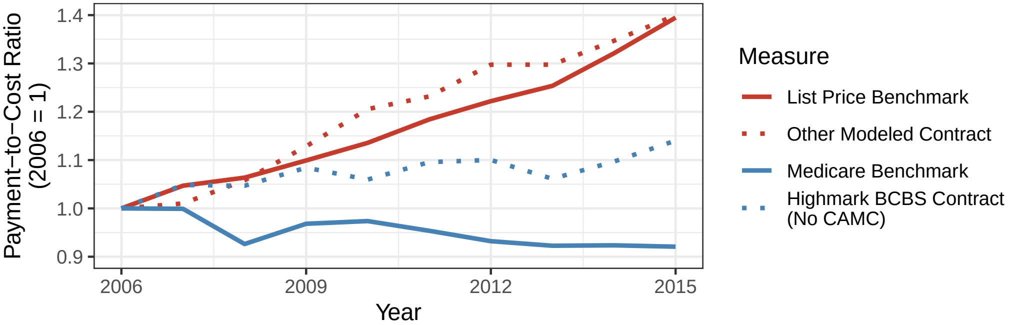


Figure: List prices went up quickly while Medicare deflated slightly relative to costs. Medium-sized insurer (list price-based) payments went up quickly while Blue Cross (Medicare-based) payments roughly tracked hospital costs. Decomposition

Decomposition of BCBS-Other Insurer Divergence

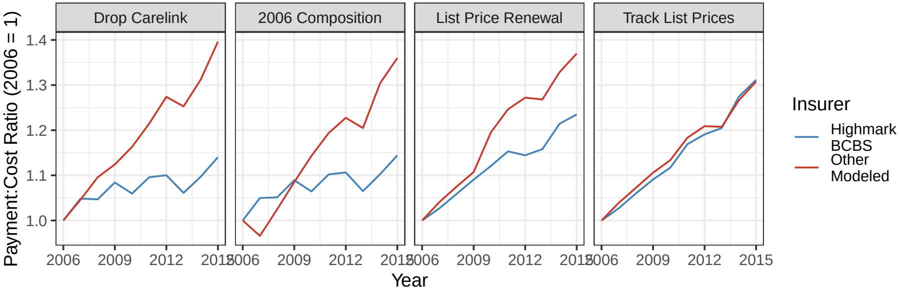


Figure: Decomposition of BCBS-other modeled insurer payment divergence by standardizing (i) insurers and (ii) insurer-hospital quantities across years, (iii) renewing prices proportionally to list prices, and (iv) renegotiating prices proportionally to list prices. The divergence between BCBS and the other insurers is largely driven by the lower renewing prices (iii) and the slower increases in starting prices (iv).

Estimated Benchmark Frequency

Insurer	Medicare	List Prices
All	46.74	53.26
Modeled	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: Estimated percentage of 2011-16 projected inpatient payments classified as Medicare-benchmarked and list price-benchmarked. Algorithm

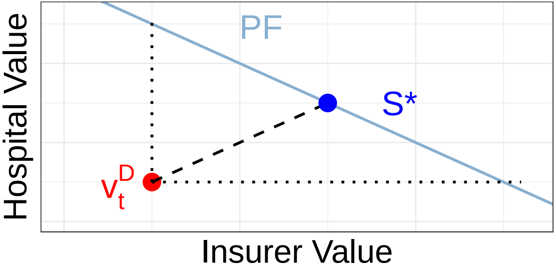
Benchmark Inference Algorithm

- Share-of-charges: same reported share of charges (up to 0.01%) in consecutive years
- Prospective (likely Medicare-based): anything else
- Possible overestimate: include per diems, any non-Medicare DRG formulas
- Possible underestimate: more charge usage than other settings (Cooper et al., 2019; Weber et al., 2019)

What/Why is this Kalai Proportional Bargaining?

$$\frac{GFT_t^{Ins}(p^*_{Kalai})}{GFT_t^{Hosp}(p^*_{Kalai})} = \frac{\tau_{ij}}{1-\tau_{ij}}$$

$$\frac{GFT_t^{Ins}(p^*_{Nash})}{GFT_t^{Hosp}(p^*_{Nash})} = \frac{\tau_{ij}}{1-\tau_{ij}} \underbrace{\frac{-V_t^{Ins}(p^*_{Nash})'}{V_t^{Hosp}(p^*_{Nash})'}}_{=1 \text{ if TU}}$$



- Static view: "central role in the theory" (Thomson, 1994) — axioms, intuition, and data
- Generalizes Nash for transferable utility models like Ho and Lee (2017)

Step 1: Hospital Demand

- Notation based on on Ho (2006) for hospital h and diagnosis ℓ:

$$u_{i,h,\ell}^{Hosp} = \delta_{h,\ell}^{Hosp} + \nu_{i,h,\ell}\rho + \varepsilon_{i,h,\ell}$$

  - $\nu_{i,h,\ell}$: diagnosis-distance interactions

- Estimate logit model with 2016 BCBS (complete network) patients Results

Step 2: Insurer Demand

$$u^{Ins}_{i,j,c} = \gamma_k WTP_{j,k,c} + \tilde{\delta}^{Ins}_{j,m} + \xi_{j,k,c} + \varepsilon_{i,j,c,m}$$

- Individual i of age group k choosing insurer j in county c in rating area m
- Control for premiums with $\tilde{\delta}^{Ins}_{j,m}$ area FEs
- Moment $E[WTP_{j,k,c}\xi_{j,k,c}] = 0$ for each age group k Details Results

Step 3: Bargaining Estimation Becomes Fairly Standard

$$\sum_{t=t_0}^{t^*} \beta^{t-t_0} D_{ijt}^{Hosp} p_{ijt}^* - \sum_{t=t_0}^{t^*} \beta^{t-t_0} \text{Pay}_{NiN,ijt} - \text{Pay}_{IRT} - \text{Pay}_{VC} = \overbrace{\text{``}\omega_{ijt_0}\text{''}}^{\mathbb{E}_{t_0}[\omega]=0}$$

- Moments $\mathbb{E}[\omega Z^\omega]$ and $\mathbb{E}[(\widehat{MedicalLoss} - MLReport)Z^{MLR}]$ Details
  - Z^ω hospital group & insurer dummies, Z^{MLR} insurer dummies, five-year finite horizon
- Approximating $\text{Pay}_{IRT} \to 0$ (ij impasse $\to$ ij disagreement via others' response)

Hospital Demand Sanity Check: Consumers Dislike Travel

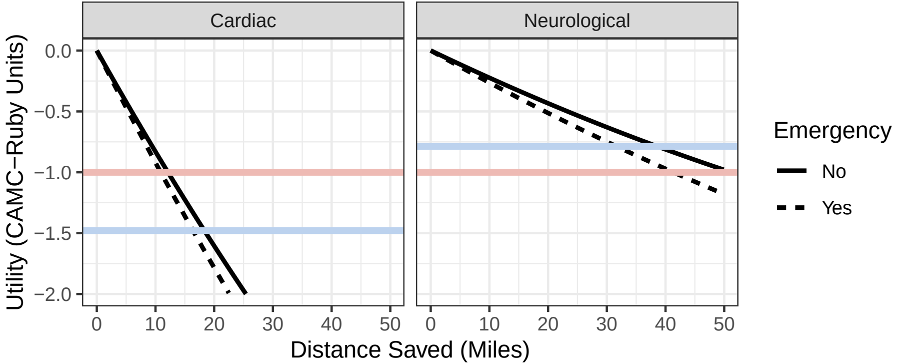


Figure: Consumer cost of travel for cardiac (left) and neurological (right) care in non-emergency (solid) and emergency (dashed) discharges, in CAMC-WVU Ruby units (red line at -1.0). Blue horizontal line is United Hospital-WVU value. Table

Hospital Demand Parameter Estimates

	Dependent variable:					
	choice					
	Cancer	Cardiac	Digestive	Labor	Neurological	Other
	(1)	(2)	(3)	(4)	(5)	(6)
100 Miles	-4.909^{**}	-8.591^{***}	-7.607^{***}	-29.100	-2.306^{***}	-4.836^{***}
	(1.949)	(1.597)	(1.821)	(72.654)	(0.138)	(0.213)
100 Miles x Emergency	-0.409	-0.899^{***}	-1.526^{***}	4.845	-0.398^{***}	-0.677^{***}
	(0.797)	(0.312)	(0.474)	(14.314)	(0.109)	(0.083)
(100 Miles) Squared	1.579^{**}	2.830^{***}	2.295^{***}	6.182	0.690^{***}	1.518^{***}
	(0.644)	(0.550)	(0.550)	(14.056)	(0.054)	(0.068)
Observations	284	2,469	2,048	4,143	1,094	10,053
R^2	0.555	0.577	0.615	0.646	0.497	0.555
Log Likelihood	-286.987	$-2,722.077$	$-2,324.572$	$-3,923.918$	$-1,297.677$	$-12,578.030$
Note:						*p<0.1; **p<0.05; ***p<0.01

Table: Consumer valuation of distance by category in units of going from highest-value (WVU Ruby) to second highest-value (CAMC) hospital. Consumers do not like traveling, especially in non-labor emergencies. They do like flagship hospitals (omitted).

Insurer Demand (2016): Willingness to Pay

	WTP Coefficient				
	γ_{0-17}	γ_{18-44}	γ_{45-64}	γ_{65-74}	γ_{75+}
	26.6***	4.94***	2.76***	2.79***	2.05***
	(2.65)	(0.67)	(0.33)	(0.27)	(0.15)
Note:			$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$		

Table: Coefficients on Willingness to Pay parameters. The smaller coefficients for older groups mainly reflect the larger probability of having a diagnosis, and resulting smaller standard deviation of WTP.

Insurer Demand Estimation Details

- Estimate 2016 BCBS, Aetna, HPUOV sales based on inpatient shares
  - Ensure at least one sale per county, at least 10% of county in outside option
- Iteratively apply outer loop-inner loop strategy to find γ_k
- Outer loop for 2016 demand: take putative United and Cigna FEs given γ_k
  - Inner loop: contraction to match non-United/Cigna sales estimates with $\tilde{\delta}^{Ins}_{j,m} + \xi$
  - Solve for outer loop to match United & Cigna sales
  - Find new γ_k from (population) weighted least squares
- Add pre-2016 insurer FE to fit state-level sales with historical population
  - Assume Carelink had same ξ as Aetna pre-2014 acquisition

Bargaining Estimation Details

- Interpolate calendar years to bargain years via day-weighted average
- τ_{ij}: hospital system (cost) size in 2006
- Optimization in terms of bargain sets $\mathcal{B}$, parameters θ, and now hospital groups i:

$$\hat{\omega}_{ijt_0}(\theta) = \sum_{t=t_0}^{t^*} \beta^{t-t_0} \left(D^{Hosp}_{ijt} p_{ijt} - \widehat{Pay}_{NiN,ijt}(\theta) \right) - \overbrace{\widehat{Pay}_{VC}(\theta)}^{\substack{(2\tau_{ij}-1) r^{Ins}_j \\ \text{by BCBS or not}}}$$

$$\hat{\theta} = \text{argmin} \sum_j \frac{\left(\frac{1}{|\mathcal{B}^{Ins}_j|} \sum_{h,t_0 \in \mathcal{B}^{Ins}_j} \hat{\omega}_{ijt_0}(\theta) \right)^2}{\frac{\sum_{t=0}^{mean(t^*-t_0)} \beta^t}{|\mathcal{B}^{Ins}_j|} \sum_{h,t_0 \in \mathcal{B}^{Ins}_j} \sum_t \beta^{t-t_0} D^{Hosp}_{hjt} p_{hjt}} + 100,000 \left(\frac{1}{6} \sum_{2011 \le t \le 2016} \hat{MLR}_{jt} - MLR_{jt} \right)^2$$

$$+ \sum_i \frac{\left(\frac{1}{|\mathcal{B}^{Hosp}_i|} \sum_{n,t_0 \in \mathcal{B}^{Hosp}_i} \hat{\omega}_{int_0}(\theta) \right)^2}{\frac{\sum_{t=0}^{mean(t^*-t_0)} \beta^t}{|\mathcal{B}^{Hosp}_i|} \sum_{n,t_0 \in \mathcal{B}^{Hosp}_i} \sum_t \beta^{t-t_0} D^{Hosp}_{int} p_{int}}$$

Estimated Gain From Trade Shares

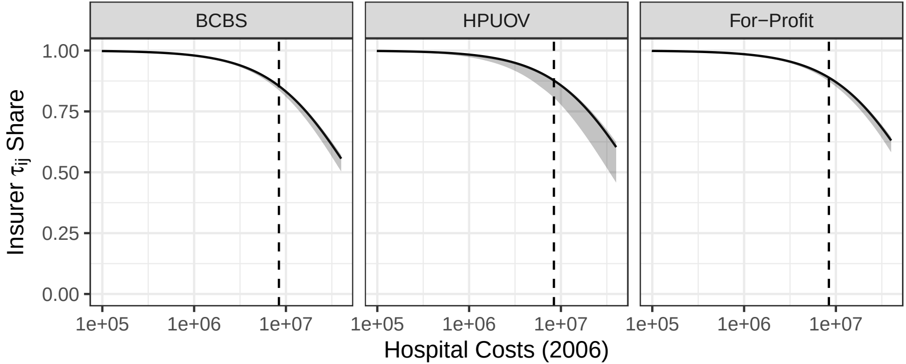


Figure: Estimated percent of gains from trade retained by the insurer under estimated dynamic model. Myopic

Estimated Gain From Trade Shares (Myopic)

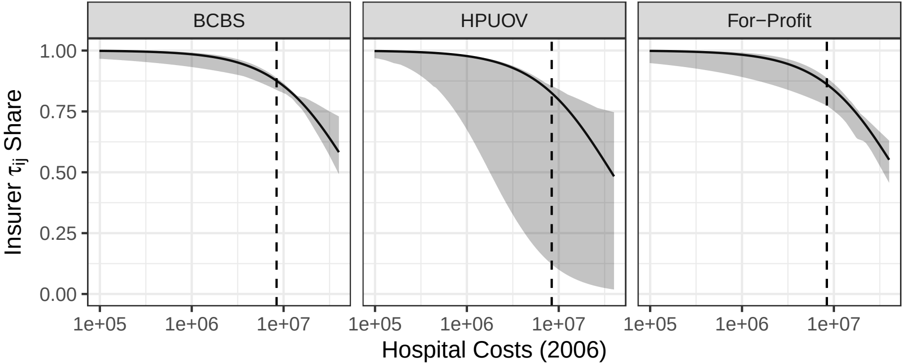


Figure: Estimated percent of gains from trade retained by the insurer under estimated myopic model.

Bargaining Parameters (Table)

	Parameter				
	β	τ_{BCBS}	τ_{HPUOV}	τ_{FP}	$-\tau^{Size}$
Only-2015	$\cdot$	0.487**	-7.54	0.694***	3.354
(Nash/Kalai)	$(\cdot)$	(0.191)	(17.204)	(0.175)	(22.875)
Myopic	$\cdot$	0.876***	0.825***	0.861***	1.037***
(Nash/Kalai)	$(\cdot)$	(0.012)	(0.232)	(0.034)	(0.199)
Forward-Looking	0.899***	0.854***	0.877***	0.889***	0.989***
($Pay_{IRT} = 0$)	(0.03)	(0.006)	(0.026)	(0.005)	(0.028)

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Other Bargaining Results

	Parameter (τ^{Size} Estimated)							
	η_{BCBS}	η_{HPUOV}	η_{Aetna}	$\eta_{UnitedHealth}$	η_{Cigna}	$\eta_{Carelink}$	r^M_{yBCBS}	r^M_{nBCBS}
Only-2015	3657***	3404***	3658***	2008***	4627***	3139***	10000***	9999***
(Nash/Kalai)	(45)	(85)	(116)	(29)	(32)	(39)	(2614)	(1441)
Myopic	4640***	4036***	3659***	3197***	4624***	3139***	10000***	10000***
(Nash/Kalai)	(14)	(650)	(37)	(374)	(26)	(463)	(1444)	(1)
Forward-Looking	4638***	3631***	3660***	3284***	4626***	3140***	9999***	9999***
($Pay_{IRT} = 0$)	(130)	(302)	(37)	(69)	(30)	(45)	(29)	(65)
Data	3600	3356	3554	1999	4635	3114		

Note: *p<0.1; **p<0.05; ***p<0.01

Bargaining Model Robustness Tests

	Parameter				
	β	τ_{BCBS}	τ_{HPUOV}	τ_{FP}	$-\tau^{Size}$
Forward-Looking	0.899***	0.854***	0.877***	0.889***	0.989***
(Baseline)	(0.03)	(0.006)	(0.026)	(0.005)	(0.028)
Forward-Looking	0.714***	0.852***	0.86***	0.685***	.
(No Hosp. Size)	(0.025)	(0.011)	(0.01)	(0.028)	(·)
Forward-Looking	0.925	0.854	0.876	0.89	0.991
(Mean $\sum \beta^t$ normalization)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.497	0.939	0.938	0.942	1.009
(Estimate Hospital Costs)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	1	1	1	1	-0.276
(Hospital Costs * 2)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.931	0.838	0.858	0.875	0.969
(Hospital Costs * 0.9)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	1	0.778	0.781	0.821	0.903
(Hospital Costs * 1/2)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.895	0.834	0.847	0.871	0.913
(Medicare Costs)	(·)	(·)	(·)	(·)	(·)
Note:			*p<0.1; **p<0.05; ***p<0.01		

	Parameter				
	β	τ_{BCBS}	τ_{HPUOV}	τ_{FP}	$-\tau^{Size}$
Forward-Looking	0.826	0.864	0.874	0.891	0.892
(η from MLR)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.722	0.881	0.905	0.897	0.847
(Inpat. Share GFT Weight)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.99	0.854	0.875	0.881	1
($\beta = 0.99$)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.696	0.001	0.001	0.001	.
(Hospital TIOLI)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.817	0.5	0.5	0.5	.
($\tau = 0.5$)	(·)	(·)	(·)	(·)	(·)
Forward-Looking	0.52	0.999	0.999	0.999	.
(MCO TIOLI)	(·)	(·)	(·)	(·)	(·)
Myopic	.	0.876***	0.825***	0.861***	1.037***
(Baseline)	(·)	(0.012)	(0.238)	(0.034)	(0.201)
Myopic	.	0.863***	0.845***	0.631***	.
(No Hosp. Size)	(·)	(0.006)	(0.016)	(0.028)	(·)
Note:			*p<0.1; **p<0.05; ***p<0.01		

Figure: Bargaining parameter estimates under alternative modeling assumptions. (Confidence intervals have only been implemented for some models.)

Nash-in-Kalai Moment

$$\mathbb{E}_{t_0}\left[\overbrace{\sum_{t=t_0}^{t^*}\beta^{t-t_0}Pay_{ijt}}^{\text{NPV Payment}}\right]=\mathbb{E}_{t_0}\left[\sum_{t=t_0}^{t^*}\beta^{t-t_0}\overbrace{\text{Pay}_{NiN,ijt}}^{\substack{\text{Static Nash}\\ \text{Flow Payment}}}+\overbrace{\text{Pay}_{NC}+\text{Pay}_{IRT}}^{\substack{\text{Added Multiperiod}\\ \text{Bargaining Terms}}}\right],$$

where Pay_{NC} reflects negotiation costs and Pay_{IRT} reflects the effect of spillovers on impasse profits (show zero in steady state & set to zero in empirical work).

Empirical Model: Ho and Lee (2017) + Dynamics

1. Price benchmarks (Medicare prices and list prices) are updated

2. Hospitals and insurers simultaneously bargain new contracts
   - Contracts can last more than one period — annual discounting rate β
   - Use Kalai solution (Dorn, 2025) to extend static Nash to dynamic model

3. Consumers choose plans and get sick $\Rightarrow$ hospital, insurer demand D^{Hosp}, D^{Ins}

4. Flow profits realized with price externalities — some internalized

$$\pi_j^{Ins} = \underbrace{D_j^{Ins}(\cdot)(\phi_j - \eta_j)}_{\substack{\text{Premium revenue} \\ \text{net of } \eta}} - \underbrace{\sum_{h \in \mathcal{G}_j^{Ins}} D_{hj}^{Hosp}(\cdot) p_{hj}}_{\textbf{Payments to hospitals}} \quad \text{and} \quad \pi_i^{Hosp} = \underbrace{\sum_{n \in \mathcal{G}_i^{Hosp}} D_{in}^{Hosp}(\cdot)(p_{in} - c_i)}_{\substack{\textbf{Payments received} \\ -\text{cost of care}}}$$

Estimation of Empirical Model

Estimation step	Data inputs	Method outputs	Timing	Identification
1. Hospital demand	BCBS inpatient choice	Hospital network WTP (utils)	Static	Observables logit
2. Insurer demand	H demand, sales estimates, Census	Network effect on sales	Static	ACA area FEs
3. Contract bargaining	Multiple years of payments, demand	Discounting β	Dynamic	Benchmarks, Lengths
4. Benchmark	Prices over time	Observed	Implicit	Observed

Adapted and extended based on Ho (2006)

Counterfactual: Faster Medicare Rate Increases

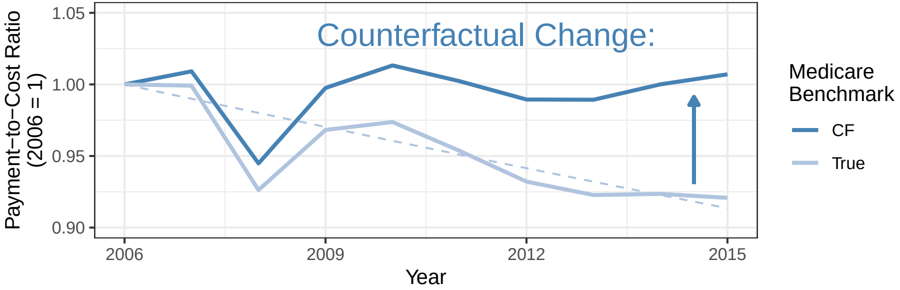


Figure: Medicare payments (light blue) decreased relative to reported costs by roughly one percentage point annually (dashed line). What if Medicare increased rates one percentage point faster each year, relative to actual rates?

Counterfactual Details

- Hold renegotiation timing, benchmark choice, hospital list prices fixed
- Assume all Medicare-based payments increase one ppt faster annually
  - Content: any idiosyncratic BCBS DRG weights increase proportionally to Medicare
- Hold fixed small insurer prices (conservative)
- Main analysis holds fixed premiums (conservative)
  - Estimate downstream response from calibrated Nash-Bertrand model

A Myopic Model Would Overestimate Effects Substantially

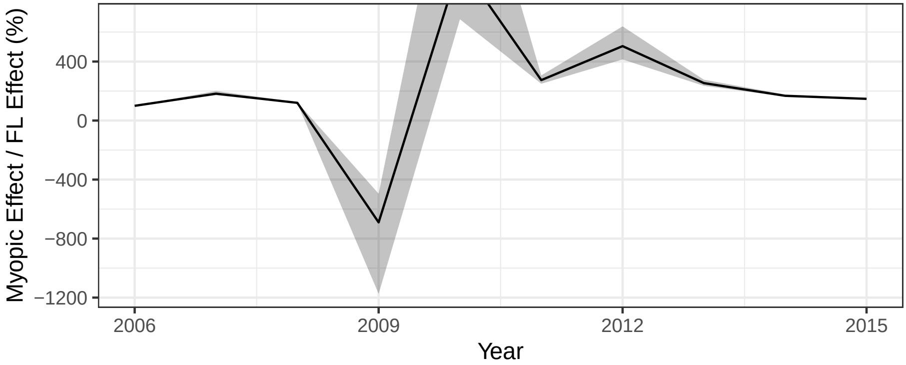


Figure: Ratio of estimated effects under myopic model to estimated effects under dynamic forward-looking model.

Counterfactual Construction (Time Series-Adjacent)

I estimate a finite horizon model with $T = 5$ periods

$$\mathbb{E}_t\left[\sum_{t=t_0}^{t^*} \beta D_{ijt}^{H} \frac{p_{it}^{B_{ijt}}}{p_{it_0}^{B_{ijt}}}\right] p_{ij,t_0}^{R} = \sum_{t=t_0}^{t^*} \mathbb{E}_{t_0}[\gamma_{ijt_0,hnt}\ p_{hnt}] + C_{ijt_0}$$

$$y_t \equiv \left(\mathbf{p}_{t-1}{}^T \quad \mathbf{p}_t{}^T \quad E_t[\mathbf{p}_{t+1}{}^T] \quad \ldots \quad E_t[\mathbf{p}_{t+4}{}^T]\right)^T$$

$$\Gamma_{0,t} y_t = \Gamma_{1,t} y_{t-1} + C_t + \Psi_t \varepsilon_t.$$

- Changing benchmark inflation $\Leftrightarrow$ changing Γ_1 matrices
- Estimate $\hat{\Gamma}_0$ and realized $\hat{\Gamma}_1 \Rightarrow$ realized prices in terms of $C + \varepsilon$
  - Currently set $\Psi_n = I$, recover $\widehat{C + \varepsilon}$ to match realized prices, and change Γ_1

Counterfactual: Decomposition

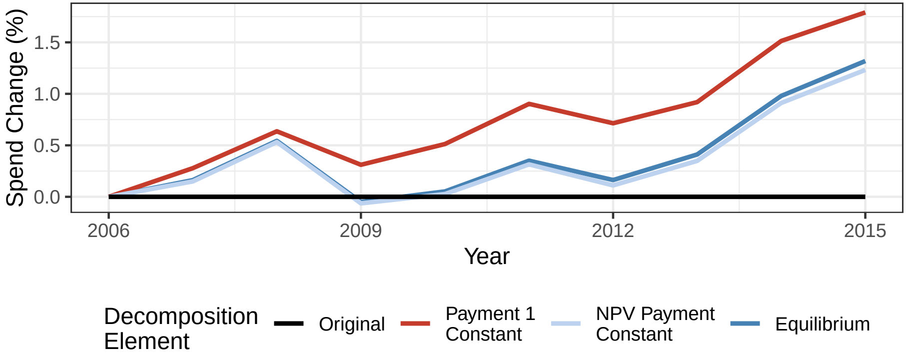


Figure: Decomposition of estimated direct effects under myopia (blue), direct effects with forward-looking firms (pink), and equilibrium effects (red).

Contracts Generally Renewed in Late Years

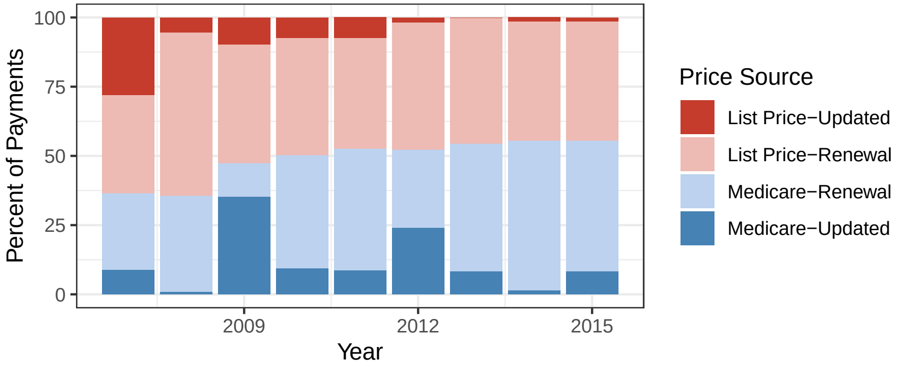


Figure: Fraction of each year's payments that reflect an inferred bargain (dark) or renewed contract (light), and which were imputed as list price-linked (teal) or other benchmark-linked (blue). Effects are large in 2015-16 because contracts generally renewed after 2013. Without imputation

Contracts Generally Renewed in Late Years (No Imputation)

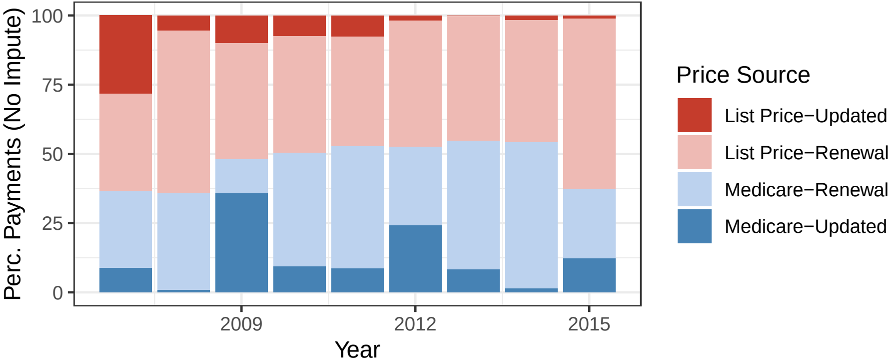


Figure: Fraction of each year's payments that reflect an inferred bargain (dark) or renewed contract (light), and which were imputed as list price-linked (teal) or other benchmark-linked (blue) without including missing reports for which I impute contracts.

Counterfactual Effects by Insurer

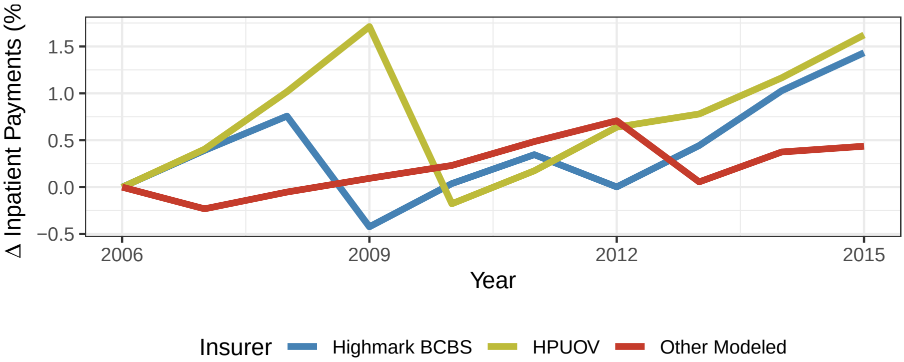


Figure: Estimated counterfactual effects on payments by insurer.

Counterfactual Effects by Hospital

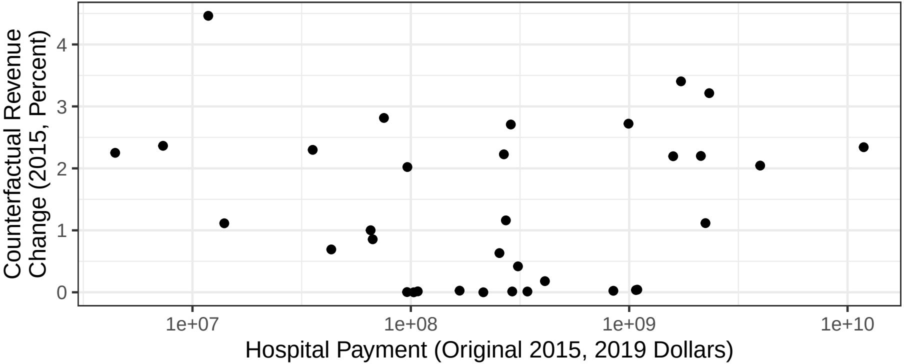


Figure: Estimated counterfactual effects on 2014 revenue by hospital. Most are generally only affected by less than 3%.

Counterfactual: Less Discounting

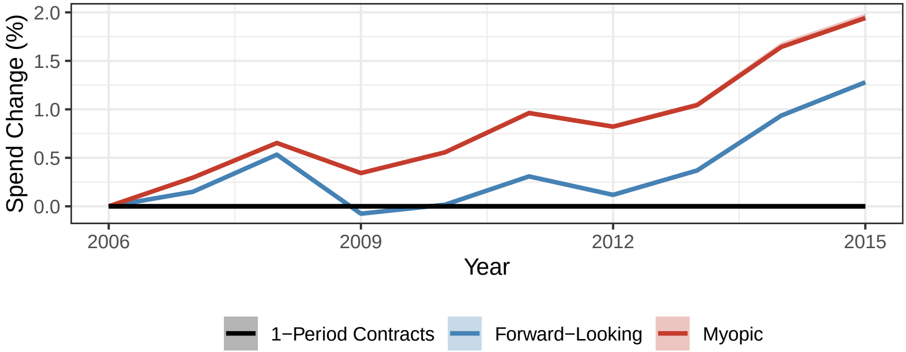


Figure: Results with discount rate β set to 0.97 rather than estimated 0.899. The forward-looking counterfactual is more forward-looking, so the estimated savings would be even smaller.

Counterfactual: Downstream Premium Effects

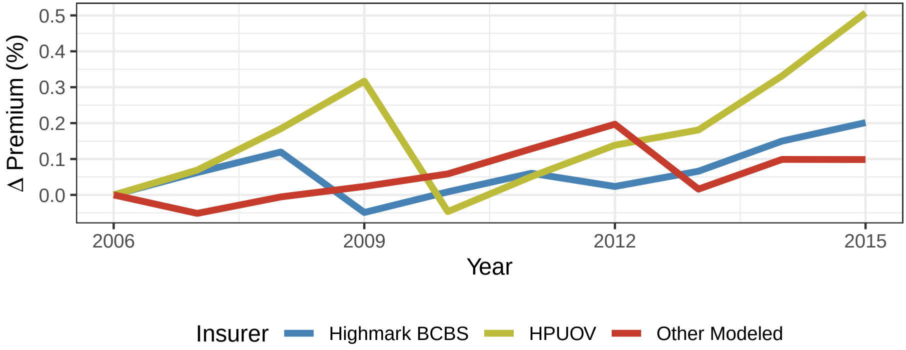


Figure: Estimated downstream effects on premiums under annual Nash-Bertrand premium competition. (Smaller percent effects because counterfactual holds outpatient constant.)

Counterfactual: Premium Change (% of Spend)

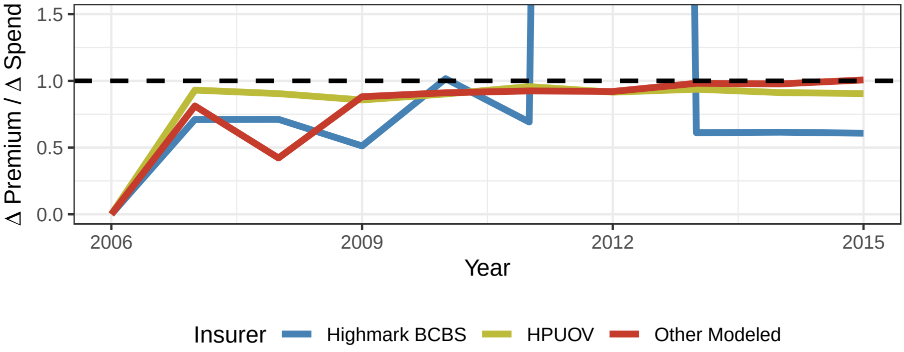


Figure: Ratio of estimated premium change to estimated marginal cost change by insurer.

Counterfactual: Drop Charleston Area Medical Center

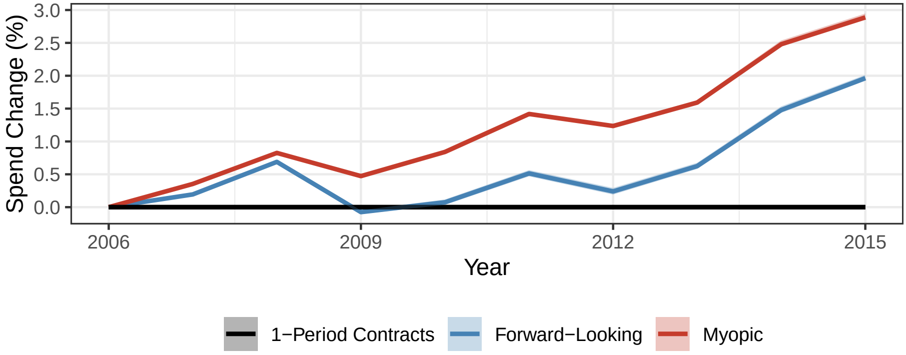


Figure: Counterfactual with Charleston Area Medical Center, a large hospital center with many low-discount high-renewal contracts, excluded.

Counterfactual: List Prices Limited

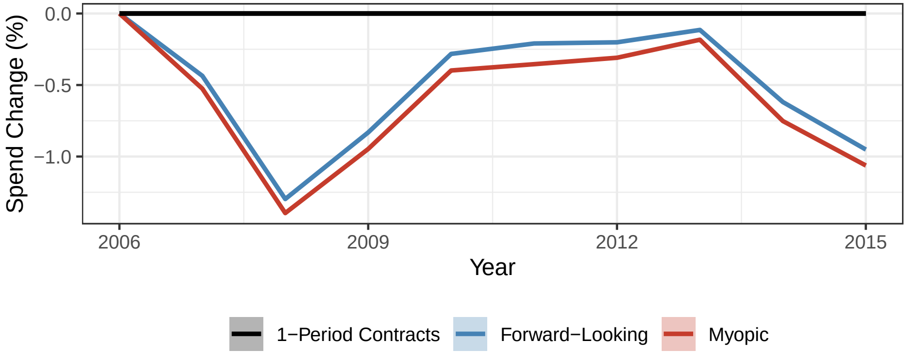


Figure: Estimated counterfactual effects on payments if list prices were capped to generally increase two ppt faster than reported costs instead of three ppt faster than reported costs. Details

Substantial Limitations (More in Paper)

- Miss outpatient, hold premiums & renegotiation constant
- Highly stylized insurer demand & premium-setting models (data limitations)
- Finite horizon, time definition, & end of panel biases
- Potential endogeneity of non-price bargaining like adjudication (minor)
- Effect of disagreement on consumer insurer inertia (future work)
- No effects from moral hazard, consumer cost-sharing, or benchmark choice
  - Cost-sharing small (Gowrisankaran et al., 2015), benchmark choice insurer-driven
  - Found suggestive evidence of some Medicare-driven supply effects (future work)
- Missing pre-2016 demand (data on way), investment (minimal with CON)
- Heterogeneous DRG weights, per diems, & other non-charge benchmarks
  - Shifted payments may include non-Medicare, per diems, or complex share of charges

Counterfactual List Price Construction

- Start: 102% of average state Medicare pay-to-cost change from previous year
- Where there is reliable state financial data, pull up to 50% of allowed increase towards hospital previous year Medicare increase (scaled by square root of previous year costs)
- Assume that hospitals attempt to set list prices at real list price
  - No added stockpiling effect beyond optimizing under the existing WV regulation