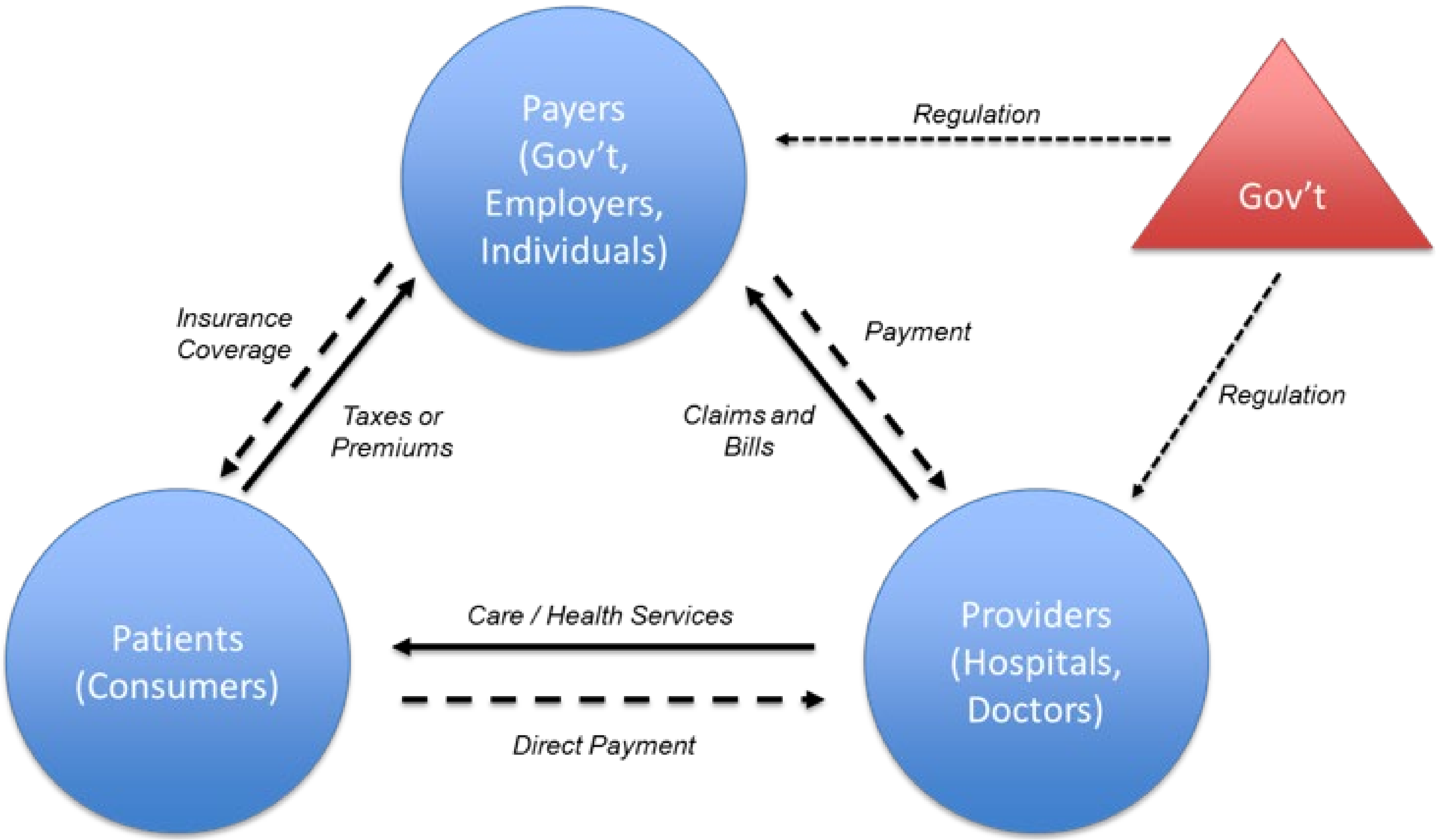
- Ref Report 2: March 17
- Problem Set 1: March 11
- Problem Set 2: April 15

- Great job with presentations last week
- Week 9: Crawford and Yurokoglu
  Week 10: Vertical markets chapter overview

- *Insurer Competition in Health Care Markets*, Kate Ho and Robin Lee, *Econometrica*, 2017
- Paper studies vertical relationships in health care markets: think about analogies to Crawford and Yurokoglu (AER, 2012) paper we discussed on cable TV markets.
- 

- Impact of insurer competition on welfare, negotiated provider prices, and premiums in the private U.S. health care industry is theoretically ambiguous.
  - -- Lower competition may increase insurer premiums and their payments made to hospitals
  - -- May also strengthen insurers' bargaining leverage when negotiating with hospitals, thereby generating offsetting cost decreases

- Estimate model with:
  - -- Employer-insurer bargaining over premiums
  - -- Hospital-insurer bargaining over provider prices
  - -- Household demand for insurance
  - -- Individual demand for hosptials

- Simulate removal of insurers from market to investigate main effects of interest
  - -- Consumer welfare decreases and premiums typically increase
  - -- Premiums can fall upon removal of small insurer if an employer imposes effective premium constraints via negotiations with the remaining insurers
  - -- Substantial heterogeneity in hospital price changes upon removal of insurer, with renegotiated price increases and decreases of as much as 10% across markets.

- Main application uses estimated model to simulate the equilibrium impact of removing one of three insurers from enrollees' choice sets on (i) premiums (ii) negotiated prices (iii) insurer enrollment (iv) hospital utilization and (v) total spending.

- Study removal of Kaiser (large) and Blue Cross (small) on Blue Shield (third insurer)

- Highlight (i) size and effectiveness of insurer removed and (ii) presence of effective premium setting constraints. Premium setting constraints here equal large employer (CalPERS) bargaining on behalf of employees

	Insurer Removed	
Premium Setting	BC (Small)	K (Large)
Unconstrained (Nash-Bertrand)	+11.0% [10.8%, 11.3%]	+19.3% [19.1%, 19.6%]
Constrained (Bargaining)	−3.4% [−4.0%, −3.3%]	+16.6% [15.8%, 16.8%]

(a) Premium Changes

	Insurer Removed	
Premium Setting	BC (Small)	K (Large)
Unconstrained (Nash-Bertrand)	−1.1% [−1.5%, −0.8%]	+3.0% [2.1%, 3.9%]
Constrained (Bargaining)	−8.9% [−13.3%, −7.7%]	+0.6% [−3.1%, 1.8%]

(b) Hospital Price Changes

Figure 1: Predicted (a) premium and (b) hospital price per admission changes for Blue Shield upon the removal of either Blue Cross (BC) or Kaiser (K), when insurers set premiums according to Nash-Bertrand competition or bargain with the employer. 95% confidence intervals are reported below estimates. See Section 4 for details.

- If premiums are not constrained by employer, and insurers compete Nash Bertrand for enrollees, premiums [Panel (a)] are expected to rise when either competitor leaves market.

- Premium effects negative when Blue Cross is removed. Why?

  -- Market power changes for different vertical levels of market supplying health insurance to consumers (where insurance reflects risk protection and access to providers)

- Panel (b) shows hospital price changes when insurers are removed

	Insurer Removed		*Insurer Removed*	
Premium Setting	BC (Small)	K (Large)	BC (Small)	K (Large)
Unconstrained (Nash-Bertrand)	+11.0% [10.8%, 11.3%]	+19.3% [19.1%, 19.6%]	−1.1% [−1.5%, −0.8%]	+3.0% [2.1%, 3.9%]
Constrained (Bargaining)	−3.4% [−4.0%, −3.3%]	+16.6% [15.8%, 16.8%]	−8.9% [−13.3%, −7.7%]	+0.6% [−3.1%, 1.8%]
	(a) Premium Changes		(b) Hospital Price Changes	

Figure 1: Predicted (a) premium and (b) hospital price per admission changes for Blue Shield upon the removal of either Blue Cross (BC) or Kaiser (K), when insurers set premiums according to Nash-Bertrand competition or bargain with the employer. 95% confidence intervals are reported below estimates. See Section 4 for details.

Model setup:

1. Employer and insurers (MCOs) bargain over per-household premium Φ_j
2. Simultaneously, all insurers and hospitals bargain to determine hospital prices p_{ij}
3. Given hospital networks (taken as given throughout paper, issue?) and premiums, households choose an insurer
4. After enrolling with insurer, individuals become sick with some probability and those that become sick visit some hospital in their network

Profits for Insurer

$$\pi_j^M(\mathcal{G}, \boldsymbol{p}, \boldsymbol{\phi}) = D_j(\cdot)(\phi_j - \eta_j) - \sum_{h \in \mathcal{G}_j^M} D_{hj}^H(\cdot) p_{hj} \ ,$$

Profits for Hospital

$$\pi_i^H(\mathcal{G}, \boldsymbol{p}, \boldsymbol{\phi}) = \sum_{n \in \mathcal{G}_i^H} D_{in}^H(\cdot)(p_{in} - c_i) \ ,$$

Employer-Insurer Premium Bargaining

Employers negotiate with insurers using standard Nash bargaining protocol. Nests standard Nash Bertrand premium setting model.

$$\phi_j = \arg\max_{\phi_j} \left[\underbrace{\pi_j^M(\mathcal{G}, \boldsymbol{p}, \{\phi, \boldsymbol{\phi}_{-j}\})}_{GFT_j^M} \right]^{\tau^\phi} \times \left[\underbrace{W(\mathcal{M}, \{\phi, \boldsymbol{\phi}_{-j}\}) - W(\mathcal{M} \setminus j, \boldsymbol{\phi}_{-j})}_{GFT_j^E} \right]^{(1-\tau^\phi)} \quad \forall j \in \mathcal{M} \ , \tag{3}$$

Given their timing assumptions, outside options from disagreement are determined by removing insurer from employer’s choice set, holding premiums and negotiated hospital prices for other insurers fixed but allowing employees to choose new insurance plans

What do you think about these assumptions?

Hospital-Insurer Bargaining

Hospital prices for a given insurer are also determined via simultaneous bilateral Nash bargaining.

$$p_{ij} = \arg\max_{p_{ij}} \Bigg[\underbrace{\pi_j^M(\mathcal{G}, \boldsymbol{p}, \boldsymbol{\phi}) - \pi_j^M(\mathcal{G} \setminus ij, \boldsymbol{p}_{-ij}, \boldsymbol{\phi})}_{\text{MCO } j\text{'s GFT with hospital } i} \Bigg]^{\tau_j} \times \Bigg[\underbrace{\pi_i^H(\mathcal{G}, \boldsymbol{p}, \boldsymbol{\phi}) - \pi_i^H(\mathcal{G} \setminus ij, \boldsymbol{p}_{-ij}, \boldsymbol{\phi})}_{\text{Hospital } i\text{'s GFT with MCO } j} \Bigg]^{(1-\tau_j)} \quad \forall ij \in \mathcal{G} \; .$$

If hospital comes to disagreement with insurer, both parties assume the network will be the same as before, but without the hospital in question. All other prices and premiums remain fixed.

What do you think about these assumptions?

-- Authors note that in reality, premiums and prices set at staggered intervals and fixed for different lengths, so, in reality, the alternative assumption that prices negotiated before premiums and that premiums immediately adjust accordingly may also be unrealistic

Insurer Premiums

Insurer Premiums. Setting the first-order conditions of (3) equal to 0 (for a given network and set of premiums $\boldsymbol{\phi}_{-j}$, and set of negotiated prices $\boldsymbol{p}^*$) implies that

$$\frac{\partial \pi_j^M(\cdot)}{\partial \phi_j} = \frac{1-\tau^\phi}{\tau^\phi} \times \frac{\pi_j^M(\cdot) \times \left(-\partial GFT_j^E(\cdot)/\partial \phi_j\right)}{GFT_j^E(\cdot)} \qquad \forall j \ , \tag{5}$$

If bargaining parameter 1, this is typical Nash Bertrand FOC. If < 1, FOC is ≥ 0 and equilibrium insurance premium will likely be lower than that predicted under Nash Bertrand.

Hospital Prices

$$\underbrace{p^*_{ij} D^H_{ij}}_{\text{total hospital payments}} = (1-\tau_j)\left[\underbrace{[\Delta_{ij} D_j](\phi_j - \eta_j)}_{\substack{\text{(i) "premium and enrollment effects"} \\ \text{(Δ MCO revenues net of non-hosp costs)}}} - \underbrace{\left(\sum_{h \in \mathcal{G}^M_j \setminus ij} p^*_{hj} [\Delta_{ij} D^H_{hj}]\right)}_{\substack{\text{(ii) "price reinforcement effect"} \\ \text{(Δ MCO j payments to other hospitals)}}}\right]$$

$$+ \tau_j \left[\underbrace{c_i D^H_{ij}}_{\substack{\text{(iii) "hospital cost effect"} \\ \text{(total hospital costs)}}} - \underbrace{\sum_{n \in \mathcal{G}^H_i \setminus ij} [\Delta_{ij} D^H_{in}](p^*_{in} - c_i)}_{\substack{\text{(iv) "recapture effect"} \\ \text{(Δ Hospital i profits from other MCOs)}}}\right] \qquad \forall ij \in \mathcal{G}\ ,$$

1. **Premium and Enrollment Effects**: Effect of hospital inclusion in insurer network on insurer revenues
2. **Price Reinforcement Effect**: Adjustment in payments per enrollee that insurer makes to other hospitals in its network after dropping hospital *i*.
3. **Hospital Cost Effect:** Every unit increase in hospital *I* costs results in a τ unit increase in payments
4. **Recapture Effect:** Adjustment in hospital *I* reimbursements from other insurers when hospital is removed from insurer network

Data and Setting

2004 enrollment, claims, and admissions information for over 1.2M enrollees covered by CalPERS, California Public Employees Retirement System, an agency that manages pension and health benefits for California public and state employees, retirees, and their families.

Offered access to:

- -- Blue Shield HMO
- -- Anthem Blue Cross PPO
- -- Kaiser Permanente HMO

Observe:

- -- 38,604 inpatient admissions for BC and BS enrollees, no data on Kaiser enrollees' admissions. Claims data aggregated to admission level and assigned DRG code
- -- Hospital characteristics, including location

Data and Setting

Table 1: Summary Statistics

		BS	BC	Kaiser
Premiums	Single	3782.64	4192.92	3665.04
(per year)	2-Party	7565.28	8385.84	7330.08
	Family	9834.84	10901.64	9529.08
	Revenues (per individual)	2860.34	3179.39	2788.05
Insurer	# Hospitals in Network	189	223	27
Characteristics	# Hospital Systems in Network	119	149	-
	Hospital Prices (per admission)	7191.11	6023.86	-
	Hospital Payments (per individual)	623.20	554.00	-
	Hospital Costs (per admission)	1709.56	1639.92	-
Household	Single	19313	8254	20319
Enrollment	2-Party	16376	7199	15903
	Family	35058	11170	29127
	Avg. # Individuals/Family	3.97	3.99	3.94

Notes: Summary statistics by insurer. The number of hospitals and hospital systems in network for BS and BC are determined by the number of in-network hospitals or systems with at least 10 admissions observed in the data. Hospital prices and costs per admission are average unit-DRG amounts, weighted across hospitals by admissions. Hospital payments per individual represent average realized hospital payments made per enrollee (not weighted by DRG).

Data and Setting

Table 2: Individual Enrollment and Hospital System Concentration

	Individual Plan Enrollment						Hospital Concentration			
	Enrollment			Market Share			# Systems		HHI (Adm)	
HSA Market	BS	BC	Kaiser	BS	BC	Kaiser	BS	BC	BS	BC
1. North	5366	15143	-	0.26	0.74	-	5	17	3686	1489
2. Sacramento	55732	6212	59772	0.46	0.05	0.49	6	8	4112	2628
3. Sonoma / Napa	6826	955	13762	0.32	0.04	0.64	5	5	3489	3460
4. San Francisco Bay West	6021	926	4839	0.51	0.08	0.41	4	4	4362	3054
5. East Bay Area	7856	1200	10763	0.40	0.06	0.54	9	10	2560	2096
6. North San Joaquin	9663	3979	4210	0.54	0.22	0.24	7	8	2482	1888
7. San Jose / South Bay	2515	762	4725	0.31	0.10	0.59	5	6	3265	2628
8. Central Coast	8028	13365	-	0.38	0.62	-	4	9	3431	2254
9. Central Valley	27663	7613	10211	0.61	0.17	0.22	12	13	1863	1539
10. Santa Barbara	3973	1416	658	0.66	0.23	0.11	7	7	2459	2863
11. Los Angeles	18205	6731	23919	0.37	0.14	0.49	22	28	741	716
12. Inland Empire	17499	2801	20690	0.43	0.07	0.50	15	15	1015	1034
13. Orange	7836	2906	5430	0.48	0.18	0.34	8	9	2425	2250
14. San Diego	14585	2298	8593	0.57	0.09	0.34	10	8	1708	2549
Total[a]	191768	66307	167572	0.45	0.16	0.39	119	147	1004	551

Notes: Individual enrollment and market shares (Kaiser was not an option for enrollees in HSAs 1 and 8) and hospital system membership and admission Herfindahl-Hirschman Index (HHI)—computed using the number of admissions for all hospital-insurer pairs in our sample—by insurer.

[a] Total (statewide) HHI accounts for hospital system membership across HSAs.

Table 3: Admission Probabilities and DRG Weights

	Admission Probabilities			DRG Weights		
	OSHPD	CalPERS		CalPERS		
Age-Sex Category	All	BS	BC	BS	BC	All
0-19 Male	2.05%	1.78%	2.08%	1.78	1.49	1.70
20-34 Male	2.07%	1.66%	2.07%	1.99	1.77	1.92
35-44 Male	3.11%	2.79%	3.21%	1.95	1.89	1.93
45-54 Male	5.58%	5.29%	5.32%	2.07	2.05	2.07
55-64 Male	10.49%	10.13%	9.70%	2.25	2.25	2.25
0-19 Female	2.28%	1.95%	2.04%	1.31	1.39	1.32
20-34 Female	11.19%	11.75%	10.22%	0.84	0.87	0.85
35-44 Female	7.91%	7.31%	7.73%	1.32	1.33	1.32
45-54 Female	6.87%	6.16%	6.82%	1.90	1.83	1.87
55-64 Female	9.74%	9.01%	9.26%	2.03	2.02	2.03

Consumer Hospital Demand Estimation

$$u^H_{k,i,l,m} = \delta_i + z_i \upsilon_{k,l} \beta^z + d_{i,k} \beta^d_m + \varepsilon^H_{k,i,l,m}$$

Consumer Ex-Ante Expected Utility for Hospital Network

$$WTP_{k,j,m}(\mathcal{G}_{j,m}) = \gamma^a_{\kappa(k)} \sum_{l \in \mathcal{L}} \gamma_{\kappa(k),l} \underbrace{\log \left(\sum_{h \in \mathcal{G}_{j,m}} \exp(\hat{\delta}_h + z_h \upsilon_{k,l} \hat{\beta}^z + d_{h,k} \hat{\beta}^d_m) \right)}_{EU_{k,j,l,m}(G_{j,m})},$$

Household Demand for Insurance Plans

$$u^M_{f,j,m} = \underbrace{\delta_{j,m} + \alpha^\phi_f (.2 \times \phi_j \Phi_{\lambda(f)}) + \sum_{\forall \kappa} \alpha^W_\kappa \sum_{k \in f, \kappa(k) = \kappa} WTP_{k,j,m}}_{\tilde{u}^M_{f,j,m}} + \varepsilon^M_{f,j,m},$$

Identification: Read the paper and think about how convincing you think it is

Estimation / Implementation of Vertical Supply Model

Look in paper. They extend model to better fit their empirical context and make assumptions necessary to derive key economic foundations relying quite a bit on estimates from hospital and insurance demand models.

Something that is somewhat strange is that they have to assume something about non-hospital marginal costs to the insurer and marginal costs to the hospitals to identify the bargaining weights, because unlike BLP papers they can't just invert prices. They end up using average inpatient costs gotten from survey data for the latter and MLRs to identify the former. How sensitive are estimates to these assumptions?

Results

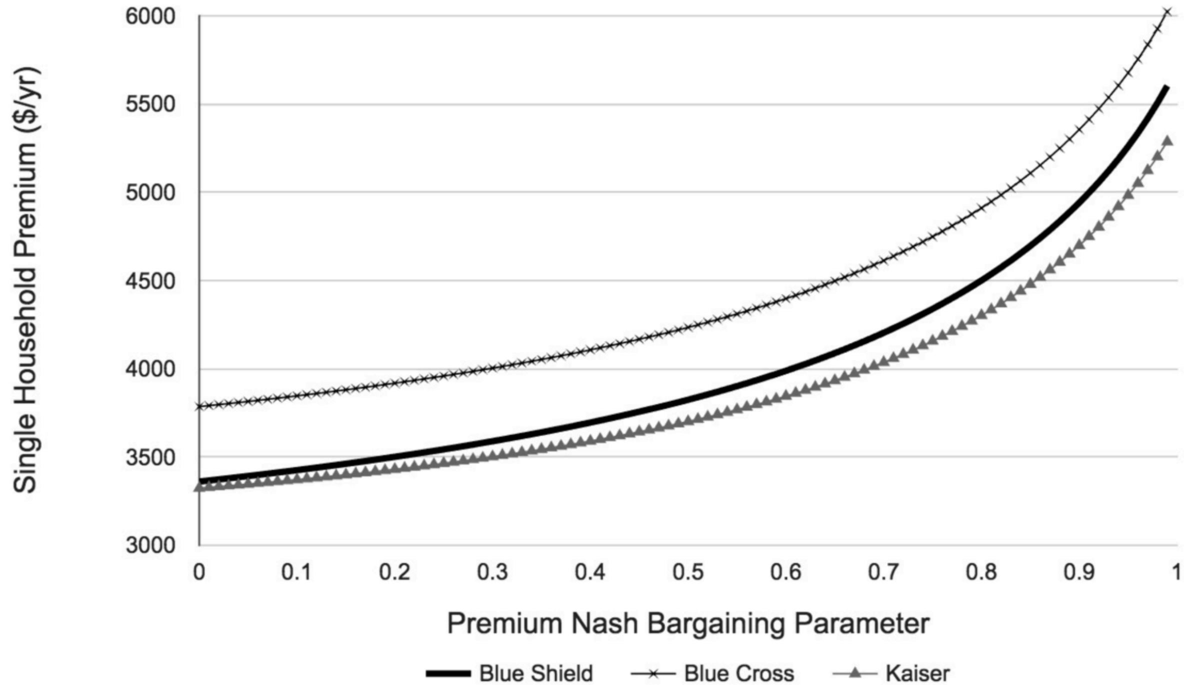


Table 5: Estimates: Insurer Marginal Costs and Nash Bargaining Parameters

		(i)	(ii)
Insurer Non-Inpatient	η_{BS}	925.78	1,691.50
Marginal Costs		11.12	10.41
(per individual)	η_{BC}	1,417.73	1,948.61
		6.93	8.14
	η_{K}	1,496.44	2,535.14
		-	0.62
Nash Bargaining	τ_{BS}	0.33	0.31
Parameters		0.01	0.05
	τ_{BC}	0.40	0.38
		0.02	0.03
	τ^{ϕ}	1.00	0.47
		-	0.00
Use Margin Moments		N	Y
Number of Bilateral Pairs		268	268

Results

Table 6: Estimates: Negotiated Hospital Price Decomposition

	Price	(i) Premium & Enrollment	(ii) Price Reinforcement	(iii) Hospital Costs	(iv) Recapture Effect
BS	7,191.11	24.2%	66.3%	8.9%	0.6%
		[23.6%, 25.5%]	[64.9%, 69.3%]	[5.1%, 10.6%]	[0.4%, 0.8%]
BC	6,023.86	32.3%	52.6%	12.1%	3.0%
		[31.8%, 33.7%]	[51.8%, 55.1%]	[9.2%, 13.1%]	[2.3%, 3.3%]

Notes: Weighted average (by hospital admissions) decomposition of negotiated hospital prices into the components provided in (3) for each insurer and hospital system (omitting residuals, and scaling by τ_j or $1-\tau_j$ where appropriate). 95% confidence intervals, reported below estimates, are constructed using 80 bootstrap samples of admissions within each hospital-insurer pair to re-estimate hospital-insurer DRG weighted admission prices, re-estimate insurer marginal costs and Nash Bargaining parameters, and re-compute price decompositions.

Results

Table 7: Removing an Insurer: Summary Results

		Baseline	(i) Remove Kaiser		(ii) Remove BC	
		Amount	Amount	% Change	Amount	% Change
Premiums	BS	3.78	4.41	16.6%	3.65	-3.4%
(per year)		[3.76, 3.79]	[4.36, 4.43]	[15.8%, 16.8%]	[3.62, 3.66]	[-4.0%, -3.3%]
	BC	4.19	4.80	14.4%	-	-
		[4.18, 4.20]	[4.75, 4.81]	[13.7%, 14.6%]		
	Kaiser	3.67	-	-	3.62	-1.4%
		[3.66, 3.67]			[3.60, 3.62]	[-1.6%, -1.3%]
Household	BS	73.91	124.16	68.0%	87.73	18.7%
Enrollment		[73.65, 74.34]	[124.13, 124.25]	[67.1%, 68.6%]	[87.44, 88.51]	[18.4%, 19.3%]
	BC	27.49	38.56	40.2%	-	-
		[27.49, 27.50]	[38.47, 38.59]	[39.9%, 40.4%]		
	Kaiser	61.31	-	-	64.99	6.0%
		[60.88, 61.58]			[64.21, 65.27]	[5.2%, 6.3%]
Hospital	BS	0.66	0.66	0.5%	0.60	-8.5%
Payments		[.65, .68]	[.64, .68]	[-3.1%, 1.7%]	[.57, .62]	[-12.7%, -7.5%]
(per individual)	BC	0.56	0.68	21.2%	-	-
		[.55, .58]	[.67, .72]	[20.0%, 24.8%]		
Hospital Prices	BS	7.19	7.23	0.6%	6.55	-8.9%
(per admission)		[7.06, 7.35]	[6.92, 7.43]	[-3.1%, 1.8%]	[6.19, 6.74]	[-13.3%, -7.7%]
	BC	6.02	7.29	21.0%	-	-
		[6.04, 6.40]	[7.14, 7.64]	[19.8%, 24.6%]		
Surplus	Insurer	0.44	0.99	125.9%	0.38	-13.3%
(per individual)		[.44, .44]	[.99, .99]	[124.6%, 126.6%]	[.38, .39]	[-13.8%, -11.7%]
	Hospitals	0.30	0.51	69.7%	0.27	-9.0%
	(Non-K)	[.29, .31]	[.49, .52]	[63.0%, 72.3%]	[.26, .28]	[-13.8%, -7.6%]
	Δ Cons.	-	-0.19	-	-0.01	-
			[-.19, -.18]		[-.01, -.01]	

Notes: Results from simulating removal of Blue Cross or Kaiser from all markets using estimates from specification (iv) in Table 5. All figures are in thousands. Baseline numbers (including premiums, hospital prices, and enrollment) are recomputed from model estimates. Average insurer payments to hospitals and average DRG-adjusted hospital prices are weighted by the number of admissions each hospital receives from each insurer under each scenario. Surplus figures represent total insurer, hospital, and changes to consumer surplus per insured individual. 95% confidence intervals, reported below estimates, are constructed by using 80 bootstrap samples of admissions within each hospital-insurer pair to re-estimate hospital-insurer DRG weighted admission prices, re-estimate insurer marginal costs and Nash bargaining parameters, and re-compute counterfactual simulations.

Results

Table 9: Removing an Insurer: Summary Results (Nash-Bertrand Premium Setting)

		Baseline	(iii) Remove BC (Nash-Bertrand)	
		Amount	Amount	% Change
Premiums	BS	3.78	4.20	11.0%
(per year)		[3.76, 3.79]	[4.17, 4.22]	[10.8%, 11.3%]
	BC	4.19	-	-
		[4.18, 4.21]		
	Kaiser	3.67	3.98	8.7%
		[3.66, 3.67]	[3.97, 4.00]	[8.4%, 8.9%]
Household	BS	73.91	82.99	12.3%
Enrollment		[73.53, 74.56]	[82.71, 83.39]	[11.8%, 12.5%]
	BC	27.49	-	-
		[27.06, 27.77]		
	Kaiser	61.31	71.13	16.0%
		[61.10, 61.44]	[70.78, 71.38]	[15.8%, 16.2%]
Hospital	BS	0.66	0.66	-0.4%
Payments		[.65, .68]	[.65, .67]	[-.7%, -.1%]
(per individual)	BC	0.56	-	-
		[.55, .58]		
Hospital Prices	BS	7.19	7.11	-1.1%
(per admission)		[7.06, 7.36]	[6.96, 7.29]	[-1.5%, -.8%]
	BC	6.02	-	-
		[6.03, 6.40]		
Surplus	Insurer	1.27	1.57	24.1%
(per individual)		[1.27, 1.27]	[1.57, 1.58]	[23.4%, 24.7%]
	Hospitals	0.30	0.29	-2.8%
	(Non-K)	[.29, .31]	[.28, .30]	[-3.9%, -1.9%]
	Δ Cons.	-	-0.09	-
			[-.09, -.08]	

Notes: Results from simulating removal of Blue Cross or Kaiser, using estimates from specification (i) in Table 5 (without insurer margin moments) and assuming Nash-Bertrand premium setting. All figures are in thousands. Baseline numbers are recomputed from model estimates. Average insurer payments to hospitals and average (DRG-adjusted) hospital prices are weighted by the number of admissions each hospital receives from each insurer under each scenario. Surplus figures represent total insurer, hospital, and changes to consumer surplus per insured individual. 95% confidence intervals, reported below estimates, are constructed by using 80 bootstrap samples of admissions within each hospital-insurer pair to re-estimate hospital-insurer DRG weighted admission prices, re-estimate insurer marginal costs and Nash bargaining parameters, and re-compute counterfactual simulations.

Discussion

What do you think?

What other markets could you use similar techniques to study?

What are "next steps,” other than the recent follow-ups on narrow networks.