Insurer Competition in Health Care Markets

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Motivation

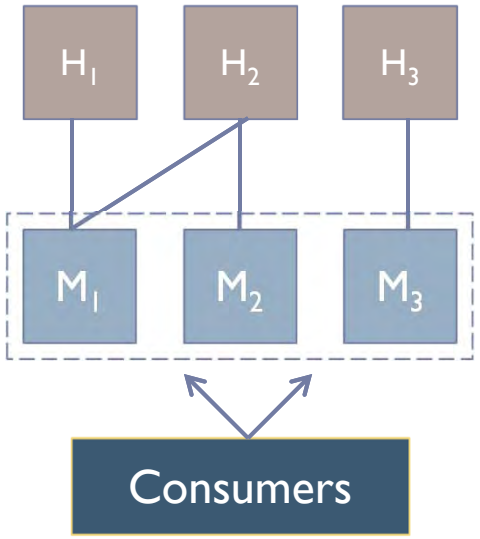
- Recent changes in US health insurance markets:
  - State & federal exchanges [PPACA 2010]
  - Employer sponsored markets:
    1. Increasing variety of insurance products
    2. Alleged non-compete agreements (e.g., BlueShield-BlueCross)
    3. Proposed mergers (e.g., Aetna-Humana, Centene-Health Net)

- **Insurer Competition** can *increase the quality of care* and *reduce premiums & costs*…

  …but due to **imperfectly competitive** insurance and medical provider (hospital, physician) markets, other effects *may not be welfare improving*

- This paper studies how insurer competition affects: *welfare (consumer & firm), hospital prices* ***and*** *premiums*

U.S. Commercial Health Care Market Overview



- Consumers enroll in an insurer (MCO) offered by their employer or exchange, and obtain access to its hospital network
  - 61% of non-elderly people in U.S. (2014)
- Hospital network and reimbursements (prices) are determined by bilateral negotiations

- Increased insurer competition can:
  1. Lead to premium competition (potentially depressing hospital prices)
  2. Provides hospitals with greater leverage to "play insurers off" one another and negotiate higher prices (mitigating premium reductions)

Net price effect is ambiguous and likely ***heterogeneous*** *across markets*

Objectives and Approach

1. **Develop, specify, and estimate a (stylized) model of:**
   - (i) Hospital-insurer bargaining, (ii) insurer premium setting, (iii) household insurer demand, and (iv) individual hospital demand
   - Decompose how insurer competition affects negotiated hospital prices ($350 billion of annual U.S. health care expenditures)
   - ***Provide a framework for examining related issues in health care markets***

2. **Simulate the removal of an insurer from choice set**
   - California Public Employees' Retirement System (CalPERS)
   - 2004 CA admissions, claims & enrollment data for 1.2M individuals
   - *[Relevant for employer-sponsored markets & exchanges]*

3. **Preview of results from removing an insurer:**
   - Premiums rise by 4-10% (but depend on whether insurers are constrained)
   - Hospital prices can both rise *and* fall by as much as 15-25% across markets, leading to a redistribution of rents across hospitals
   - ("Countervailing Effect" is empirically plausible in some markets…)

Related Literature (Briefly)

1. **Market concentration on hospital prices:** *[c.f. Gaynor Town 12]*
   - Many rely on HHI-regression analyses (cross-section and panel)
     - Insurer Concentration: [Moriya et al 10, Melnick et al 10, Dafny et al 10, 12,…]
     - Hospital Concentration: [Burgess et al 05, Capps Dranove 04, Dafny 09,…]

   ➔ Use formal model to decompose mechanisms, capture *heterogeneous effects*, and conduct *out-of-sample* counterfactuals and welfare evaluation

2. **Structural Models of Hospital-Insurer Demand / Bargaining**
   - Many abstract away from insurer competition (focus on hospital mergers) [E.g., Town Vistnes 01, Capps Dranove Satterthwaite 03, Lewis Pflum 13, Gowrisankaran Nevo Town 14; exceptions: Ho 06/09, Lee Fong 13]

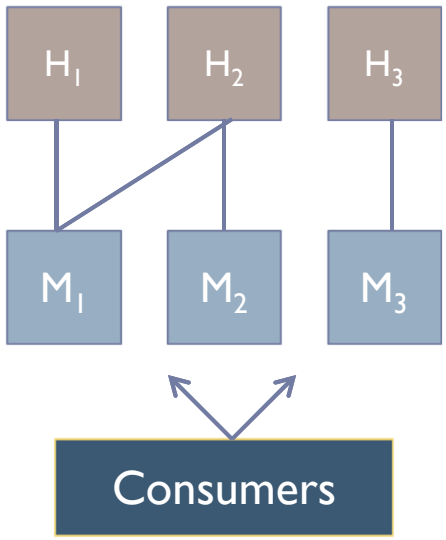
   ➔ Estimation & counterfactual simulation w/ multiple MCOs & hospitals; Control for selection of and demand by households for insurers

3. **Broader IO literature on Bargaining in Vertical Markets:**
   - Methods: [Crawford Yurukoglu 12, Crawford Lee Whinston Yurukoglu 15, …]
   - Countervailing Power: [Galbraith 52, Chipty Snyder 99, Ellison Snyder 10, …]

Roadmap

- Theoretical Model
- Empirical Analysis
- Counterfactual Simulations
- Conclusion

Model: (Simplified) Timing & Setup



("G" is given network)

1. (a) Hospitals and MCOs **bargain** over prices **p**
   (b) MCOs set **premiums** Φ
2. Households **choose insurer**: D_j (household) and D_j^E (individual) demand for MCO *j*
3. Individuals become sick and **choose a hospital:** D_{hj}^H is demand for hospital *h* on MCO *j*'s network

Profit Equations:

MCO j: $$\pi_j^M = D_j \phi_j - D_j^E \eta_j - \sum_{h \in G_j} D_{hj}^H p_{hj}^*$$

Hosp i: $$\pi_i^H = \sum_{n \in G_i} D_{in}^H (p_{in}^* - c_i)$$

Model: Hospital-Insurer Bargaining Equation

Each MCO *j* and Hospital *i* engage in simultaneous bilateral Nash bargaining over "gains-from-trade". Implied F.O.C. yields:

[Horn Wolinsky 88, Crawford Yurukoglu 12; Collard-Wexler Gowrisankran Lee 14]
[Generalized to system bargaining in paper]

$$p_{ij}^{*} D_{ij}^{H} = (1-\tau_j)\left[\left([\Delta_{ij} D_j]\phi_j - [\Delta_{ij} D_j^{E}]\eta_j\right) - \sum_{h \in G_j \setminus ij} p_{hj}^{*}[\Delta_{ij} D_{hj}^{H}]\right]$$

Total Payments from MCO j to Hospital i

(i) **Premium & Enrollment Effect:** Change in MCO j's premium revenues (net of non-hospital costs) when losing hospital i

(ii) **Price Reinforcement Effect:** Change in MCO j's payments to other hospitals when losing hospital i

$$+\tau_j\left[D_{ij}^{H} c_i \quad - \quad [\Delta_{ij} D_{i,-j}^{H}](p_{h,-j}^{*} - c_i)\right]$$

(iii) **Hospital Costs**

(iv) **Recapture Effect:** Change in hospital i's "profits" from other insurer -j when dropping MCO j

Model: Hospital-Insurer Bargaining Equation

Hospital "Gains-From Trade" (<0)

(iii) **Hospital Costs**

(iv) **Recapture Effect**

MCO "Gains-From-Trade" (>0)

(i) **Premium & Enrollment Effect**

(ii) **Price Reinforcement Effect**

Model: Hospital-Insurer Bargaining Equation

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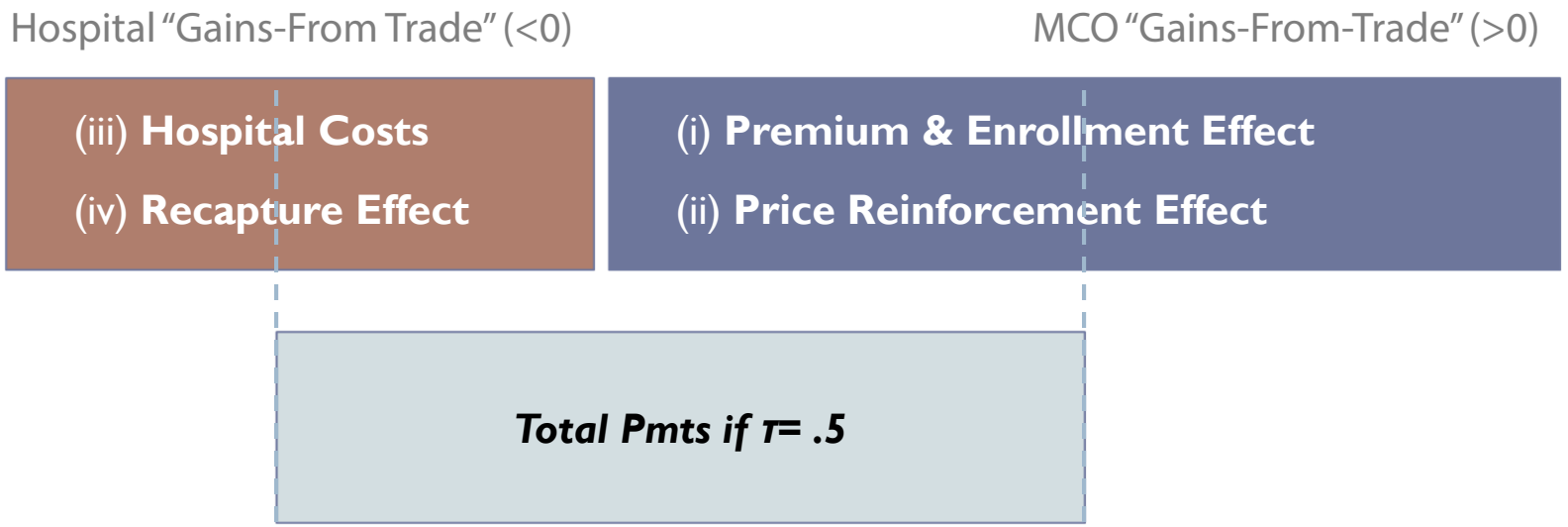
Total Pmts if τ= 1

Model: Hospital-Insurer Bargaining Equation



Model: Hospital-Insurer Bargaining Equation

Hospital "Gains-From Trade" (<0)

MCO "Gains-From-Trade" (>0)

(iii) **Hospital Costs**

(iv) **Recapture Effect**

(i) **Premium & Enrollment Effect**

(ii) **Price Reinforcement Effect**

Total Pmts if τ= 0

Roadmap

- Theoretical Model
- Empirical Analysis
  - Setting & Data
  - Model: Hospital and Insurer Demand, Premium-setting and Bargaining
- Counterfactual Simulations
- Conclusion

Empirical Analysis: Setting & Data

- California (CalPERS 2004)
  - Agency managing pension/health benefits for CA public employees (~1.2M covered lives, ~10% total CA commercial market)
  - Markets: 14 HSAs (health service areas) defined by CA OSHPD
- Stable choice set of 3 insurers (2/3 of total CA commerical mkt):
  - BlueShield of CA HMO (BS) – 45% of enrollees
  - Anthem Blue Cross PPO (BC) – 16% of enrollees
  - Kaiser Permanente HMO (K) – 39% of enrollees
- Data: Admissions, Claims, Enrollment, Networks, Plans
  - Admissions: 35.6K inpatient admissions
  - **Claims: Observed prices per-admission (w/ DRG weight)**
  - Enrollment: 163K HHs (426K indivs) w/ salary, fam. composition
  - Networks: 400 insurer-hospital pairs w/ > 10 admissions
  - Supplemental: AHA Hospital Data (Costs, Systems, Characteristics)

Table 1: Summary Statistics

		BS	BC	Kaiser
Premiums ($/yr)	Single	3782.64	4192.92	3665.04
	2-Party	7565.28	8385.84	7330.08
	Family	9834.84	10901.64	9529.08
Insurer Characteristics	# Hospitals in Network	187	220	27
	# Hospital Systems in Network	119	147	-
	Avg. Hospital Prices	6741.54	6085.64	-
	Avg. Hospital Costs	3181.95	3271.36	-
Household Enrollment	Single	19313	8254	20319
	2-Party	16376	7199	15903
	Family	35058	11170	29127
	Avg. # Individuals/Family	3.97	3.99	3.94

- Households pay only 20% of annual premiums
- CalPERS constrains premiums: vary only by household size; 2-party and family are fixed multiples of single party premium.

Empirical Analysis: Matching the Model to the Data

Model	Data & Inputs	Outputs

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Model	Data & Inputs	Outputs
III. Hospital Demand (Individual)	Admissions (age-sex-diag-zip) Hospital Networks	1. Patient flows for any network 2. EU of hospital network

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II. Insurer Demand (Household)	Household Enrollment, Family Characteristics, Premiums, Networks, *[Hospital Demand]*	1. Insurer premium & network "elasticities" 2. Enrollment for any CF network

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Ia. Premium Setting **Ib. Hospital-Insurer Bargaining**	Premiums, Prices, Networks, *[Hospital + Insurer Demand]*	1. Estimates of MCO (non-hospital) MCs 2. "Bargaining Weights" 3. CF premiums and negotiated prices

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- Detailed demand systems (I+II) restrict the sensitivity of results to particulars of bargaining specification

Stage III: Hospital Demand

- **Utility** of individual *k* with diagnosis *l* from hospital *i:*

$$u^{H}_{k,i,l,m} = \partial_i + z_i \nu_{k,l} \beta^z + d_{k,i} \beta^d_m + \varepsilon^{H}_{k,i,d}$$

Hospital fixed effects — *hospital x ind. chars* — *distance (mkt specific)* — *Type I EV*

- **Estimate**: MLE using 35,570 inpatient admissions for BS & BC
  [Control for choice set (network of hospitals on each plan)]
- **Output**: patient flows for any potential hospital network
- **Identification**: unobservable preference shocks uncorrelated with observable hospital characteristics (including location) [c.f., Ho (2006)]
- **WTP** (in utils): Individual k of age-sex type κ(k) for MCO j's network:

$$WTP_{k.m}(G_{j,m}) = \gamma^{a}_{\kappa(k)} \sum_{l} \gamma_{\kappa(k),l} E_{\varepsilon}[\max_{h \in G_{j,m}} u^{H}_{k,h,l,m}]$$

Prob that typeκ(k) is admitted and diagnosed with l

Stage II: Insurer Demand (1/2)

- **Utility** of family *f* for insurer *j:*

$$u^{M}_{f,j,m} = \partial_{j,m} + \alpha^{\phi}_{f}\phi_{\lambda(f),j} + \sum_{\kappa}\alpha^{W}_{\kappa} \sum_{k \in f, \kappa(k)=\kappa} WTP_{k,m}(G_{j,m}) + \varepsilon^{M}_{f,j,m}$$

Insurer-market fixed effects

premiums (coeff varies by income)

indiv network utility (hospital demand) (coeff varies by age-sex category)

- **Details**: λ(f) {single, 2-party, family}; Kaiser is "outside option"
- **Estimate**: MLE on 163K households (426K indivs), 14 markets
- **Identification:**
  - WTP: within-plan, within-market variation across zip codes in distance to hospitals within networks
  - Premiums: within-plan variation across household types
    - (Premiums for 2-party and families are fixed multiple of single premium)
    - Cond'l on income, premium sensitivities do not vary across household types

Stage II: Insurer Demand (2/2)

- **Output**: WTP & premium elasticities, insurer market shares
  (for every family type, any hospital network, any level of premiums)

	Single	2-Party	Family
BS	-1.25	-2.18	-2.56
BC	-1.62	-2.50	-2.94
Kaiser	-1.20	-2.04	-2.41

  - Recovered premium elasticities in-line with previous estimates:
    Royalty and Solomon (1998): -1.02 to -3.5; Cutler and Reber (1996): -2.0;
    Ho (2006): -1.24; Shepard (2015): -1.35

- **Selection** on [age-sex-zip, family type, income] across insurers;
  insurers internalize this and face ``cream-skimming'' incentives

Stage I: Premium Setting and Bargaining (1/2)

We jointly estimate insurer marginal costs $\{\eta_{BS}, \eta_{BC}, \eta_K\}$ and Nash bargaining parameters $\{\tau_{BS}, \tau_{BC}\}$ via GMM using 3 sets of moments:

(i) Premium Setting:

- Insurers compete via ***Nash Bertrand*** premium setting
- Variants (competition for inclusion on choice set):
  a) A "scaled" elasticity of demand wrt premiums
  b) Included by an employer w/ some prob. z( ): $\max_{\varphi} z(\varphi)\pi_j^M(\varphi, \cdot)$
  c) Fixed markups (MLR regulations)

(ii) Insurer Margins: (for alternatives to Nash Bertrand)

- Match 2004 CA DMHC data on [total medical costs / total revenues]
- Lower margins than implied by premium elasticities → interpreted as constraints on premium setting behavior

Stage I: Premium Setting and Bargaining (2/2)

(iii) Hospital-Insurer Bargaining:

$$p_{ij}^{e} D_{ij}^{H} = (1-\tau_j)\left([\Delta_{ij} D_j]\phi_j - \sum_{h \in G_j \setminus ij} p_{hj}^{e} [\Delta_{ij} D_{hj}^{H}] \right) - (1-\tau_j)\eta_j [\Delta_{ij} D_j^{E}]$$

Total Payments (DRG adjusted)

(i) & (ii) **Premium, Enrollment, Price Reinforcement Effects**

$$+\tau_j \left[D_{ij}^{H} c_i \quad - \quad [\Delta_{ij} D_{i,-j}^{H}](p_{h,-j}^{e} - c_i) \right] + \omega_{ij}$$

(iii) **Hospital Costs**

(iv) **Recapture Effect**

Residual
Function of price errors and demand objects

(Paper adapts equation to account for hospital systems bargaining jointly)

- Moments: $E[\omega_{ij} Z] = 0$ where instruments are constructed from equation, replacing prices with costs and $\Delta WTP_{h,j}$ of other hospitals.
- Identification: correlation of prices w/ costs, enrollment changes

Estimates: Cost and Bargaining Parameters

		(iv)
Insurer Marginal Costs	η_{BS}	1,645.18
		(94.13)
	η_{BC}	2,113.84
		(69.36)
(Kaiser includes hospital costs)	η_K	2,507.22
		(46.09)
Nash Bargaining Parameters	τ_{BS}	0.13
		(0.03)
	τ_{BC}	0.17
		(0.04)
Elasticity Scaling	ρ	2.85
		(0.20)
System Bargaining		Y
Use Margin Moments		Y
Number of Observations		266

- **Non-Hosp Marginal Costs:**
  - KFF (CA '14): $1,836 pp/py on physician & clinical services
  - MA APCD ('10-'12): $1,644 pp/py on prof services (3 largest commercial payers)
- **Bargaining Parameters:**
  - Hospitals are able to capture a significant share of insurers' GFTs
- **Elasticity Scaling:**
  - Insurers perceive ~3x larger
  - Alternative Model: insurers perceive a $100 increase in premiums increases probability of being dropped by 9.5%

Roadmap

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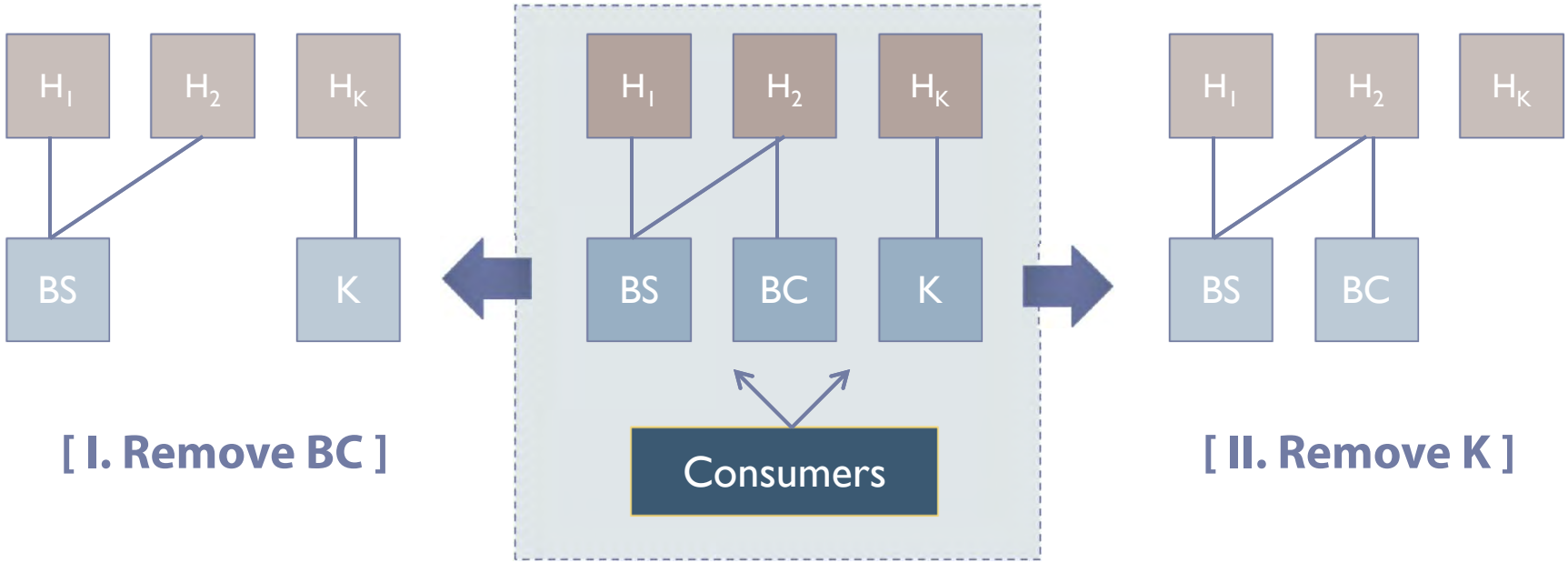
Removing an Insurer from the Choice Set



- **Recompute Equilibrum:** negotiated prices, premiums, enrollment, utilization *(in all markets, for all households and individuals)*
- **Hold Fixed:** Non-premium characteristics of remaining insurers (e.g., networks), characteristics of hospitals, entry/exit of providers
- **Presentation:** Focus only Counterfactual #1 (Remove BC)

Counterfactual #1: Remove BC

		Baseline	(i) Remove BC	
		Amount	Amount	% Change
Premiums	BS	3.69	3.85	4.35%
		[3.49, 4.02]	[3.62, 4.27]	[3.6%, 6.2%]
(Single, $000/yr)	BC	3.99	-	-
		[3.74, 4.15]		
	Kaiser	3.90	3.97	1.65%
		[3.87, 3.93]	[3.95, 4.04]	[.9%, 4.4%]
Avg Hosp Prices	BS	6.87	6.78	-1.37%
		[5.76, 8.80]	[5.58, 8.92]	[-3.9%, 1.7%]
($000 / Admission)	BC	5.39	-	-
		[4.86, 6.69]		
Surplus	Insurer	0.48	0.59	22.91%
		[.42, .54]	[.54, .66]	[18.5%, 35.2%]
($000 / Capita)	Hospitals	0.21	0.23	5.36%
	(Non-K)	[.18, .23]	[.18, .29]	[-4.3%, 24.5%]
	Δ Cons.	-	-0.05	-
			[-.07, -.04]	

- Premiums increase by ~4% for BS (11% if unconstrained)
- *Average hospital prices and payments relatively unchanged for BS*
- Surplus higher for insurers, lower for consumers ($50/capita)

Table 9: Remove BC Counterfactual: Blue Shield Hospital Price Changes & Decomposition

	Avg. Hospital Price ($ / admission)			Decomposition of Change ($ / admission)				
	Baseline	Remove BC	% Change	(ia) Prem Effect	(ib) Enroll Effect	(ii) Price Reinforce	(iii) Cost Effect	(iv) Re-Capture
ADJUSTING PREMIUMS								
All Mkts	6,873.35	6,913.26	0.58%	190.15	-302.91	156.11	0.06	-3.49
2. Sacramento	7,868.21	8,415.18	6.95%	178.12	-73.12	445.14	0.05	-3.23
4. SF Bay W.	8,932.39	9,320.72	4.35%	178.57	-155.32	365.79	0.82	-1.54
5. E. Bay	7,125.87	7,716.08	8.28%	209.42	-41.08	427.26	0.24	-5.64
9. C. Valley	6,313.49	5,357.35	-15.14%	178.57	-744.53	-378.64	0.16	-11.70
10. S. Barbara	7,917.27	6,756.13	-14.67%	134.56	-965.57	-320.48	-0.19	-9.46
11. LA	5,430.24	5,580.30	2.76%	192.46	-243.63	206.29	0.06	-5.11
14. SD	6,400.68	6,353.75	-0.73%	139.31	-283.17	100.38	0.01	-3.46
FIXING PREMIUMS								
All Mkts	6,873.35	6,281.69	-8.61%	-	-312.05	-274.17	0.05	-5.48
2. Sacramento	7,868.21	7,697.85	-2.17%	-	-144.32	-22.83	0.03	-3.23
4. SF Bay W.	8,932.39	8,684.86	-2.77%	-	-231.57	-15.32	0.90	-1.54
5. E. Bay	7,125.87	6,929.21	-2.76%	-	-124.19	-66.92	0.09	-5.64
9. C. Valley	6,313.49	4,909.07	-22.24%	-	-697.79	-695.05	0.11	-11.70
10. S. Barbara	7,917.27	6,527.35	-17.56%	-	-885.28	-495.05	-0.14	-9.46
11. LA	5,430.24	4,823.52	-11.17%	-	-311.31	-290.34	0.04	-5.11
14. SD	6,400.68	5,770.17	-9.85%	-	-306.46	-320.59	0.01	-3.46

- *Premiums fixed:* hospital prices fall (enrollment effect dominates)
- *Premiums adjust*: heterogeneous effect. Hospital prices rise in most markets when BC exits, but fall in some areas. Zero effect on avg.

Discussion: Removing an Insurer

- Higher premiums overall, higher hospital prices in many markets
  - Premiums rise by 4-10% depending on insurer that is removed (and 10-20% w/o constraints); consumer welfare harmed
  - Can be mitigated if significant constraints on premium setting behavior
- However, removal of BC allows BS to negotiate *lower* prices in some markets (particularly where BC was a stronger competitor)
  - Hospital prices fall by ~15% in certain markets (but rise in most others)
  - Redistribution of rents across hospitals and potential long-term implications (*can identify markets that are most likely to be affected*)
- Key Caveat: holds fixed (non-premium) provider characteristics
- ***Suggests that countervailing power effects are empirically relevant and can constrain spending in certain markets***

Concluding Remarks

1. Establish the empirical plausibility of insurer concentration leading to a countervailing effect on hospital prices
   a) Plausible mechanism by which insurance mergers can lead to "cost savings"
   b) Though premiums are likely to increase, we also provide conditions under which both premiums + hospital prices can fall
   c) **Highlights important details to consider in policy evaluation**

2. Quantify the heterogeneity of price impacts across hospitals
   a) Decompose hospital prices into estimable components
   b) Longer-term hospital incentives [investment, entry, exit, merger]

3. Provide a framework to analyze equilibrium changes in markets with competing insurers and non-overlapping networks
   a) Implications for employer-sponsored markets, insurance exchanges
   b) **Costs and benefits more nuanced than simple models might predict**

Empirical Analysis: Setting & Data (2/2) - Prices

- We observe the payment for every hospital-MCO-admission:
  - We assume each hospital i and MCO j bargain over a "DRG-adjusted" price p^*_{ij} per admission *a*, approximated by:

$$p^e_{ij} = \frac{1}{\#A_{ij}} \sum_{a \in A_{ij}} \frac{p^o_a}{DRG_a} = p^*_{ij} + \varepsilon^A_{ij}$$

[DRG weights control for resource utilization / severity per admission]

  - $\varepsilon^A_{i,j}$: average of unanticipated admission-specific payment shocks (mean 0, independent of insurer and hospital observed characteristics) Source of "unobservable" in bargaining and premium-setting equations

Estimates: Hospital Price Decomposition

Hospital "Gains-From Trade" (<0)

MCO "Gains-From-Trade" (>0)

(iii) **Hospital Costs**

(iv) **Recapture Effect**

(i) **Premium & Enrollment Effect**

(ii) **Price Reinforcement Effect**

Total Pmts @r= .13 , .17

Table 6: Estimates: Negotiated Hospital Price Decomposition

	Price	(i) Premium & Enrollment	(ii) Price Reinforcement	(iii) Hospital Costs	(iv) Recapture Effect
BS	7417.17	31.9%	50.3%	17.3%	0.5%
		[28.2%, 32.7%]	[45.0%, 51.3%]	[14.4%, 18.3%]	[0.4%, 0.5%]
BC	6235.84	34.4%	38.2%	24.6%	2.7%
		[30.9%, 35.8%]	[34.5%, 39.5%]	[22.3%, 26.5%]	[2.4%, 3.0%]

Stage II: Insurer Demand (3/3)

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

Recall Predictions of Theory

- The effect of removing an insurer on negotiated prices p_{ij}:
  - *Ia.* ***Premium effect***: softer premium competition, **higher p_{ij}**
  - *Ib.* ***Enrollment effect***: dropping a hospital causes smaller loss in insurer j's enrollment, improves j's outside option, **lower p_{ij}**
  - *IV.* ***Recapture effect***: when hospital i dropped, fewer consumers may switch plans to keep access to hospital i; i's outside option worsens, **lower p_{ij}**
  - *II.* ***Price reinforcement effect***: changes in both enrollment and other hospital prices; ***ambiguous*** effect on pij
- We predict the net effects across markets and hospitals

Recap: Estimation & Identification of Model

- Premiums, hospital prices and costs, consumer and household choices of hospital and insurance plan are all observed in the data
- Hospital and insurer demand identified from individual-level data on observed choices over observed product choice sets (MLE)
  - Exogenous variation in premiums by construction
  - Assume exogenous variation in consumer location
- Insurer premium-setting & margin moments identify non-hosp costs
  - We assume premiums set to maximize insurer profits given costs
  - Demand estimates provide premium elasticities – a crucial input
  - Also utilize observed insurer markups – important tie to reality
  - We perform multiple robustness tests re: assumptions here
- Remaining piece is bargaining equation:
  - To estimate bargaining weights
  - And provide structure to predict price effects of removing an insurer