Hospital Network Competition and Adverse Selection
Evidence from the Mass. Health Insurance Exchange

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Motivation: Growth of Limited Networks

- Growing phenomenon in health insurance: **Limited networks of covered medical providers**
  - ACA: 45% of plans have “narrow” hospital networks (McKinsey 2015)

- Controversy: Tend to exclude “star” academic hospitals

  **Top Hospitals Opt Out of Obamacare**

  **The Seattle Times**
  Left off many networks, Seattle Children’s sues

  **Managed Care**
  Plans Use Narrow Networks in Exchanges; Public, Politicians Predictably Perturbed
Adverse Selection and Star Hospitals

- Why might insurers exclude top hospitals?
  1. **Cost reduction**: Top hospitals have high prices *(Ho 2009: 60% > avg.)*
  2. **Adverse selection**: Avoid high-cost consumers

- **Question**: Does adverse selection deter covering star hospitals?
  - Exchanges: Use risk adjustment ↦ Is selection still relevant?

- Why study this question?
  - Implications for understanding narrow networks in ACA, Medicaid, etc.
  - Implications for market power of star hospitals
  - Broader issue: How well does competition work in selection markets?
Typical channel: **Medical risk**
- Policy: Risk adjust payments to compensate plans extra for the sick

Alternate channel: **Likelihood to use star hospital** when sick
- Key fact: Star hospitals have high prices, paid by insurer not patients

Idea: Selection on preference for using high-cost hospital
- Creates “selection on moral hazard” (Einav et al. 2013)
Setting and Methods

- **Setting**: Subsidized Massachusetts health insurance exchange
  - Nice setting for studying hospital networks, selection
  - Data: Plan choices + insurance claims (costs, hospital choices)

- **Reduced form evidence on selection**:
  1. Choices across plans varying in star hospital coverage
  2. Network *change* in 2012 → Observe plan switching and cost changes

- **Structural model and policy counterfactuals**:
  - Study equilibrium, welfare implications of policies to address selection
Preview of Results

- **Substantial adverse selection** against plans covering star hospitals
  - Key group: Patients loyal to star hospital based on past use

- **Strong incentive to drop star hospitals from network**
  - Model simulations: All plans drop star hospital system (with fixed prices)
  - Alternate possibility: Star hospitals might instead lower prices

- **Counterfactuals: Modified risk adjustment**
  - Restores star hospital coverage, but no net gains in welfare
  - Problem: Covering them raises costs (moral hazard); plan choice imperfectly sorts which patients should use star hospital
Outline

1. Background and Theory

2. Reduced Form Evidence

3. Structural Model and Estimates
   - Hospital Choice, Insurance Choice, Costs

4. Equilibrium and Counterfactuals

5. Conclusion
Setting: Mass. Health Insurance Exchange (CommCare)

- Offers subsidized plans to nonelderly adults below 3x poverty
  - Size: 5 insurers, ~170,000 enrollees/month (~3% of Mass. population)

- Key institutions:
  - Single plan per insurer
  - Community rated premiums + Risk adjustment
  - Most benefits fixed by regulation → Key exception is provider networks

- Data: Plan choices and Insurance claims for all enrollees
  - 1.6 million plan choices by 611,455 unique individuals
  - 74,383 general acute hospital admits (including actual paid amounts)
1. Insurers negotiate with star hospital $\rightarrow$ coverage, payment rates
   - My analysis: Holds payment rates fixed as observed

2. Insurers set plan prices at start of year
   - $Revenue_{ij} = Price_j + RiskAdjustment_i$

3. Consumers choose plans

4. When sick: Patients choose hospitals, incur costs
Characteristics of “star” hospitals:

- **Top reputations** – e.g., ranked highly in *U.S. News “Best Hospitals”*
  - Especially for **most complex patients**

- **Academic hospitals** – centers of medical teaching and research

- **Tend to have high prices** (*Ho 2009: +60% above avg.*)
Star vs. Non-Star Hospital Example

**Star:** Mass. General Hospital
- Large Academic Med. Ctr. (947 beds)
- *U.S. News* Rank: #1 in MA (#2 in U.S.)
- Avg. Price/admit = $19,950

**Non-Star:** Mt. Auburn Hospital
- Smaller Teaching Hospital (203 beds)
- Not ranked in top MA hospitals
- Avg. Price/admit = $9,529
Cost and Selection Effects of Star Hospital Coverage

\[
\pi(\text{No Star Hospital}) = \sum_i \left[ P^0 - C_i^0 + RA_{ij} \right] \cdot D_i^0
\]

\[
\pi(\text{Cover Star Hosp}) = \sum_i \left[ (P^0 + \Delta P) - (C_i^0 + \Delta C_i) + RA_{ij} \right] \cdot (D_i^0 + \Delta D_i)
\]

Effects of Covering Star Hospital:

1. **Cost Increase** (*moral hazard*): \( \Delta C_i > 0 \)

2. **Adverse Selection**: \( \text{Cov}(\Delta D_i, C_i^0 + \Delta C_i) > 0 \)
   - Two components: Selection on cost level \( C_i^0 \) and cost increase \( \Delta C_i \)

- **Risk Adjustment**: Not designed to offset selection on moral hazard (Einav et al. 2015)
Inefficient Sorting across Plans

- Ideal: Choose plan A if \( \Delta V_{Value_i} > \Delta C_{ost_i} \)
- Actual: Choose plan A if \( \Delta V_{Value_i} > \Delta P_{remium} \)

Potentially: Adverse selection death spiral

- Attract high-costs \( \rightarrow \) Raise price \( \rightarrow \) Lose low-costs \( \rightarrow \) Raise price \( \rightarrow \) ...
- Either stabilizes at high price or leads to dropping star hospital

Disciplines market power of star hospital

- Adverse selection improves insurers’ bargaining threat point
Outline

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5. Conclusion
Three Components:

1. High-price hospitals (*star hospitals*)

2. Consumer group especially **likely to use** star hospitals

3. Three facts about this group:
   - High cost even after risk adjustment
   - Tend to choose plans covering star hospitals
   - High cost change ("moral hazard") when star hospitals are covered
## High-Price Star Hospitals: Partners Healthcare

- **Price:** Estimated with model of average amount paid per admission, adjusted for patient severity → *Details*

<table>
<thead>
<tr>
<th>Hospital</th>
<th>System</th>
<th>Price</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Brigham &amp; Women's</td>
<td>Partners</td>
<td>$20,474</td>
<td>1.12</td>
</tr>
<tr>
<td>2 Mass. General</td>
<td>Partners</td>
<td>$19,550</td>
<td>1.09</td>
</tr>
<tr>
<td>3 Boston Med. Ctr.</td>
<td>BMC</td>
<td>$15,919</td>
<td>1.05</td>
</tr>
<tr>
<td>4 Tufts Med. Ctr.</td>
<td>Tufts</td>
<td>$14,038</td>
<td>1.10</td>
</tr>
<tr>
<td>5 UMass Med. Ctr.</td>
<td>UMass</td>
<td>$14,111</td>
<td>1.07</td>
</tr>
<tr>
<td>6 Charlton Memorial</td>
<td>Southcoast</td>
<td>$14,210</td>
<td>1.03</td>
</tr>
<tr>
<td>7 Baystate Med. Ctr.</td>
<td>Baystate</td>
<td>$12,223</td>
<td>1.11</td>
</tr>
<tr>
<td>8 Lahey Clinic</td>
<td>Lahey</td>
<td>$11,742</td>
<td>1.13</td>
</tr>
<tr>
<td>9 Beth Israel Deaconess</td>
<td>CareGroup</td>
<td>$11,787</td>
<td>1.08</td>
</tr>
<tr>
<td>10 St. Vincent</td>
<td>Vanguard</td>
<td>$11,455</td>
<td>1.03</td>
</tr>
<tr>
<td>All Other Hospitals</td>
<td>---</td>
<td>$8,585</td>
<td>0.95</td>
</tr>
</tbody>
</table>
**Key Group:** Past patients at Partners facilities (outpatient care)

- Idea: Patients likely to be **loyal** to Partners hospitals/docs in future
- Loyalty may reflect *either* heterogeneity or state dependence
- Implement “unused observable” test for adverse selection (Finkelstein and Poterba 2012)

**Test Results:** Past outpatients at Partners hospital are:

- Almost 5x as likely to use Partners hospital when hospitalized
- 28% higher cost *after* risk adjustment
- 80% more likely to *actively* choose plan covering Partners
Evidence from Network Changes

- **Additional evidence**: How do selection patterns, costs respond to change in network coverage of Partners?

- **Biggest change**: Large plan (Network Health) drops Partners (+ several other hospitals) in 2012

- How did network changes affect selection and costs?
  - **Selection**: Look at plan switching
  - **Cost changes (moral hazard)**: Analyze cost changes for non-switchers
<table>
<thead>
<tr>
<th>Enrollee Group</th>
<th>Risk Adj. Costs</th>
<th>Group Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>All Enrollees</td>
<td>$4,439</td>
<td>$3,761</td>
</tr>
<tr>
<td>Stayers</td>
<td>$3,807</td>
<td>$3,596</td>
</tr>
<tr>
<td>Left Plan in 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switched Plans</td>
<td>$6,109</td>
<td>[$5,106]</td>
</tr>
<tr>
<td>Exited Market</td>
<td>$5,511</td>
<td>---</td>
</tr>
<tr>
<td>Joined Plan in 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switched Plans</td>
<td>[$3,641]</td>
<td>$3,706</td>
</tr>
<tr>
<td>Entered Market</td>
<td>---</td>
<td>$4,007</td>
</tr>
</tbody>
</table>

Both effects driven by Partners patients
Evidence of Selection: Plan Switching

Share of Enrollees Switching away from Network Health

Past Partners Patients

RAdj. Cost = $6,852

Other Dropped Hospitals’ Patients

RAdj. Cost = $4,340

Average

RAdj. Cost = $3,318

All Others

Fiscal Year

2009 2010 2011 2012 2013
Summary So Far

- **Summary**: Strong evidence of adverse selection by past Partners patients when Network Health dropped Partners
  - Raised costs for rival plans (Additional Evidence)

- **Final fact to test**: Are cost changes (moral hazard) larger for Partners patients when drop star hospitals?
  - Next: Examine cost history for fixed set of “stayers” in Network Health
Evidence of Overall Cost Reductions for Stayers

Total Cost per Year - Non-Switchers Only

- Stayers in Network Health
- Stayers in Another Plan

Note: Points are group x time coeffs. from regression with individual fixed effects.
Differential Cost Reductions for Partners Patients

Total Cost per Year - Non-Switchers Only

- **Partners Patients**
- **All Other Enrollees**

**Fiscal Year Date**

- 2011
- 2012
- 2013

**Note:** Points are group x time coeffs. from regression with individual fixed effects.
Summary and Partners Coverage History

- **Summary**: Dropping Partners reduces costs both through selection and cost reduction

- **Decomposition using model**: Selection explains ~50% of fall in risk-adjusted costs for Network Health in 2012 (Results)

- **Concern**: Unraveling of coverage of Partners
  - 2012: Network Health drops Partners
  - 2014: Another plan drops Partners (citing selection)
  - Only one plan left covering Partners (bought by Partners in 2013)
1. Background and Theory

2. Reduced Form Evidence

3. Structural Model and Estimates
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4. Equilibrium and Counterfactual Simulations

5. Conclusion
Summary so far: Evidence that heterogeneous prefs. for star hospitals creates adverse selection and selection on moral hazard

Open questions:
- How quantitatively important for incentive to cover star hospital?
- What are the welfare implications?
- How should risk adjustment or other policies respond?

Need a structural model to address these questions
### Setup: Follows past literature [e.g., Capps, et al. 2003; Ho 2006]

<table>
<thead>
<tr>
<th>Model Part</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hospital Choice</td>
<td>• Hospital admission data</td>
<td>• Hospital demand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Network utility (WTP)</td>
</tr>
<tr>
<td>2. Plan Choice</td>
<td>• Plan choice data</td>
<td>• Plan demand</td>
</tr>
<tr>
<td></td>
<td>• Network utility</td>
<td>• Cons. welfare metric</td>
</tr>
<tr>
<td>3. Costs</td>
<td>• Hospital prices and demand</td>
<td>• Cost model</td>
</tr>
<tr>
<td></td>
<td>• Non-hospital costs</td>
<td></td>
</tr>
<tr>
<td>4. Equilibrium</td>
<td>• Plan demand</td>
<td>• Simulate Nash eq.</td>
</tr>
<tr>
<td></td>
<td>• Cost model</td>
<td></td>
</tr>
</tbody>
</table>

- **Adverse selection story**: Captured by hospital preferences (in #1) entering plan choice and cost model
Model Part 1: Hospital Choice

**MN Logit Model:** \((\text{patient } i, \text{ plan } j, \text{ diagnosis } d, \text{ hospital } h)\)

\[ u_{ijdh} = \eta_h + \gamma X_h Z_i + \delta \text{Dist}_{i,h} + \lambda \text{PastPat}_{i,h} + \kappa_j OONetw_{h,j} + \epsilon_{ijdh} \]

- First three terms are standard in literature
- Distinct from past work:
  - Dummy for whether past patient at hospital \(h\) (inpatient & outpatient)
  - Allow out-of-network use, estimate “hassle cost” of plan authorization
## Hospital Choice Model Estimates

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>Marginal Effects</th>
<th>(+10) miles = (-31)%</th>
<th>(+1) s.d. = (+47)%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital/Patient Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance in Miles (avg. coeff.)</td>
<td>-0.144***</td>
<td>(0.001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Severity x Academic Med. Ctr.</td>
<td>2.076***</td>
<td>(0.044)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital dummies, Specialized services</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Past Patient at this Hospital (&gt;60) days prior</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient Care</td>
<td>1.417***</td>
<td>(0.020)</td>
<td></td>
<td>Past IP = (+146)%</td>
<td></td>
</tr>
<tr>
<td>Outpatient Care</td>
<td>2.202***</td>
<td>(0.013)</td>
<td></td>
<td>Past OP = (+468)%</td>
<td></td>
</tr>
<tr>
<td><strong>Out-of-Network Hassle Disutility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x) Plan = BMC</td>
<td>-1.117***</td>
<td>(0.034)</td>
<td></td>
<td>Out-of-Network</td>
<td></td>
</tr>
<tr>
<td>(x) Plan = CeltiCare</td>
<td>-1.464***</td>
<td>(0.058)</td>
<td></td>
<td>= (-63)% (avg.)</td>
<td></td>
</tr>
<tr>
<td>(x) Plan = Fallon</td>
<td>-1.583***</td>
<td>(0.059)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x) Plan = NHP</td>
<td>-0.543***</td>
<td>(0.049)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x) Plan = Network Health</td>
<td>-1.011***</td>
<td>(0.036)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R(^2) in Shares (Area-Plan-Year Level)</td>
<td>0.742</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num. Hospitalizations</td>
<td>74,383</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Std. Errors in parentheses. * = 5% sign., ** = 1% sign., *** = 0.1% sign.

Full model also includes: (1) Distance\(^2\), Distance \(x\) region, income grp., age, gender, severity, emergency; (2) Out-of-network \(x\) emergency, (3) Eight specialty services \(x\) associated diagnoses.
Model Part 2: Insurance Plan Choice

New Enrollees: \((\text{consumer } i, \text{ plan } j, \text{ time } t)\)

\[
U_{ijt}^{\text{New}} = \alpha(Z_i) \cdot \text{Prem}_{ijt} + \beta(Z_i) \cdot \text{Network}_{ijt} + \xi_{j,t,\text{Reg}_i} + \xi_{j,\text{Reg}_i,\text{Inc}_i} + \epsilon_{ijt}
\]

1. **Premium** (post-subsidy)

2. **Hospital Network Variables:**
   - Expected utility from hospital choice model (\(\rightarrow\) More)
   - Additional dummy: Whether covers ind.’s past-used hospital(s)

3. **Plan Dummies:** Unobserved quality (used for identification)

Current Enrollees: Add “switching cost” dummy to capture inertia in simple way (\(\rightarrow\) Details)
Use cross-group variation (for same plan) induced by subsidy rules
  - Above Poverty: Consumer premiums change with prices
  - Below Poverty: Subsidies make all plans $0 (control group)

Idea: Similar to difference-in-difference
  - Utility specification: Plan dummies absorb all variation except within-plan differential premium changes across income groups

Assumption: Parallel trends in unobserved quality across incomes
  - Next slides: Test for parallel trends
Market Share around Price Decreases

New Enrollees, 2008-2011

Zero-Price (<100% Pov.)

Price-Paying Enrollees

Marked Share

Months (Relative to Price Change = 0)
Market Share around Price Increases

New Enrollees, 2008-2011

Zero-Price (<100% Pov.)

Price-Paying Enrollees

Months (Relative to Price Change = 0)
## Plan Demand Estimates

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Coeff.</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium (avg. coeff.)</td>
<td>-1.000***</td>
<td>(0.025)</td>
</tr>
<tr>
<td>x Income/50% Pov. (avg.)</td>
<td>0.304***</td>
<td>(0.014)</td>
</tr>
<tr>
<td>x Age/5 (avg.)</td>
<td>0.035***</td>
<td>(0.002)</td>
</tr>
<tr>
<td><strong>Hospital Network</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Utility (avg. coeff.)</td>
<td>6.949***</td>
<td>(0.670)</td>
</tr>
<tr>
<td>x Income/50% Pov. (avg.)</td>
<td>0.627</td>
<td>(0.440)</td>
</tr>
<tr>
<td>Whether Covers Past-Used Hospital</td>
<td>5.736***</td>
<td>(0.853)</td>
</tr>
<tr>
<td>x Partners Hospital</td>
<td>11.546***</td>
<td>(0.771)</td>
</tr>
<tr>
<td><strong>Inertia / Switching Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Coeff.</td>
<td>95.638***</td>
<td>(0.234)</td>
</tr>
<tr>
<td>x Plan Drops Past Used Hospital</td>
<td>-27.275***</td>
<td>(1.010)</td>
</tr>
<tr>
<td>x Drops Partners Hospital</td>
<td>-20.218***</td>
<td>(1.384)</td>
</tr>
<tr>
<td><strong>Plan Dummies</strong></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No. Choice Instances</td>
<td>1,588,889</td>
<td></td>
</tr>
</tbody>
</table>

* = 5% sign., ** = 1% sign., *** = 0.1% sign.

Full model also includes: (1) Premium x income grp., age group (5-year), sex; (2) Network utility x income grp.; (3) Inertia x age grp., sex; (4) Plan dummies (region-year and region-income grp.)
## Distribution of Value of Partners Coverage

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Avg. Value ($/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50%</td>
<td>$0.5</td>
</tr>
<tr>
<td>50-70%</td>
<td>$2.2</td>
</tr>
<tr>
<td>70-79%</td>
<td>$4.3</td>
</tr>
<tr>
<td>80-89%</td>
<td>$8.8</td>
</tr>
<tr>
<td>90-95%</td>
<td>$23.6</td>
</tr>
<tr>
<td>96-100%</td>
<td>$46.8</td>
</tr>
</tbody>
</table>

**Average** $5.7

Past Partners patients
Model Part 3: Insurer Costs

- **Goal**: Individual-level model of costs in different plans/networks

- **Inpatient Hospital Costs**:
  \[
  C_{ij}^{Hosp} = \sum_{n=1}^{nAdmit_i} \hat{\omega}_{i,n} \cdot \sum_h \hat{P}_{jh} \cdot s_{idh}(N_j)
  \]
  - Condition on observed admissions, hospital prices
  - Adjust hospital choices based on plan network using model

- **Non-Inpatient Costs**: Reduced form model of plan effects on costs
  \[
  \rightarrow \text{Details}
  \]

- **Total Costs** = Inpatient + Non-inpatient costs
<table>
<thead>
<tr>
<th>Consumer Value of Partners Covg.</th>
<th>Costs to Insurer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentiles</td>
<td>Avg. Value ($/month)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50%</td>
<td>$0.5</td>
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</tr>
<tr>
<td>96-100%</td>
<td>$46.8</td>
</tr>
<tr>
<td>Average</td>
<td>$5.7</td>
</tr>
</tbody>
</table>
Have all elements of plan profit function:

\[ \pi_j(P, N) = \sum_i \left( P_j + RAdj_i - C_{ij}(N_j) \right) \cdot D_{ij}(Prem(P), N) \]

Simulate full-info, static Nash eq. in two-stage insurer game:
1. Cover or exclude Partners hospitals
2. Set plan prices

Key assumptions:
- Fixed hospital prices and hospital networks other than Partners
- Single plan per insurer
Condition on past history and simulate static equilibrium for a single year (e.g., 2012)

Accounting for plan choice inertia

- Challenge: Creates dynamics, but fully dynamic game complex and difficult to estimate from small number of years in Mass. exchange

- **What I do:** Adjust static FOC for effect of inertia on future profits
  (\(\rightarrow\) Details)

Cost assumptions:

- Counterfactual Partners hospital prices = Avg. observed prices among plans covering it (not a full bargaining model)

- Other costs: Change in proportion to average hospital costs (\(\rightarrow\) Details)
1. Background and Theory

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4. Equilibrium and Counterfactual Results

5. Conclusion
### Equilibrium (2012, ACA-like policies)

<table>
<thead>
<tr>
<th></th>
<th>BMC</th>
<th>CeltiCare</th>
<th>Netw. Health</th>
<th>NHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partners Coverage</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Price</td>
<td>$427</td>
<td>$365</td>
<td>$371</td>
<td>$418</td>
</tr>
<tr>
<td>Market Share</td>
<td>22%</td>
<td>19%</td>
<td>41%</td>
<td>16%</td>
</tr>
</tbody>
</table>

#### Financial Statistics ($ / member-month)

<table>
<thead>
<tr>
<th></th>
<th>BMC</th>
<th>CeltiCare</th>
<th>Netw. Health</th>
<th>NHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Adj. Transfer</td>
<td>$6</td>
<td>-$43</td>
<td>-$1</td>
<td>$12</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>$433</td>
<td>$322</td>
<td>$370</td>
<td>$429</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$386</td>
<td>$304</td>
<td>$360</td>
<td>$378</td>
</tr>
<tr>
<td>Profit Margin</td>
<td>$47</td>
<td>$18</td>
<td>$10</td>
<td>$51</td>
</tr>
<tr>
<td>Total Profit ($millions)</td>
<td>$10.99</td>
<td>$3.55</td>
<td>$4.32</td>
<td>$8.55</td>
</tr>
</tbody>
</table>

### Deviation: NHP covers

- **Change (added)**
  - $12
  - 1%
  - $17
  - $29
  - $35
  - -$6

- **Total Profit ($millions)**
  - **-$1.33**

**Finding:** Full unravelling of Partners coverage (robust across years)
Policy Change:

- Scale up risk adjustment payments for sick, decrease for healthy
- Idea: “Over adjust” to offset noisy signal (Glazer & McGuire 2000)

Findings:

- Policies can reverse unraveling of Partners coverage
- But net welfare declines (net $\Delta \text{Cost} > \Delta \text{Consumer value}$)
  - $\Delta \text{Value} > \Delta \text{Cost}$ for Partners patients; opposite for rest of population
- Competitive Effect: Weakens insurer incentive to reduce markups
## Risk Adjustment Changes

<table>
<thead>
<tr>
<th>Over-Adjustment Factor</th>
<th>Plans Covering Partners</th>
<th>Welfare Analysis (per member-month)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔCons. Surplus</td>
<td>Insurer Profit</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>$0.0</td>
</tr>
<tr>
<td>25%</td>
<td>None</td>
<td>$4.1</td>
</tr>
<tr>
<td>50%</td>
<td>NHP Only</td>
<td>$5.4</td>
</tr>
</tbody>
</table>

- Note: Social Surplus = Cons. Surplus + Insurer Profit + Partners Net Revenue – Govt. Cost
1. Background and Theory

2. Reduced Form Evidence

3. Structural Model and Estimates
   - Hospital Choice, Insurance Choice, Costs

4. Equilibrium and Counterfactual Simulations

5. Conclusion
**Main result:** Adverse selection discourages covering star hospitals

- **Mechanism:** Selection on preference for using expensive star provider

**Implication #1:** Changing economics of star hospitals in exchanges

- No longer “must cover” hospitals, puts downward pressure on their prices
- Selection may help explain rise in narrow network plans

**Implication #2:** Additional non-risk channel for thinking about adverse selection – selection on use of higher-cost option

- May apply more generally: Covg. of high-cost drugs, cancer treatments
- Policy challenge: Selection linked to moral hazard/risk protection tradeoff
Thank You!
Appendix Slides
Network Utility Measure for Plan Demand

- Method from Capps, Dranove, Satterthwaite (2003), Ho (2006)

1. **Calculate expected utility** (inclusive value) of access to plan j’s network using hospital choice model:

   \[
   HospEU_{i,d,j}(N_j) = E \max_h \left\{ \hat{u}_{i,d,h}(N_j) + \varepsilon_{i,d,h} \right\} = \log \left( \sum_h \exp(\hat{u}_{i,d,h}(N_j)) \right)
   \]

   **Expected Utility in Logit Model**

2. **Network Utility** (entering plan demand) = Illness probability (based on age/sex) * Hospital Expected Utility

   \[
   NetworkUtil_{i,j,t} = \sum_d \hat{p}_{i,d,t} \cdot HospEU_{i,d,j}(N_{j,t})
   \]

   ➢ **Assumption**: Network valuation proportional to expected use of hospital
Estimate hospital prices w/ Poisson regression in claims data:

\[
E\left[\text{Payment}_{i,j,h,t} \mid \text{Diag}_{it}, Z_{it}\right] = \exp\left(\rho_{j,h,t}\right) \cdot \exp\left(\text{Diag}_{it} \lambda + Z_{it} \gamma\right)
\]

\[
\text{Price} \equiv \hat{P}_{j,h,t} \quad \text{Severity} \equiv \hat{\omega}_{it}
\]

Details:

- Covariates: Diagnoses (CCS categories), age x sex, income grp.
- Limit price flexibility b/c of sample size:
  - Separate constant for each plan-hospital-network status w/ >50 obs.
  - Separate plan-year effects for each of top 6 systems covered by plan
  - Residual plan-year effect for other hospitals, separate by network status
Two times when enrollees choose plans:

- **New enrollment in exchange:**
  - Must **actively choose** a plan to get coverage (default = not enrolled)

- **Current enrollees at annual open enrollment:**
  - Prices and networks may change, so enrollees given chance to switch plans
  - **Default**: Re-enrollment in current plan
  - **Empirically**: Very low switching rate (~5%) – consistent finding w/ insurance

- **Model**: Needs to account for possibility of inertia/switching costs
Utility model for enrollee $i$, in year $t$, for choosing plan $j$:

$$V_{ijt} = \alpha(Z_i) \cdot \text{Prem}_{ijt} + \beta(Z_i) \cdot \text{NetworkUtil}_{ijt} + \xi_{j,t,\text{Reg}_i} + \xi_{j,\text{Reg}_i,\text{Inc}_i}$$

- **Premium**
- **Hosp. Network Utility**
- **Unobs. Plan Quality**

$$U_{ijt}^{\text{New}} = V_{ijt} + \eta_{ij} + \varepsilon_{ijt}$$

$$U_{ijt}^{\text{Curr}} = V_{ijt} + \chi(Z_i) \cdot \text{CurrPlan}_{ijt} + \eta_{ij} + \varepsilon_{ijt}$$

- **Default Choice Coeff.**
- **Ind. Error**
## Model Breakdown of Network Health Cost Change
(Enrollees in Exchange in Both 2011-12)

<table>
<thead>
<tr>
<th>Market Shares</th>
<th>Model Cost Function</th>
<th>Decomposition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>2011 Shares</td>
<td>$353</td>
<td>$325</td>
</tr>
<tr>
<td>2012 Shares</td>
<td>$331</td>
<td>$308</td>
</tr>
</tbody>
</table>
Network Health Premiums (Boston region)

2010 Price = Minimum

2011 Price = $17.74 above min

- <100% Pov.: $0 above min
- 100-150% Pov.: $10.38 above min
- 150-200% Pov.: $17.88 above min
- 200-250% Pov.: $27.78 above min
- 250-300% Pov.: $29.85 above min

All Groups: Premium = $0 above min
Inpatient Hospital Costs

- Estimate plan-specific hospital prices \((P)\) and patient severities \((\omega)\) using regression with claims data → Details

- **Condition** on observed admissions, severities, prices; **Predict** shares using hospital choice model (applying alternate network)

\[
C_{ijt}^{Hosp} (N_{jt}) = \sum_{n=1}^{NAdmits_{it}} \hat{\omega}_{i,t,n} \cdot \left( \sum_h \hat{P}_{j,h,t} \cdot S_{i,d,t,h}^{Hosp} (N_{jt}) \right)
\]

Other (Non-Hospital) Costs

- Estimate reduced form model of plan effect on costs → Details

- Scale observed cost by this plan effect:

\[
c_{ij}^{Model} = c_{ij}^{Obs} \cdot \left( \frac{\hat{\rho}_j}{\hat{\rho}_{jObs}} \right)
\]
Non-Hospital Costs

- Estimate insurer non-hospital costs with regression in claims data:

\[
E[\text{NonHospCost}_{i,j,t} | \text{Diag}_{it}, Z_{it}] = \exp(\chi_{j,t}) \cdot \exp(D\text{iag}_{it}\mu + Z_{it}\xi)
\]

- Define non-hospital cost function:

\[
C_{ijt}^{\text{NonHosp}}(N_{jt}) = \hat{C}_{j,t} \cdot \hat{v}_{i,t} \cdot \phi\left(N_{jt}\right)
\]

- \(\phi = \) reduced-form adjustment to account for effect of network changes (e.g., due to changes in physician costs)
### Summary: Correlation of Partners Value and Cost

<table>
<thead>
<tr>
<th>Consumer Value of Partners Covg.</th>
<th>Costs to Insurer</th>
<th>Not Covering Partners</th>
<th>ΔCost if Cover Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentiles</td>
<td></td>
<td>Unadjusted Cost</td>
<td>Risk Adj. Cost</td>
</tr>
<tr>
<td>0-50%</td>
<td></td>
<td>$300.0</td>
<td>$301.2</td>
</tr>
<tr>
<td>50-70%</td>
<td></td>
<td>$269.6</td>
<td>$294.5</td>
</tr>
<tr>
<td>70-79%</td>
<td></td>
<td>$264.3</td>
<td>$292.7</td>
</tr>
<tr>
<td>80-89%</td>
<td></td>
<td>$300.1</td>
<td>$311.8</td>
</tr>
<tr>
<td>90-95%</td>
<td></td>
<td>$455.7</td>
<td>$360.4</td>
</tr>
<tr>
<td>96-100%</td>
<td></td>
<td>$482.3</td>
<td>$340.1</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td><strong>$308.8</strong></td>
<td><strong>$305.6</strong></td>
</tr>
</tbody>
</table>

Average Value ($/month): $5.7
Challenge: Enrollee inertia creates dynamics, but full dynamics are complex to model – especially w/ unpredictable policy

Assumption: Insurers maximize current profits + Effect of today’s enrollees on future profits (due to inertia)

\[ \pi_{Total}^j = \sum_i \left( Risk_i \cdot P_j - c_{ij} \left( N_j \right) \right) \cdot D_{ij} \left( P, N \right) + V_{i,Future} \cdot D_{ij} \left( P, N \right) \]

Assumptions:
- Exogenous inertia probability (90%) each year
- Future profit margins (at enrollee-level) = Today’s profit margin
- Use consumers’ actual future exchange enrollment length
**Issue:** Covering/dropping Partners affects non-hospital costs also (e.g., b/c Partners system includes doctors)

**Challenge:** Do not have structural model for non-hospital costs

**Solution:** When add/drop Partners, adjust non-hospital costs in proportion to regional avg. hospital cost change \((\text{with } \lambda = 0.038)\)

\[
c_{\text{NonHosp}}^{\text{N}}(N_{jt}) = c_{\text{N}}^{\text{NonHosp}}(N_{jt}^{\text{Ob}}) \cdot \left(1 + \lambda \cdot \%\Delta \text{HospCost}_{j,\text{Reg},t}(N_{jt})\right)
\]

**Future robustness:** More heterogeneity in cost adjustment, based on observed changes when plan dropped Partners
## Marginal Subsidies

<table>
<thead>
<tr>
<th>Marginal Subsidy Rate</th>
<th>Plans Covering Partners</th>
<th>Welfare Analysis (per member-month)</th>
<th>ΔCons. Surplus</th>
<th>Insurer Profit</th>
<th>Partners Net Rev.</th>
<th>Govt. Costs</th>
<th>ΔSocial Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>$0.0</td>
<td>$26.5</td>
<td>$0.6</td>
<td>$322.7</td>
<td>$0.0</td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>None</td>
<td>$0.7</td>
<td>$33.4</td>
<td>$0.6</td>
<td>$331.1</td>
<td>-$0.8</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>BMC Only</td>
<td>$0.7</td>
<td>$39.5</td>
<td>$1.0</td>
<td>$338.8</td>
<td>-$1.9</td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td>BMC + NHP</td>
<td>$2.5</td>
<td>$65.5</td>
<td>$2.4</td>
<td>$370.2</td>
<td>-$4.1</td>
<td></td>
</tr>
</tbody>
</table>

- Qualitatively similar results: Can undo Partners unravelling, but raises prices and profits at government expense.
Model vs. Data: Plan Switching Patterns

Share of Enrollees Switching away from Network Health

- Data
- Model

Past Partners Patients

Other Dropped Hospitals' Patients

All Others

Fiscal Year:
- 2009
- 2010
- 2011
- 2012
- 2013
## Network Health: Average Costs 2011-12

<table>
<thead>
<tr>
<th>Enrollee Group</th>
<th>Data</th>
<th>Risk Adj.</th>
<th>Data</th>
<th>Risk Adj.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
<td>%Δ</td>
<td>%Δ</td>
</tr>
<tr>
<td>All Enrollees</td>
<td>$378</td>
<td>$313</td>
<td>-17%</td>
<td>-15%</td>
</tr>
<tr>
<td>Stayers (in plan both years)</td>
<td>$317</td>
<td>$305</td>
<td>-4%</td>
<td>-5%</td>
</tr>
<tr>
<td>2011 Only Enrollees</td>
<td>$476</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2012 Only Enrollees</td>
<td>---</td>
<td>$310</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
Model vs. Data: Partners Hospital Use Patterns

Share of Admissions at Partners Hospitals

- **Network Health**
- **Full Market**
- **All Other Plans**

Fiscal Year

2008 2009 2010 2011 2012 2013

Share

0.25

0.2

0.15

0.1

0.05

0

Data

Model
Recall: Default choice for current enrollees is to not switch
  - Likely affects behavior: Avg. switching rate <5% (c.f. Handel 2013)

Method: Add reduced form “switching cost” to choice utility

\[
U_{ijt}^{Curr} = V_{ijt}^{New} + \chi(Z_i) \cdot 1_{j=\text{CurrPlan}} + \epsilon_{ijt}
\]

"Excess Utility" of Curr. Plan

Issue: Picks up both true inertia and unobserved heterogeneity
  - Future work: Separate these by allowing persistent taste heterogeneity with time-invariant random coefficients
Share of Admissions at Star Hospitals

Past Partners = 0.322** (0.010)
Price per Hospital Admission

Past Partners = $3,143**

(127)
Hospitalization Rate per Year

Past Partners = 0.0039
(0.0034)
Total Health Care Spending per Year

Past Partners = $1,137**
(96)
Note: Based on active choices by re-enrollees after a coverage gap.