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

U.S.News & WORLD REPORT
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. <u>Cost reduction:</u> Top hospitals have high prices *(Ho 2009: 60% > avg.)*

    2. <u>Adverse selection</u>: Avoid high-cost consumers

- **Question**: Does <u>adverse selection</u> 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?

$$Cost_i = \sum_d \overbrace{PrSick_{i,d}}^{\text{Medical Risk}} \cdot \left(\sum_h \overbrace{PrChoose_{i,d,h} \cdot Price_{d,h}}^{\text{Price of Chosen Providers}} \right)$$

- 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 <u>preference</u> 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

- <u>Substantial adverse selection</u> 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 <u>provider networks</u>

- Data: <u>Plan choices</u> and <u>Insurance claims</u> for all enrollees
  - 1.6 million plan choices by 611,455 unique individuals
  - 74,383 general acute hospital admits (including actual paid amounts)

Insurance Competition Model

1. Insurers negotiate with star hospital → coverage, payment rates

   • My analysis: Holds payment rates fixed as observed

2. Insurers set <u>plan prices</u> at start of year

   • $Revenue_{ij} = Price_j + RiskAdjustment_i$

3. Consumers <u>choose plans</u>

4. When sick: Patients <u>choose hospitals</u>, incur costs

Competitive Incentives

Adverse Selection

What is a "Star" Hospital?

Characteristics of "star" hospitals:

- <u>Top reputations</u> – e.g., ranked highly in *U.S. News* "Best Hospitals"
    - Especially for <u>most complex patients</u>

- <u>Academic hospitals</u> – centers of medical teaching and research

- Tend to have <u>high prices (</u>*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

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

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

Effects of Covering Star Hospital:

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

2. **Adverse Selection**: $Cov\left(\Delta D_i, \; C_i^0 + \Delta C_i\right) > 0$

   - Two components: Selection on cost level (C_i^0) and cost increase (ΔC_i)

➤ **Risk Adjustment**: Not designed to offset selection on moral hazard (Einav et al. 2015)

Equilibrium and Efficiency Implications

- Inefficient Sorting across Plans

  - Ideal: Choose plan A if $\Delta Value_i > \Delta Cost_i$

  - Actual: Choose plan A if $\Delta Value_i > \Delta Premium$

- Potentially: Adverse selection death spiral

  - Attract high-costs → Raise price → Lose low-costs → Raise price → …

  - Either stabilizes at high price or leads to dropping star hospital

- Disciplines market power of star hospital

  - Adverse selection improves insurers' bargaining threat point

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<u>Three Components:</u>

1. <u>High-price</u> hospitals (*star hospitals*)

2. Consumer group especially <u>likely to use</u> 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

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

	Hospital	System	Average Values	
			Price	Severity
1	Brigham & Women's	Partners	$20,474	1.12
2	Mass. General	Partners	$19,550	1.09
3	Boston Med. Ctr.	BMC	$15,919	1.05
4	Tufts Med. Ctr.	Tufts	$14,038	1.10
5	UMass Med. Ctr.	UMass	$14,111	1.07
6	Charlton Memorial	Southcoast	$14,210	1.03
7	Baystate Med. Ctr.	Baystate	$12,223	1.11
8	Lahey Clinic	Lahey	$11,742	1.13
9	Beth Israel Deaconess	CareGroup	$11,787	1.08
10	St. Vincent	Vanguard	$11,455	1.03
	All Other Hospitals	---	*$8,585*	*0.95*

Star Hospitals
**Partners Healthcare**

Consumer Group Driving Adverse Selection

- **Key Group**: <u>Past patients at Partners facilities</u> (outpatient care)

  - Idea: Patients likely to be <u>loyal</u> 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   → *Graphs*

Evidence from Network Changes

- **Additional evidence**: How do selection patterns, costs respond to <u>change in network coverage</u> 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

Health Care Costs per Member-Year.
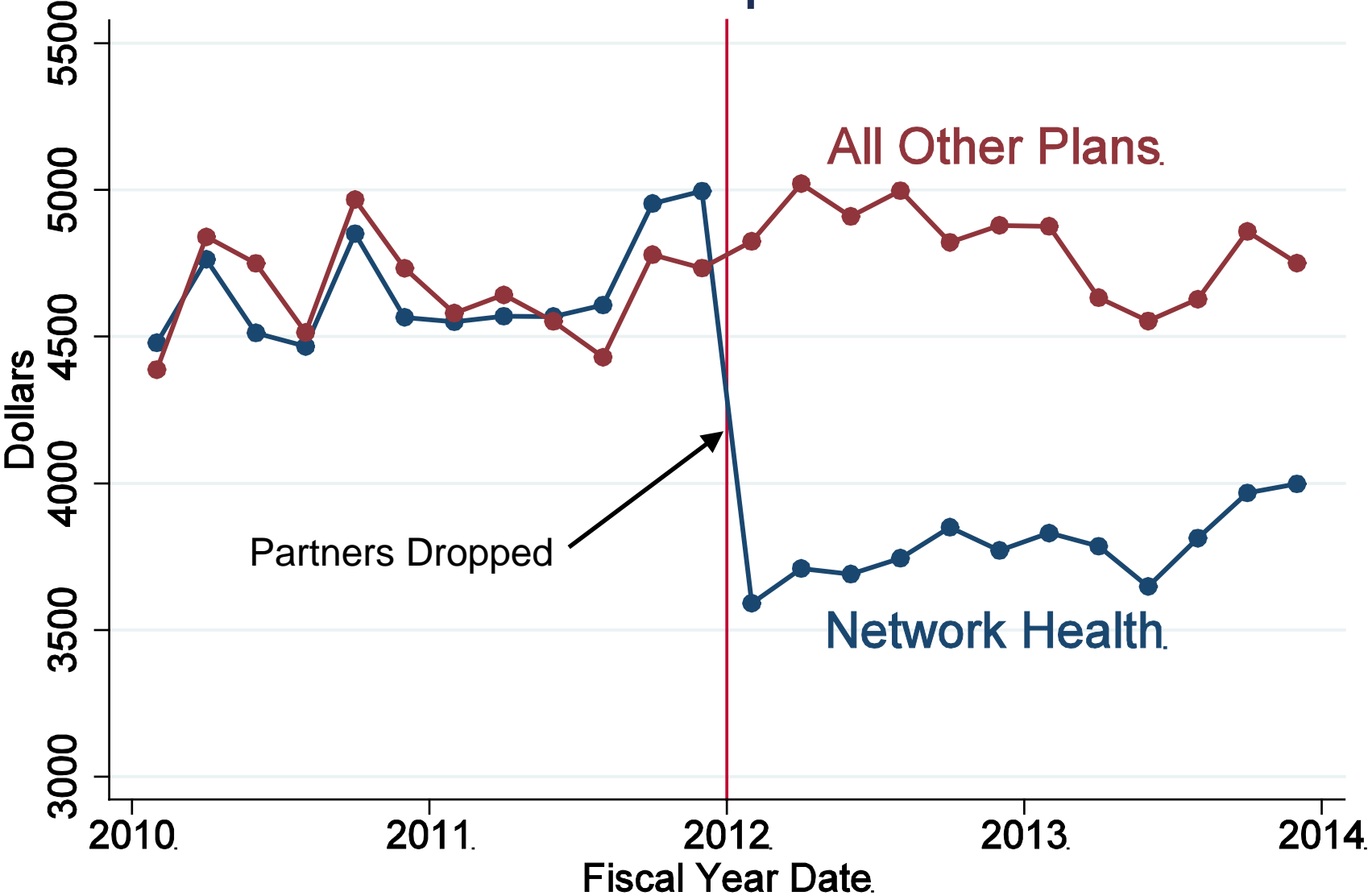
Network Health Costs per Member-Year

Enrollee Group	Risk Adj. Costs			Group Size
	2011	**2012**	**%Δ**	
All Enrollees	**$4,439**	**$3,761**	**-15%**	**---**
Stayers	$3,807	$3,596	-6%	36,768
Left Plan in 2012				
Switched Plans	$6,109	*[$5,106]*	---	4,640
Exited Market	$5,511	---	---	22,617
Joined Plan in 2012				
Switched Plans	*[$3,641]*	$3,706	---	15,062
Entered Market	---	$4,007	---	51,109

Both effects driven by Partners patients

Share of Enrollees Switching away from Network Health
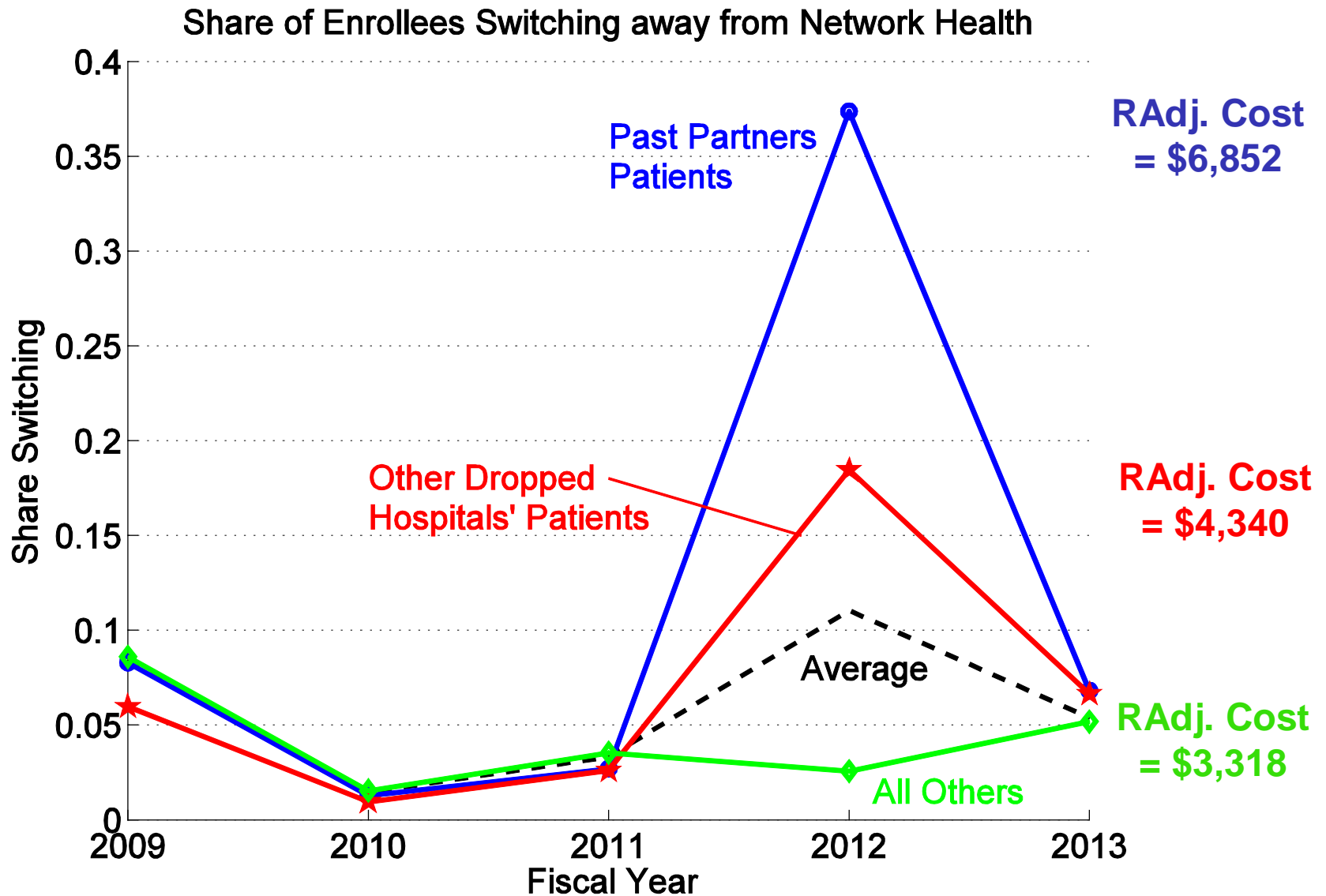
Summary So Far

- **Summary**: Strong evidence of <u>adverse selection</u> 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
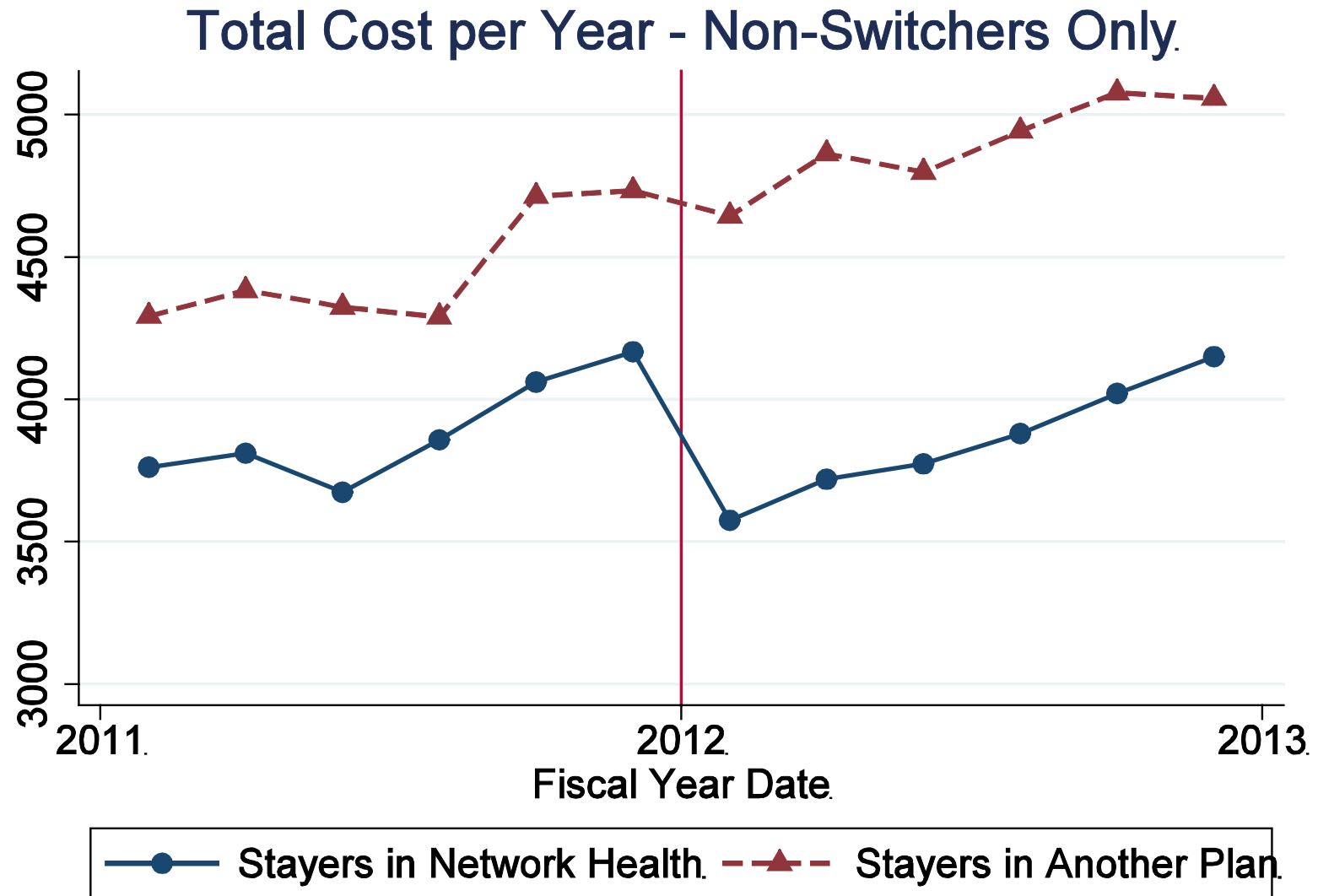
Total Cost per Year - Non-Switchers Only

Note: Points are group x time coeffs. from regression with individual fixed effects.

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Differential Cost Reductions for Partners Patients

Total Cost per Year - Non-Switchers Only
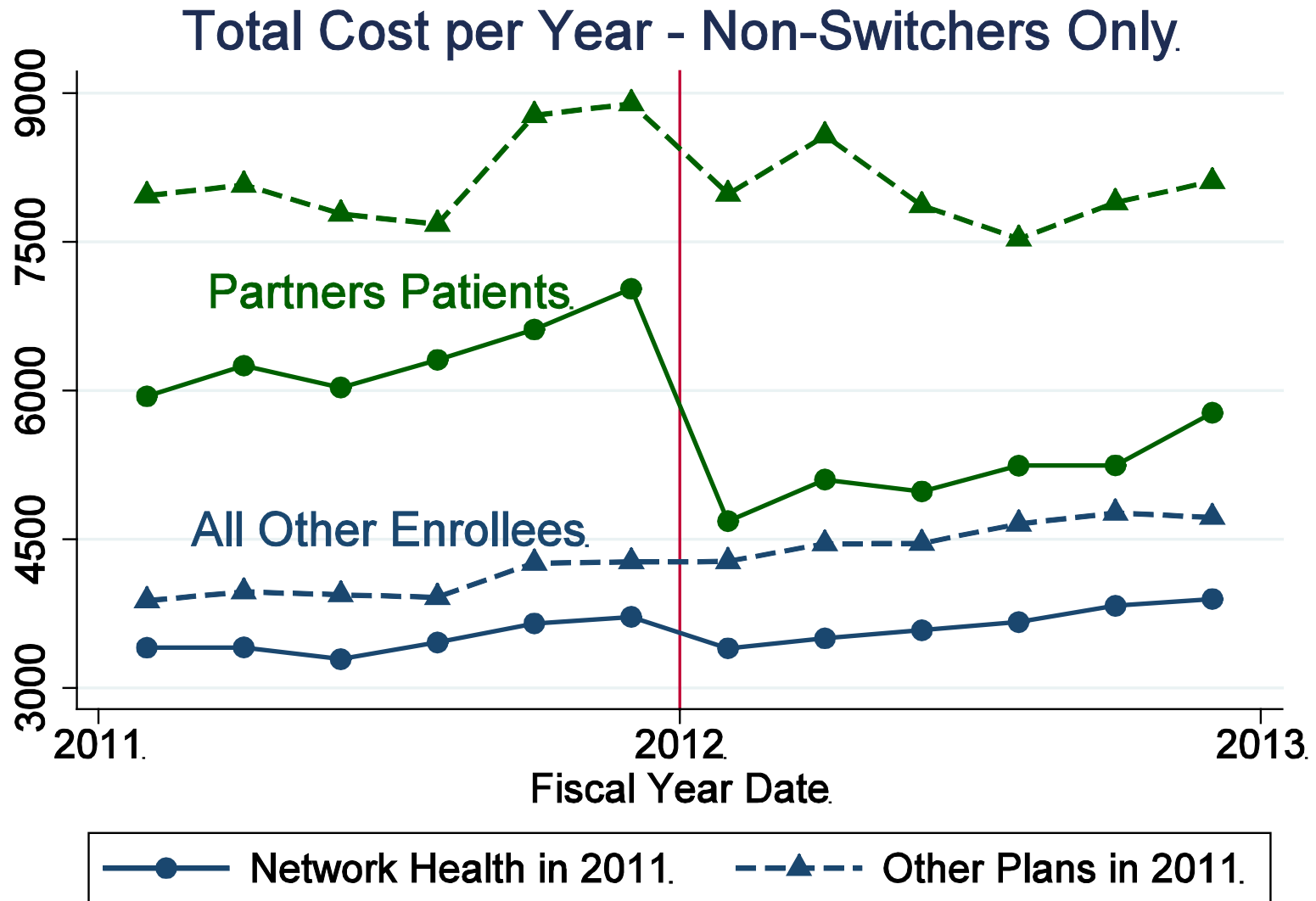
Note: Points are group x time coeffs. from regression with individual fixed effects.

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)

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3. **Structural Model and Estimates**

   ➢ Hospital Choice, Insurance Choice, Costs

4. Equilibrium and Counterfactual Simulations

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Structural Analysis Introduction

- **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

Structural Model Summary

- **Setup**: Follows past literature [e.g., Capps, et al. 2003; Ho 2006]

Model Part	Inputs	Outputs
1. Hospital Choice	• Hospital admission data	• Hospital demand • Network utility (*WTP*)
2. Plan Choice	• Plan choice data • Network utility	• Plan demand • Cons. welfare metric
3. Costs	• Hospital prices and demand • Non-hospital costs	• Cost model
4. Equilibrium	• Plan demand • Cost model	• Simulate Nash eq.

➤ **Adverse selection story**: Captured by hospital preferences (in #1) entering plan choice and cost model

Model Part 1: Hospital Choice

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

$$u_{ijdh} = \eta_h + \gamma X_h Z_i + \delta Dist_{i,h} + \lambda PastPat_{i,h} + \kappa_j OONetw_{h,j} + \varepsilon_{ijdh}$$

Hospital Dummy

Hospital x Patient Characs.

Distance

Whether past patient at *h*

Out of Network "hassle cost"

- 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

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

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: *(consumer i, plan j, time t)*

$$U_{ijt}^{New} = \alpha(Z_i) \cdot \underbrace{Prem_{ijt}}_{\text{Premium}} + \beta(Z_i) \cdot \underbrace{Network_{ijt}}_{\text{Network Vars}} + \underbrace{\xi_{j,t,Reg_i} + \xi_{j,Reg_i,Inc_i}}_{\text{Plan Dummies}} + \underbrace{\varepsilon_{ijt}}_{\text{Logit Error}}$$

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

2. **Hospital Network Variables**:

    ➢ Expected utility from hospital choice model (*→ 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 (*→ Details*)

Premium Coefficient Identification

- Use cross-group variation (for same plan) <u>induced by subsidy rules</u>

  - Above Poverty: Consumer premiums change with prices

  - Below Poverty: Subsidies make all plans $0 (control group)

    → Example

- Idea: Similar to **difference-in-difference**

  - Utility specification: Plan dummies absorb all variation except within-plan <u>differential premium changes</u> across income groups

- **Assumption**: Parallel trends in *unobserved* quality across incomes
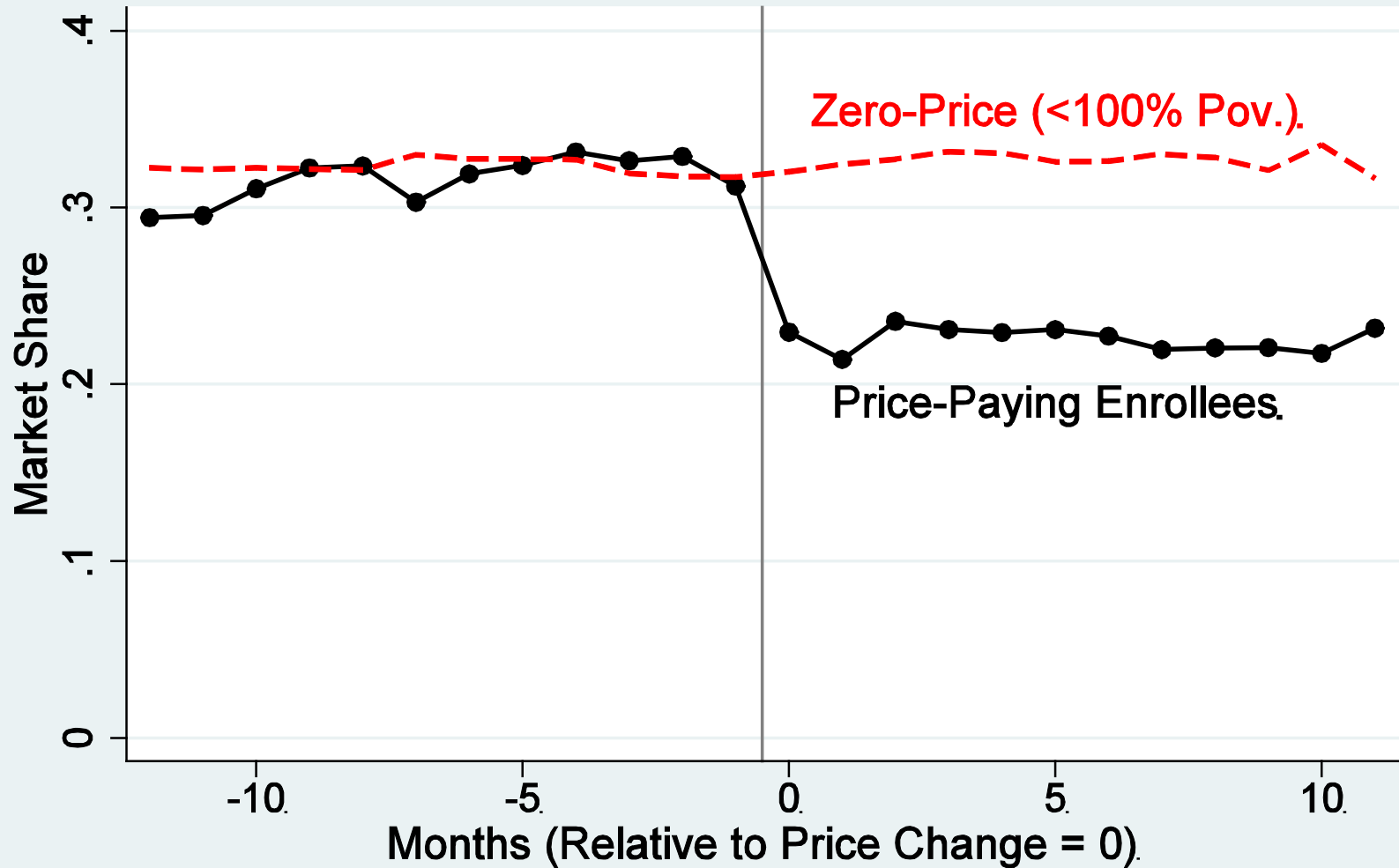
  - *Next slides*: Test for parallel trends

Market Share around Price Decreases

New Enrollees, 2008-2011

Zero-Price (<100% Pov.)

Price-Paying Enrollees

Market Share

Months (Relative to Price Change = 0)

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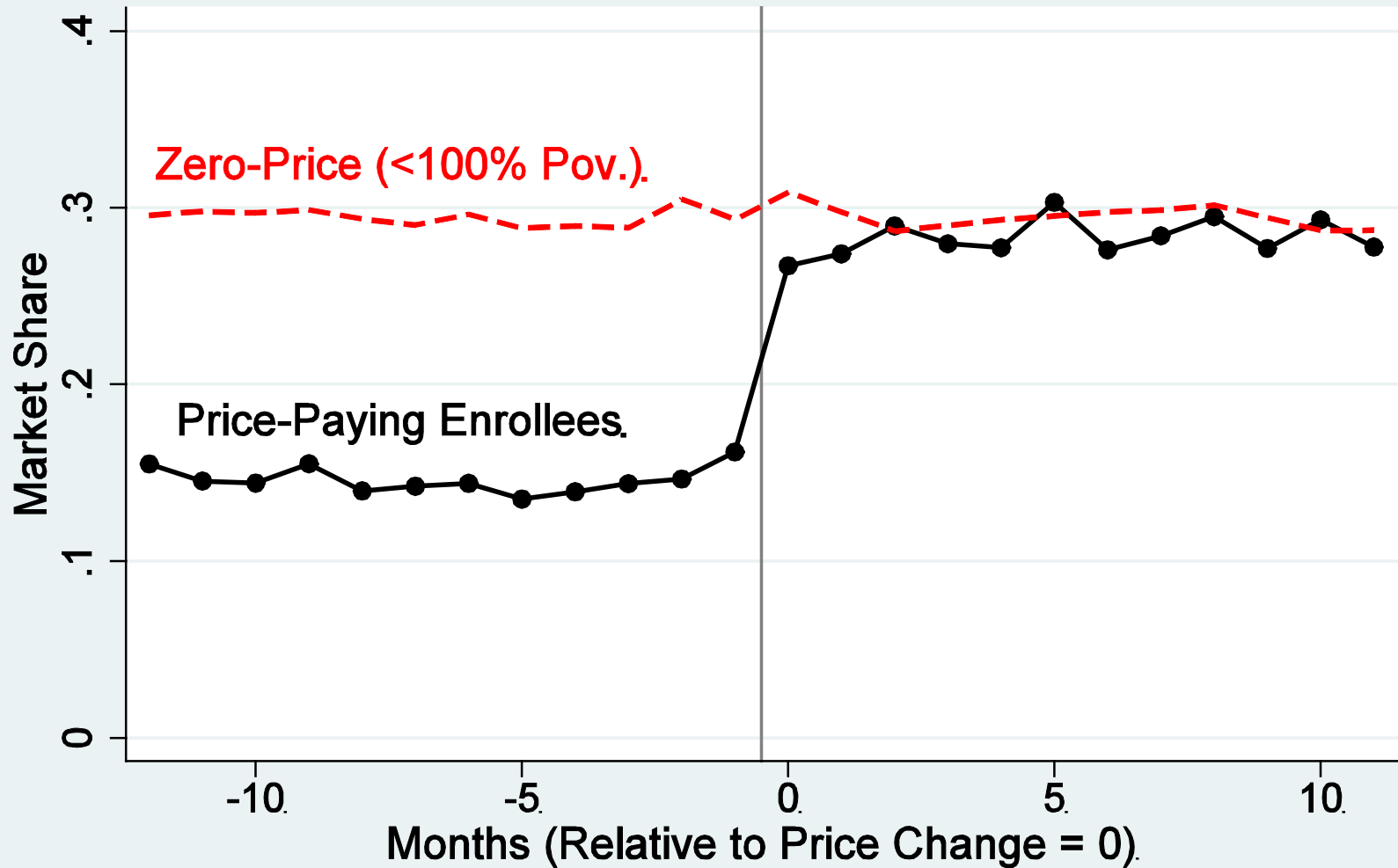
Market Share around Price Increases
New Enrollees, 2008-2011

Zero-Price (<100% Pov.)

Price-Paying Enrollees

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Plan Demand Estimates

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

* = 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.)

Consumer Value of Partners Covg.

Percentiles	Avg. Value ($/month)	
0-50%	$0.5	
50-70%	$2.2	
70-79%	$4.3	
80-89%	$8.8	
90-95%	$23.6	Past Partners patients
96-100%	$46.8	
Average	*$5.7*	

Model Part 3: Insurer Costs

- **Goal**: <u>Individual-level</u> 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

  → *Details*

- **Total Costs** = Inpatient + Non-inpatient costs

Table: Correlation of Partners Value and Cost

Consumer Value of Partners Covg.		Costs to Insurer			
		Not Covering Partners		**ΔCost if Cover Partners**	
Percentiles	Avg. Value ($/month)	Unadjusted Cost	Risk Adj. Cost	ΔCost	ΔCost - Partners Hospital Mkup.
0-50%	$0.5	$300.0	$301.2	$8.0	$7.0
50-70%	$2.2	$269.6	$294.5	$14.0	$10.6
70-79%	$4.3	$264.3	$292.7	$18.1	$12.4
80-89%	$8.8	$300.1	$311.8	$23.5	$14.0
90-95%	$23.6	$455.7	$360.4	$37.9	$21.1
96-100%	$46.8	$482.3	$340.1	$48.5	$23.3
Average	*$5.7*	*$308.8*	*$305.6*	*$15.6*	*$10.6*

- Have all elements of plan profit function:

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

- Simulate full-info, static Nash eq. in two-stage insurer game:

  1. Cover or exclude Partners hospitals

  2. Set plan prices

- Key assumptions:

  - <u>Fixed</u> hospital prices and hospital networks other than Partners

  - Single plan per insurer

Equilibrium Analysis Details

- 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 (→ *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 *(→ Details)*

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4. **Equilibrium and Counterfactual Results**

5. Conclusion

Equilibrium with ACA-Like Policies

	Equilibrium (2012, ACA-like policies)				Deviation: NHP covers
	BMC	CeltiCare	Netw. Health	NHP	Change
Partners Coverage	**No**	**No**	**No**	**No**	**(added)**
Price	$427	$365	$371	$418	+$12
Market Share	22%	19%	41%	16%	-1%
Financial Statistics ($ / member-month)					
Risk Adj. Transfer	*$6*	*-$43*	*-$1*	*$12*	*+$17*
Total Revenue	$433	$322	$370	$429	+$29
Total Cost	$386	$304	$360	$378	+$35
Profit Margin	$47	$18	$10	$51	-$6
Total Profit ($millions)	**$10.99**	**$3.55**	**$4.32**	**$8.55**	**-$1.33**

- Finding: Full unravelling of Partners coverage (robust across years)

Counterfactual Policy: Modified Risk Adjustment

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 ΔCost > ΔConsumer value)

  - ΔValue > ΔCost for Partners patients; opposite for rest of population

- Competitive Effect: Weakens insurer incentive to reduce markups

Risk Adjustment Changes

Over-Adjustment Factor	Plans Covering Partners	Welfare Analysis (per member-month)				
		ΔCons. Surplus	Insurer Profit	Partners Net Rev.	Govt. Costs	ΔSocial Surplus
None	None	$0.0	$26.5	$0.6	$322.7	$0.0
25%	None	$4.1	$30.0	$0.6	$330.7	-$0.4
50%	NHP Only	$5.4	$33.4	$1.7	$337.1	-$1.0

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

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Conclusion

- **Main result**: Adverse selection discourages covering star hospitals

  - <u>Mechanism</u>: 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 – <u>selection on use of higher-cost option</u>

  - 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 <u>expected utility</u> (inclusive value) of access to plan j's network using hospital choice model:

$$HospEU_{i,d,j}\left(N_j\right) \equiv E\max_h\left\{\hat{u}_{i,d,h}\left(N_j\right) + \varepsilon_{i,d,h}\right\} = \log\left(\underbrace{\sum_h \exp\left(\hat{u}_{i,d,h}(N_j)\right)}_{\text{Expected Utility in Logit Model}}\right)$$

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

$$NetworkUtil_{i,j,t} \equiv \sum_d \hat{p}_{i,d,t} \cdot HospEU_{i,d,j}\left(N_{j,t}\right)$$

➤ <u>Assumption</u>: Network valuation proportional to expected use of hospital

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Hospital Price Estimation

- Estimate hospital prices w/ Poisson regression in claims data:

$$E\left[Payment_{i,j,h,t} \mid Diag_{it}, Z_{it} \right] = \underbrace{\exp\left(\rho_{j,h,t} \right)}_{\text{Price} \equiv \hat{P}_{j,h,t}} \cdot \underbrace{\exp\left(Diag_{it}\lambda + Z_{it}\gamma \right)}_{\text{Severity} \equiv \hat{\omega}_{it}}$$

<u>Details:</u>

- 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

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Insurance Plan Demand: Consumer Choice Process

<u>Two times when enrollees choose plans</u>:

- New enrollment in exchange:

  - Must <u>actively choose</u> 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

  - <u>Default</u>: 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

Insurance Plan Demand Model

Utility model for enrollee *i,* in year *t,* for choosing plan *j:*

$$V_{ijt} = \alpha\left(Z_i\right) \cdot \underbrace{Prem_{ijt}}_{\text{Premium}} + \beta\left(Z_i\right) \cdot \underbrace{NetworkUtil_{ijt}}_{\text{Hosp. Network Utility}} + \underbrace{\xi_{j,t,Reg_i} + \xi_{j,Reg_i,Inc_i}}_{\text{Unobs. Plan Quality}}$$

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

$$U_{ijt}^{Curr} = V_{ijt} + \underbrace{\chi\left(Z_i\right) \cdot CurrPlan_{ijt}}_{\text{Default Choice Coeff.}} + \underbrace{\eta_{ij} + \varepsilon_{ijt}}_{\text{Ind. Error}}$$
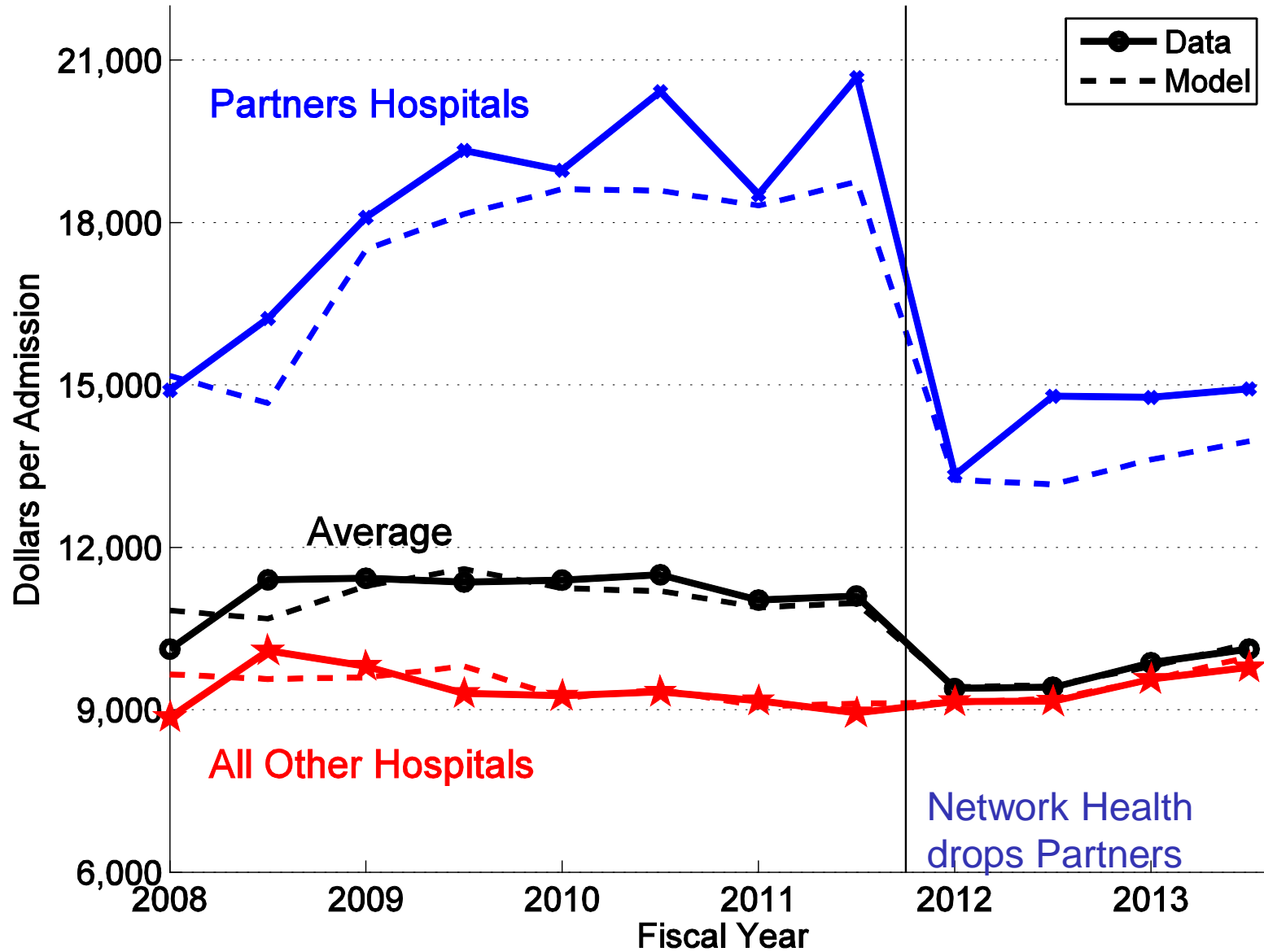
Model Breakdown of Network Health Cost Change
(Enrollees in Exchange in Both 2011-12)

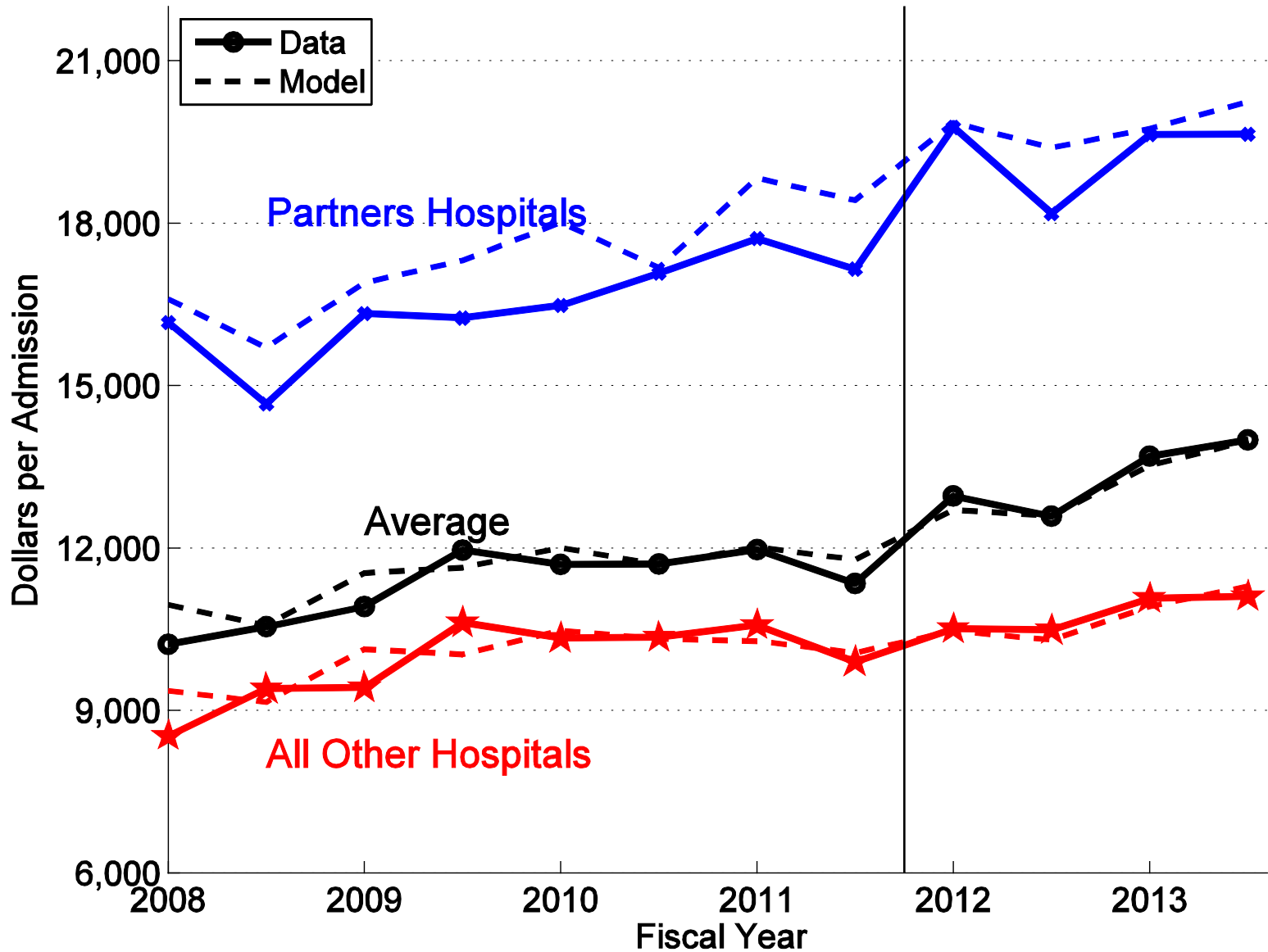| Market Shares	Model Cost Function		Decomposition		
	2011	2012	%Δ Costs	Selection	Total
2011 Shares	$353	$325	8.2%	4.6%	12.8%
2012 Shares	$331	$308	6.4%	6.4%	12.8%

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Network Health Hospital Costs Per Admission

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NHP and CeltiCare Hospital Costs Per Admission

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Network Health Premiums (Boston region)

2010 Price = Minimum

2011 Price = $17.74 above min

250-300% Pov.: $29.85 above min

200-250% Pov.: $27.78 above min

150-200% Pov.: $17.88 above min

100-150% Pov.: $10.38 above min

All Groups:
Premium = $0 above min

<100% Pov.: $0 above min

Premium (relative to min premium) (y-axis: $0, $5, $10, $15, $20, $25, $30, $35, $40)

2010

2011
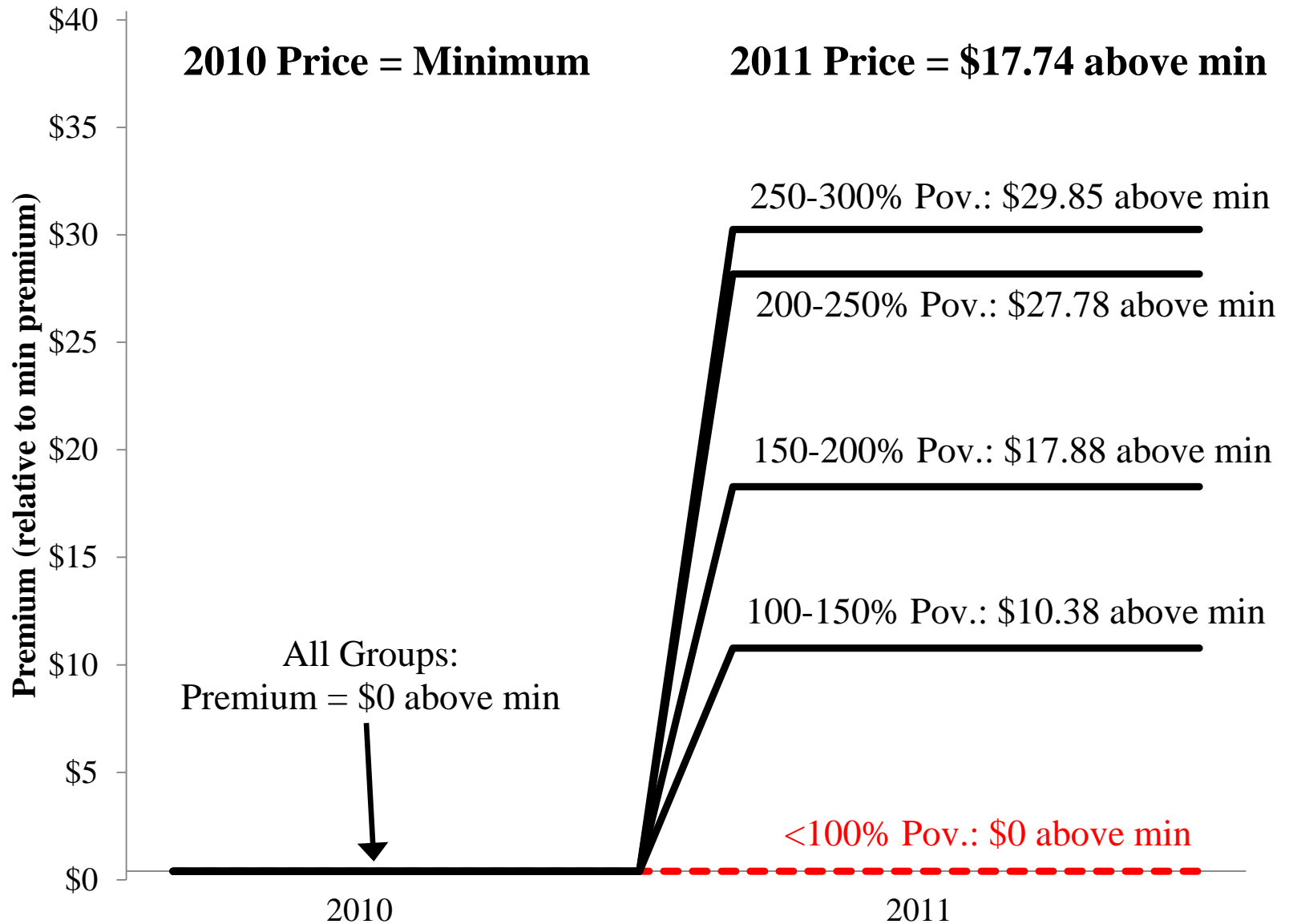
Insurer Cost Model Details

Inpatient Hospital Costs

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

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

$$c_{ijt}^{Hosp}\left(N_{jt}\right) = \sum_{n=1}^{NAdmits_{it}} \underbrace{\hat{\omega}_{i,t,n}}_{\text{Severity}} \cdot \left(\sum_{h} \underbrace{\hat{P}_{j,h,t} \cdot s_{i,d,t,h}^{Hosp}\left(N_{jt}\right)}_{\text{Price x Hosp. Demand Share}} \right)$$

Other (Non-Hospital) Costs

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

- Scale observed cost by this plan effect: $c_{ij}^{Model} = c_i^{Obs} \cdot \left(\dfrac{\hat{\rho}_j}{\hat{\rho}_{j^{Obs}}} \right)$

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Other (Non-Hospital) Costs Details

Non-Hospital Costs

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

$$E\left[NonHospCost_{i,j,t} \mid Diag_{it}, Z_{it} \right] = \underbrace{\exp\left(\chi_{j,t} \right)}_{\text{Plan Effect} \equiv \hat{C}_{j,t}} \cdot \underbrace{\exp\left(Diag_{it}\mu + Z_{it}\varsigma \right)}_{\text{Ind. Severity} \equiv \hat{v}_{i,t}}$$

- Define non-hospital cost function:

$$c_{ijt}^{NonHosp}\left(N_{jt} \right) = \underbrace{\hat{C}_{j,t}}_{\text{Plan Effect}} \cdot \underbrace{\hat{v}_{i,t}}_{\text{Ind. Severity}} \cdot \underbrace{\phi\left(N_{jt} \right)}_{\text{Network Adjustment}}$$

  - φ = 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

Consumer Value of Partners Covg.		Costs to Insurer			
		Not Covering Partners		ΔCost if Cover Partners	
Percentiles	Avg. Value ($/month)	Unadjusted Cost	Risk Adj. Cost	ΔCost	ΔCost - Partners Hospital Mkup.
0-50%	$0.5	$300.0	$301.2	$8.0	$7.0
50-70%	$2.2	$269.6	$294.5	$14.0	$10.6
70-79%	$4.3	$264.3	$292.7	$18.1	$12.4
80-89%	$8.8	$300.1	$311.8	$23.5	$14.0
90-95%	$23.6	$455.7	$360.4	$37.9	$21.1
96-100%	$46.8	$482.3	$340.1	$48.5	$23.3
Average	*$5.7*	*$308.8*	*$305.6*	*$15.6*	*$10.6*

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Accounting for Inertia: Insurer Profit Assumptions

- 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)

$$\pi_j^{Total} = \sum_i \underbrace{\left(Risk_i \cdot P_j - c_{ij}\left(N_j\right)\right) \cdot D_{ij}\left(P,N\right)}_{\text{Current Year Profit}} + \underbrace{V_{i,Future} \cdot D_{ij}\left(P,N\right)}_{\text{Future Profit Effect}}$$

- Assumptions:
  - Exogenous inertia probability (90%) each year
  - Future profit margins (at enrollee-level) = Today's profit margin
  - Use consumers' actual future exchange enrollment length

Other (Non-Hospital) Cost Change Details

- **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 <u>regional avg. hospital cost change</u> *(with λ = 0.038)*

$$c_{ijt}^{NonHosp}\left(N_{jt}\right) = c_{ijt}^{NonHosp}\left(N_{jt}^{Obs}\right) \cdot \underbrace{\left(1 + \lambda \cdot \%\Delta HospCost_{j,Reg,t}\left(N_{jt}\right)\right)}_{\text{Network Cost Adjustment}}$$

- Future robustness: More heterogeneity in cost adjustment, based on observed changes when plan dropped Partners

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Marginal Subsidies

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

- Qualitatively similar results: Can undo Partners unravelling, but raises prices and profits at government expense

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Model vs. Data: Plan Switching Patterns

Share of Enrollees Switching away from Network Health

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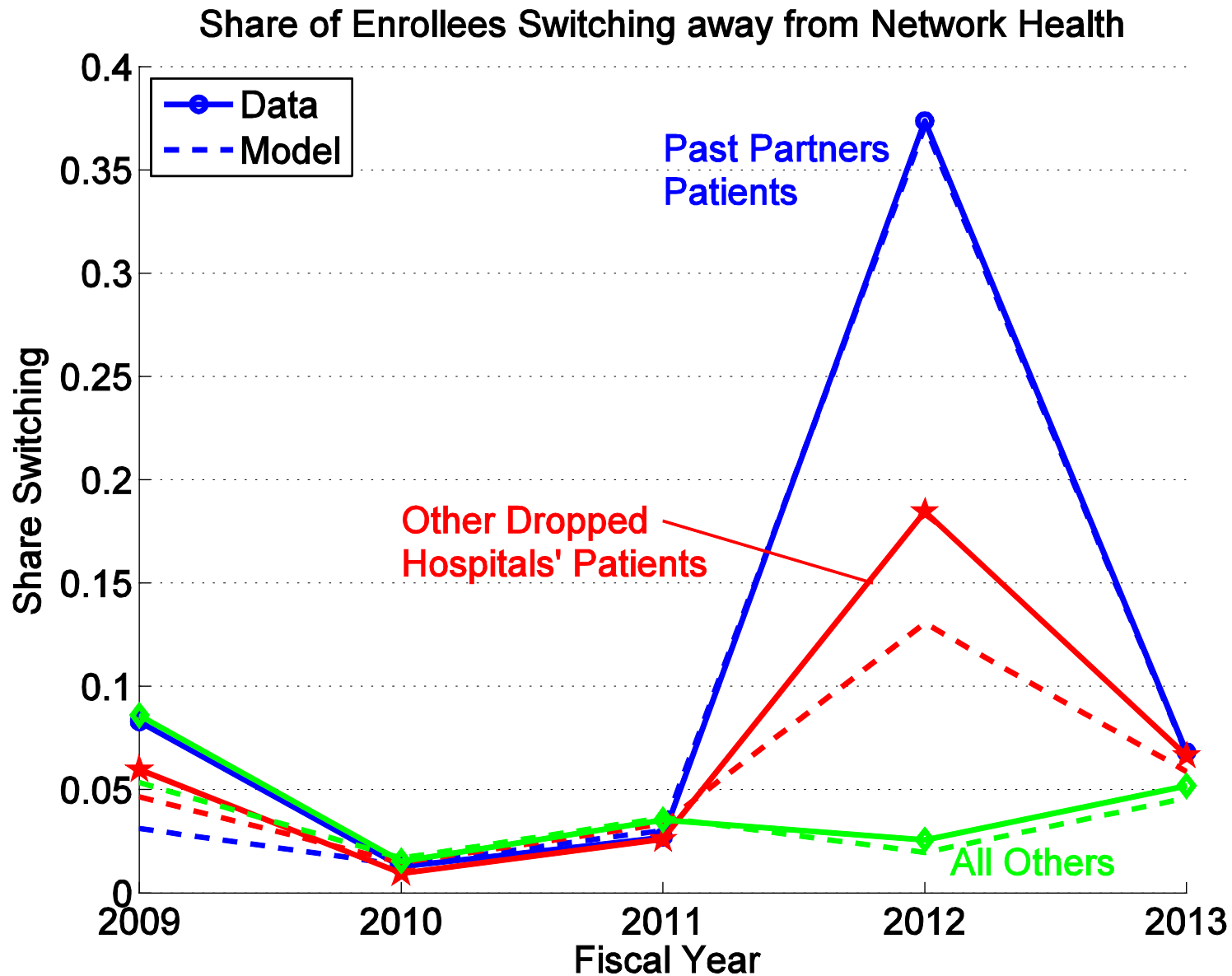
Network Health: Average Costs 2011-12

Enrollee Group	Data				Model			
	2011	2012	%Δ	Risk Adj. %Δ	2011	2012	%Δ	Risk Adj. %Δ
All Enrollees	**$378**	**$313**	**-17%**	**-15%**	**$374**	**$310**	**-17%**	**-16%**
Stayers (in plan both years)	$317	$305	-4%	-5%	$334	$312	-7%	-9%
2011 Only Enrollees	$476	---	---		$435	---	---	
2012 Only Enrollees	---	$310	---		---	$302	---	

Share of Admissions at Partners Hospitals
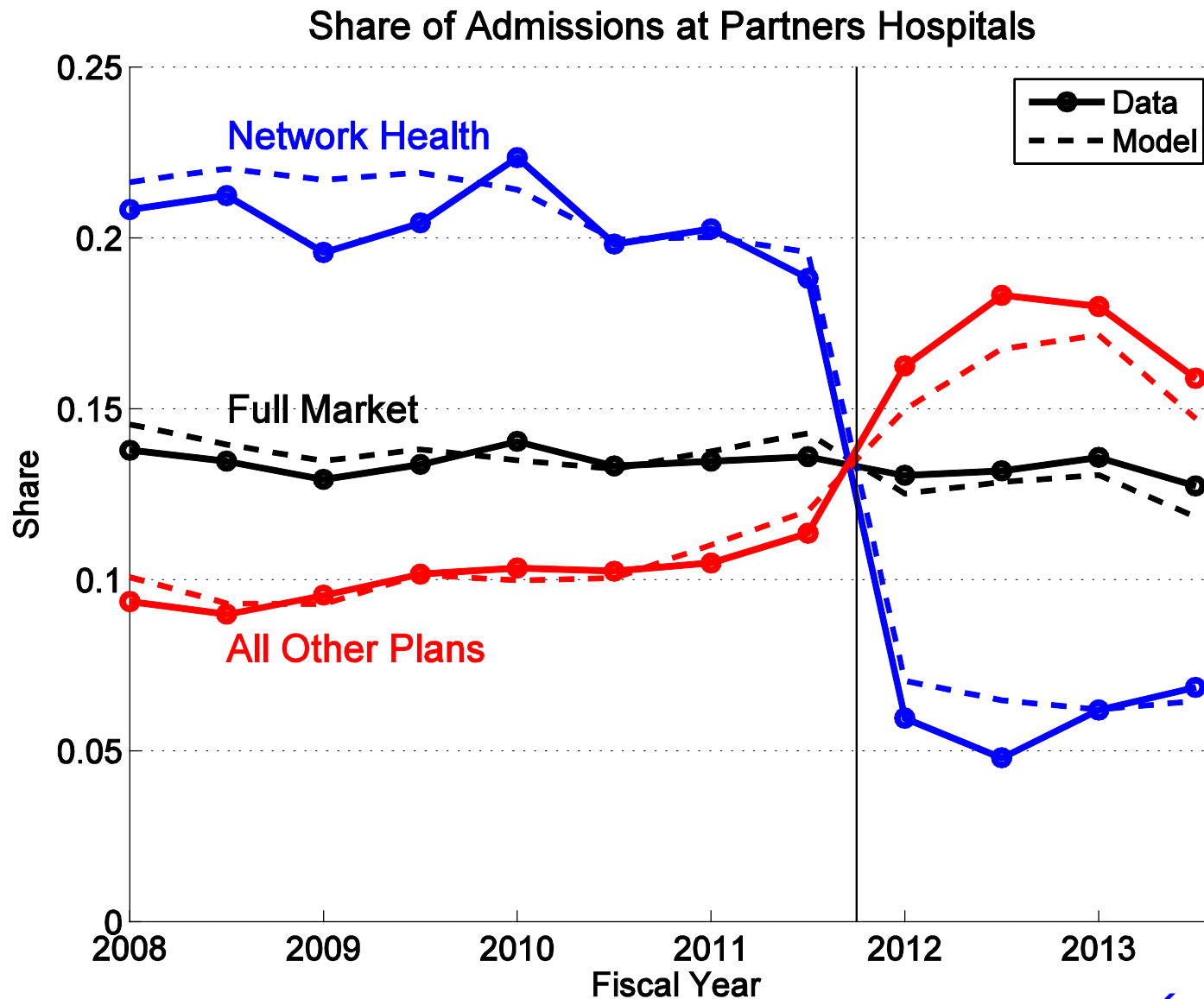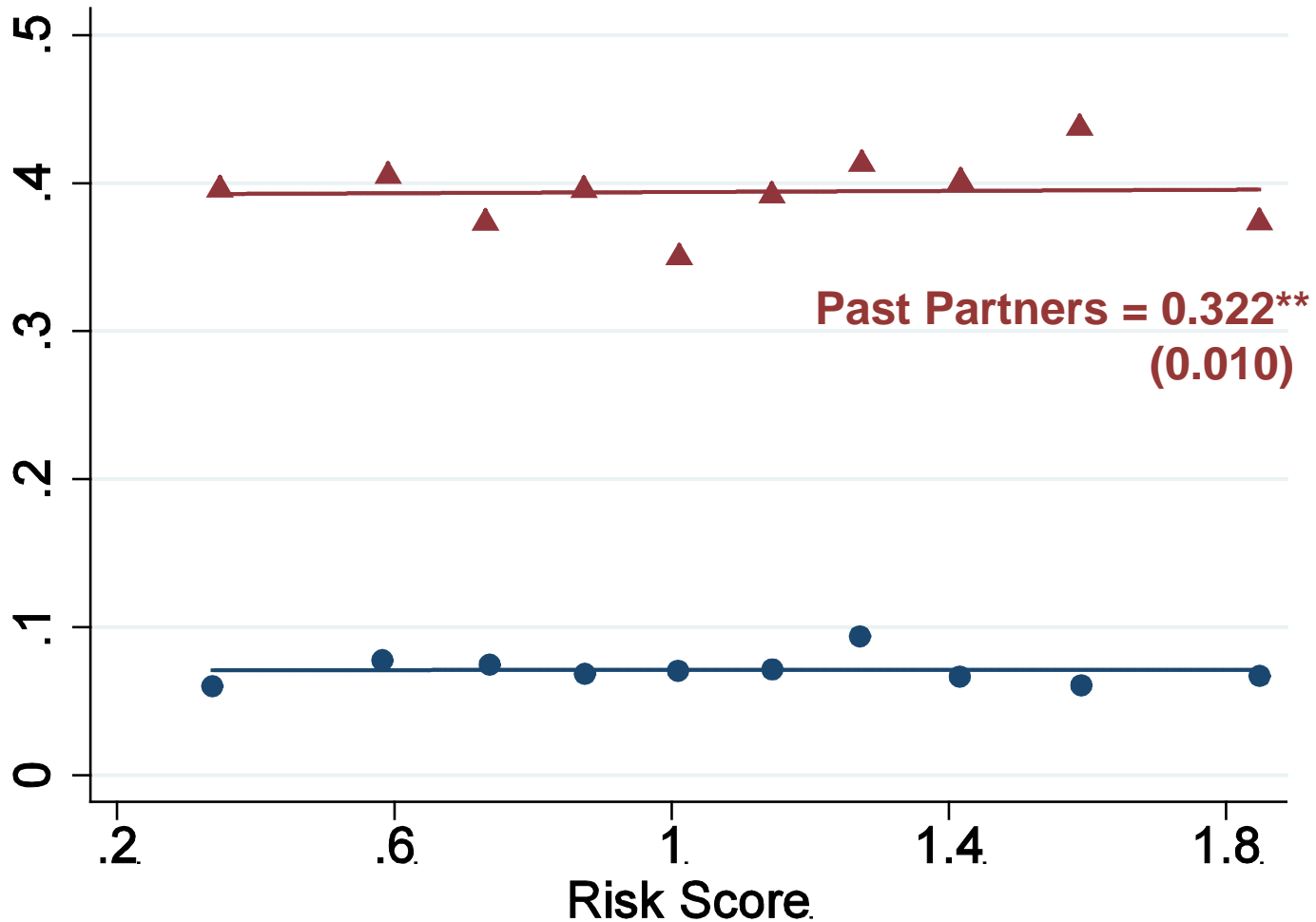
Switching Cost for Current Enrollees

- 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

$$U_{ijt}^{Curr} = V_{ijt}^{New} + \underbrace{\chi\left(Z_i\right)\cdot 1_{j=CurrPlan}}_{\text{"Excess Utility" of Curr. Plan}} + \varepsilon_{ijt}$$
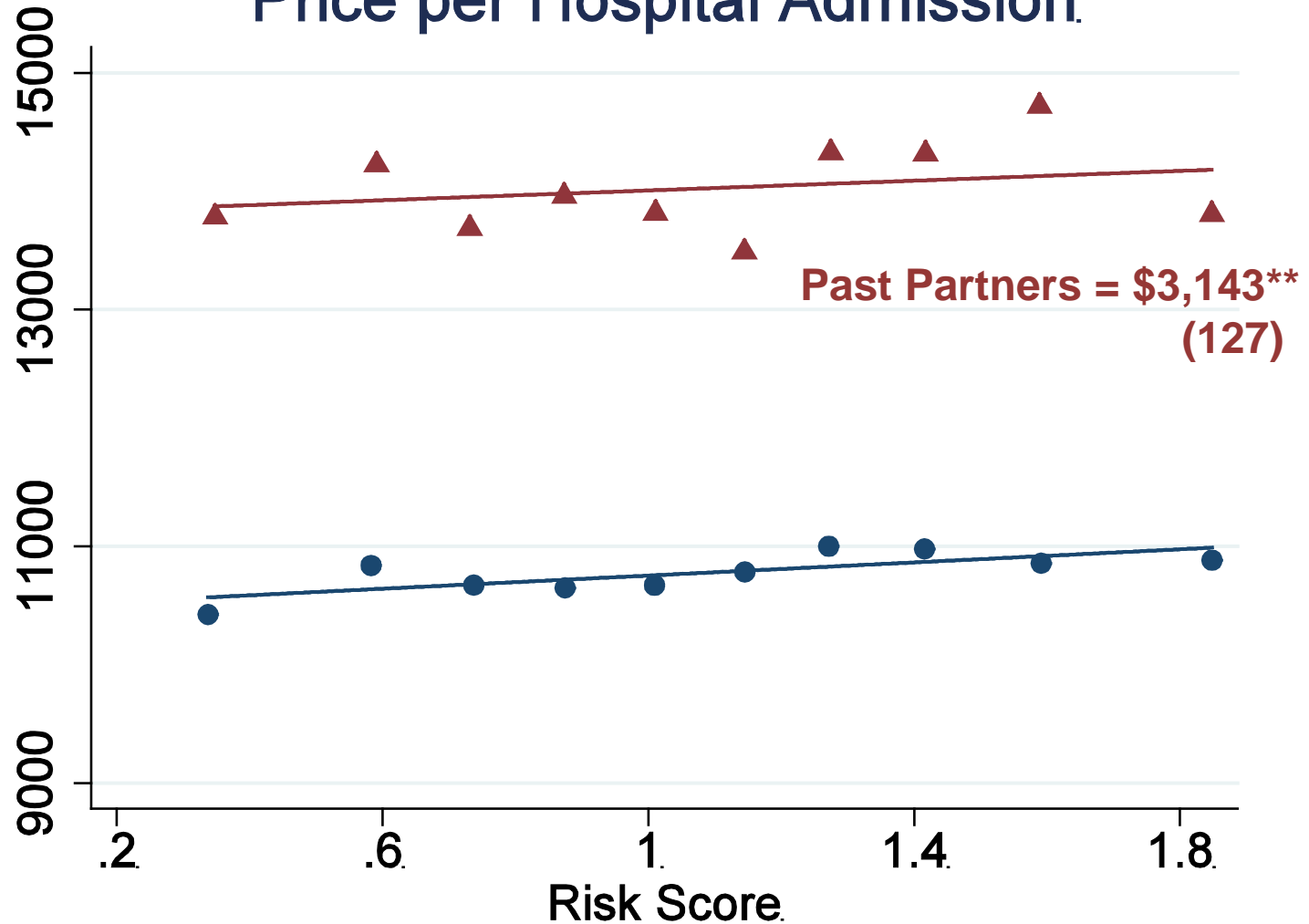
- Issue: Picks up both true inertia and unobserved heterogeneity

  - Future work: Separate these by allowing persistent taste heterogeneity with time-invariant random coefficients
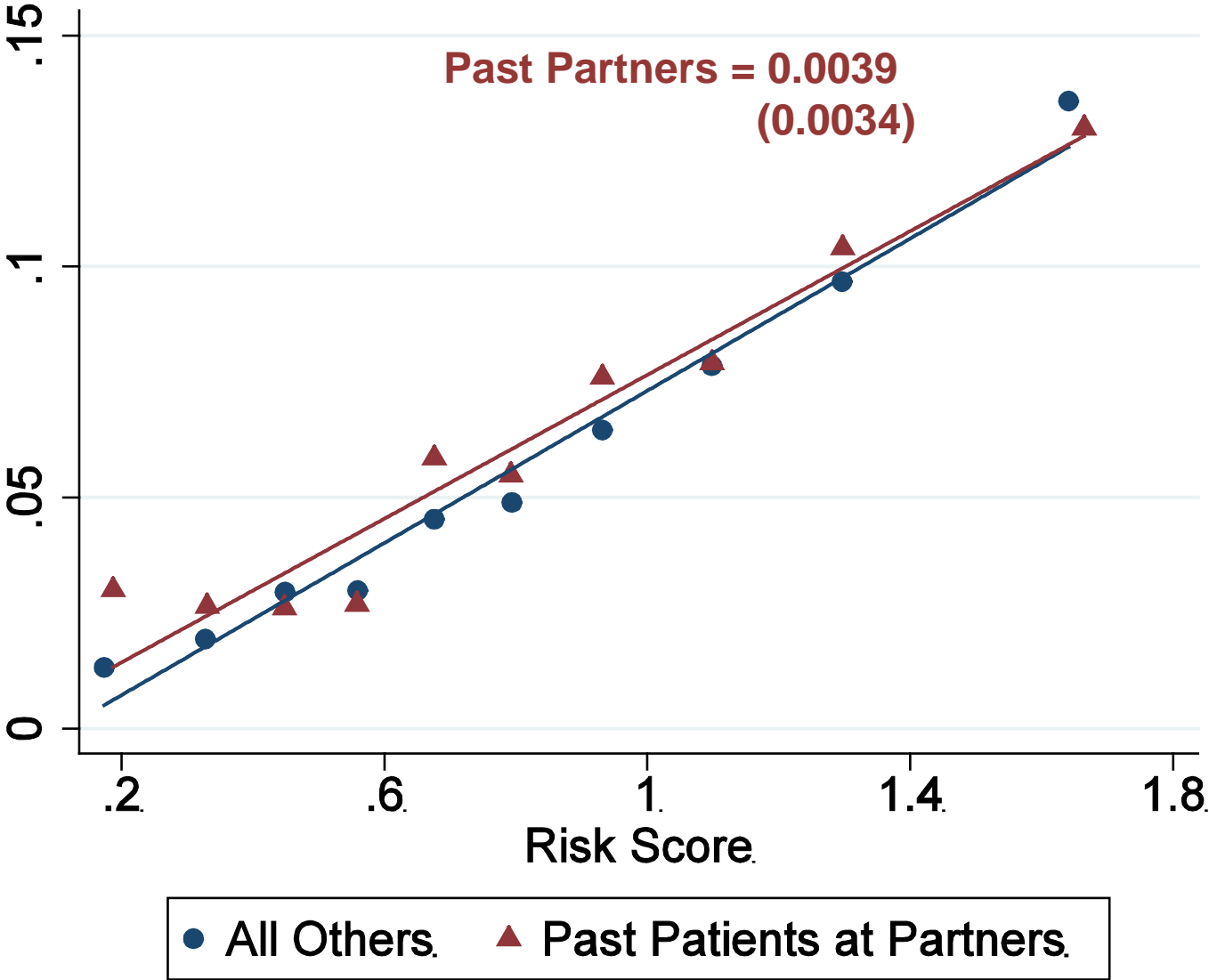
Share of Admissions at Star Hospitals

Past Partners = 0.322**
(0.010)

● All Others   ▲ Past Patients at Partners

Risk Score

Price per Hospital Admission

Past Partners = $3,143**
(127)

Legend: ● All Others   ▲ Past Patients at Partners

X-axis: Risk Score
Y-axis: 9000, 11000, 13000, 15000

Hospitalization Rate per Year

Past Partners = 0.0039
(0.0034)

Legend: ● All Others ▲ Past Patients at Partners

X-axis: Risk Score
Y-axis: 0, .05, .1, .15

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Total Health Care Spending per Year
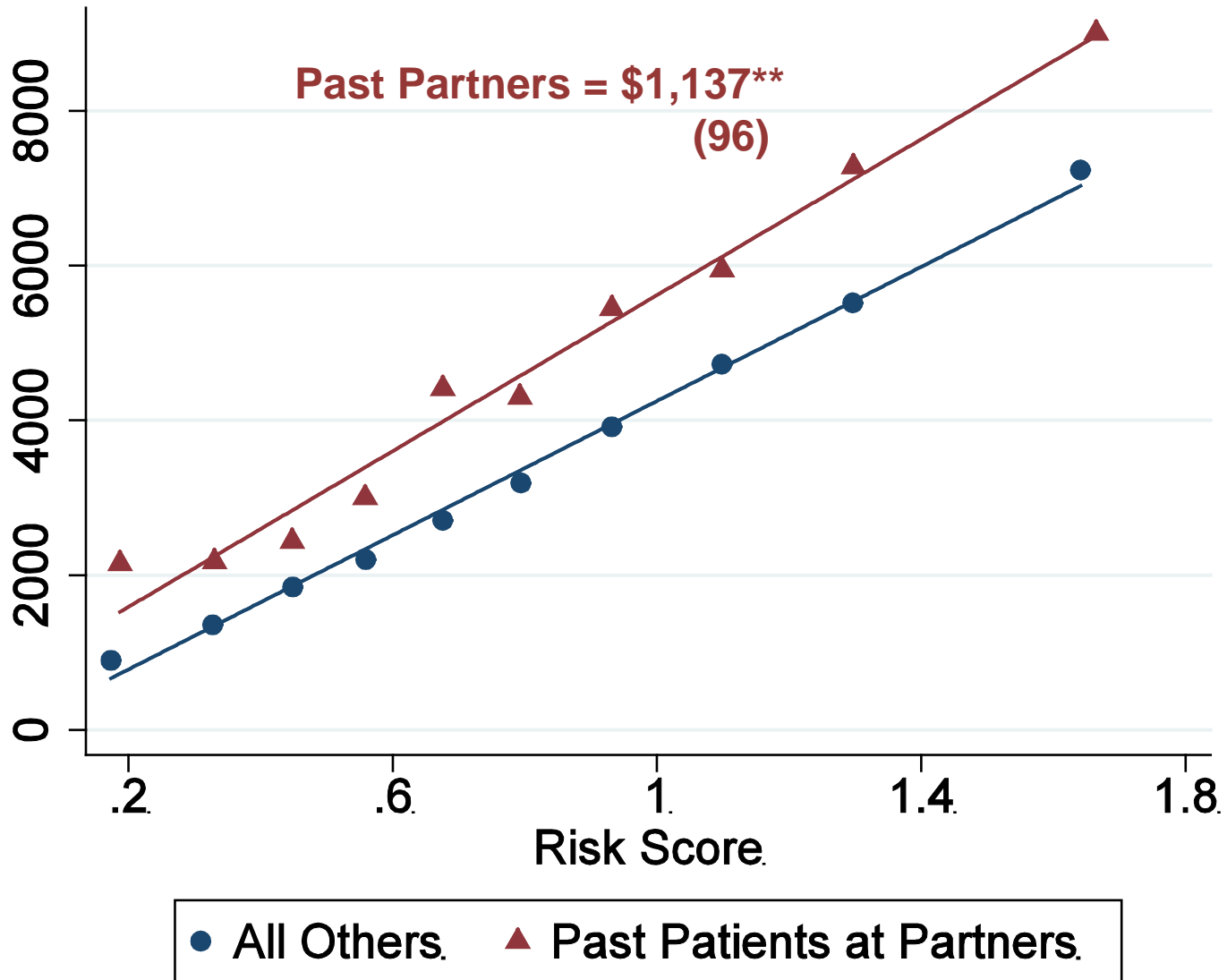
Past Partners = $1,137**
(96)

All Others   Past Patients at Partners

Risk Score

Share Choose Plan Covering Partners

Past Partners = 0.298**
(0.004)

Risk Score
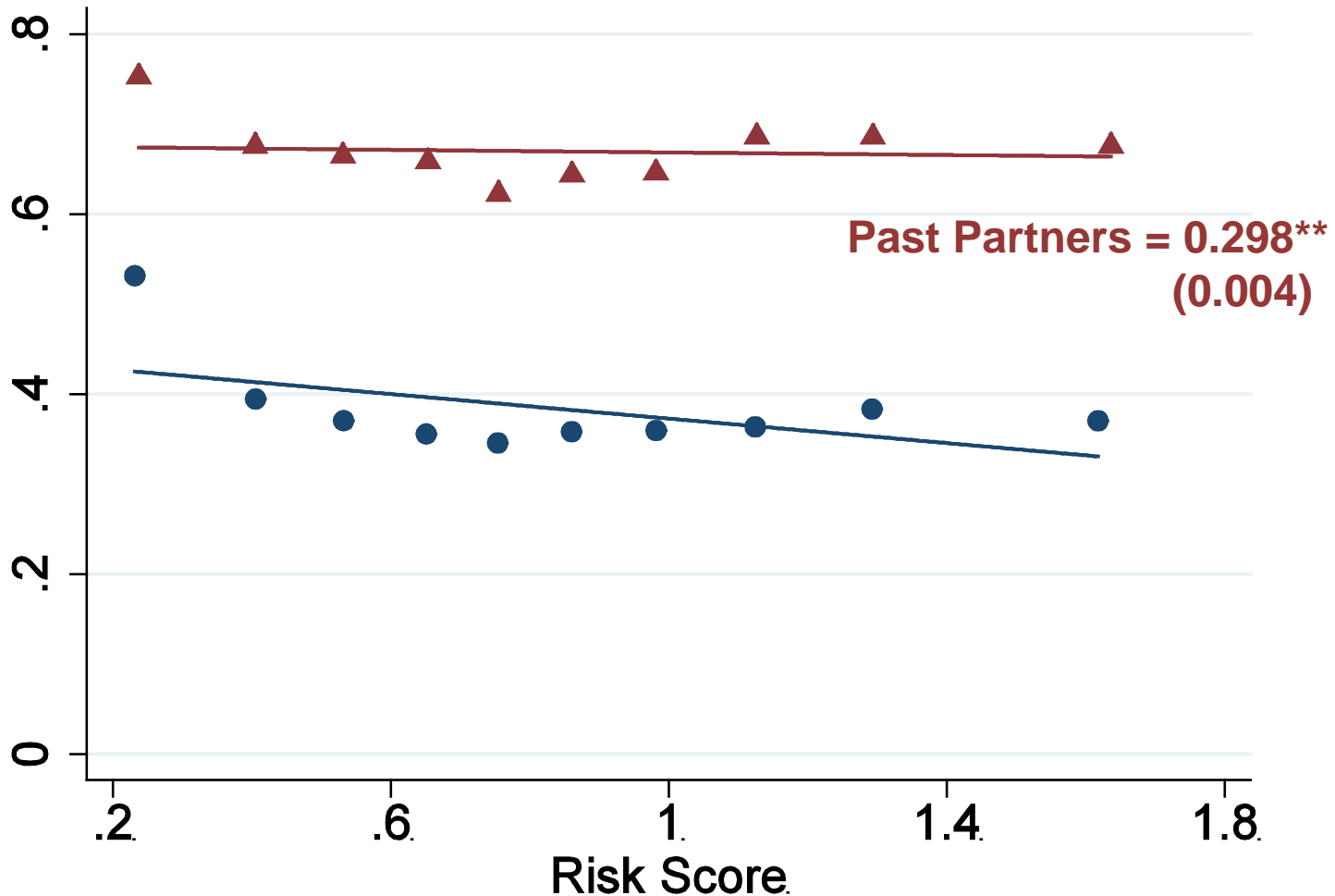
Legend: ● All Others ▲ Past Patients at Partners

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Note: Based on <u>active</u> choices by re-enrollees after a coverage gap.