

# Government Payments and Private Prices: Evidence from Medicare Advantage

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# Outline

- **Motivation and Background**
- Policy Context
- Data
- Estimation Strategy
- Results
- Conclusion

# Motivation and Background

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  - Benchmarks - Maximum per-enrollee subsidies set by CMS
  - Bids - Insurers bid, representing their costs, to provide MA plans
  - Rebate and subsidy - For bids below the benchmark, portion of difference between bid and benchmark goes to consumers

# Motivation and Background

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  - Phaseout of floors from ACA
- Outcomes of Interest
  - MA Enrollment
  - MA Plans, Insurers, Market Concentration (HHI)
  - Prices: Price index based on detailed claims data from HCCI 1.0

## Motivation and Background

Nash-Bargaining between providers and insurers (Gowrisankaran, Nevo, Town (2015) [GNT], Gaynor, Ho, Town (2015) [GHT])

- Equilibrium depends on weighted product of provider surplus and insurer surplus.

Nash Bargaining Details

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- Enrollment Effect:  $\uparrow$  enrollment  $\rightarrow$   $\uparrow$  expected number of patients  $\rightarrow$   $\uparrow$  provider surplus
- Entry Effect:  $\uparrow$  subsidy  $\rightarrow$   $\uparrow$  insurers  $\rightarrow$   $\downarrow$  insurer surplus (ambiguous)

Nash Bargaining Details

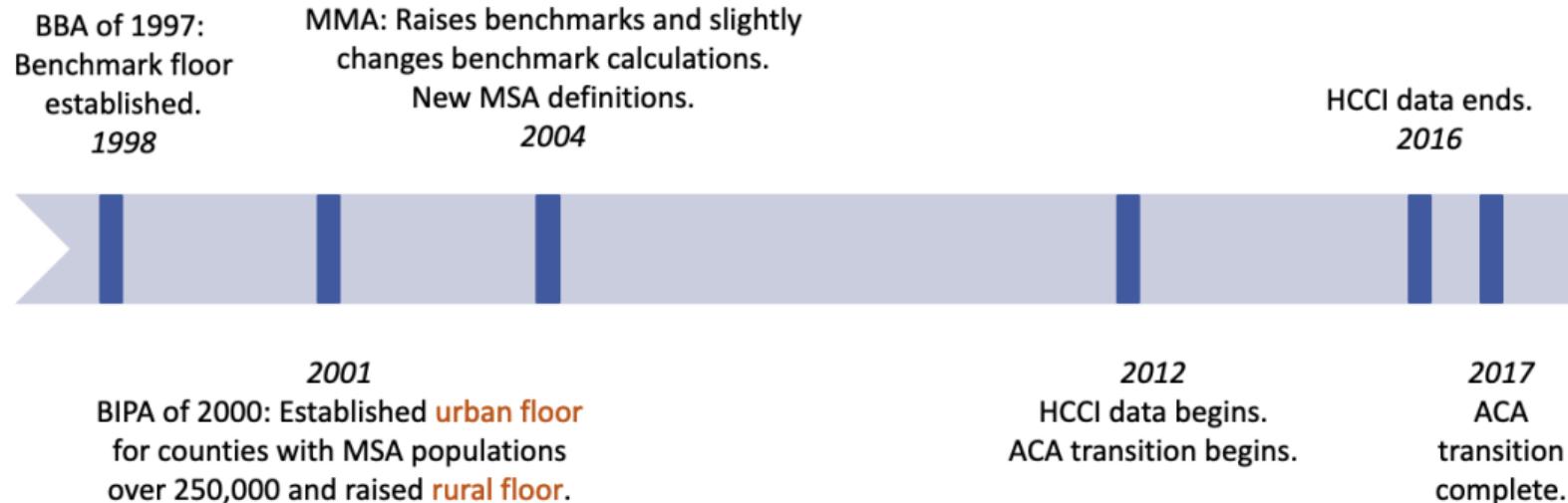
## Preview of Results

- MA Benchmarks (First Stage)
  - 2012: ~\$63 increase in benchmarks across the urban cutoff
  - 2016: Reduction to ~\$8 increase (ACA-phaseout)
- MA Enrollment
  - 2012: ~15 percentage point increase across the urban cutoff
  - 2016: Effect on penetration rates persists at ~17 percentage point increase
- MA Entry/Exit
  - More plans and insurers across the urban cutoff
  - But similar market concentration (HHI)
- MA Medical Prices
  - Persistent decreases in OP prices between ~18% and 30% across the urban cutoff.
  - No significant differences for IP prices in 2012 - 2015, but significant decrease in 2016

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# Policy Timeline

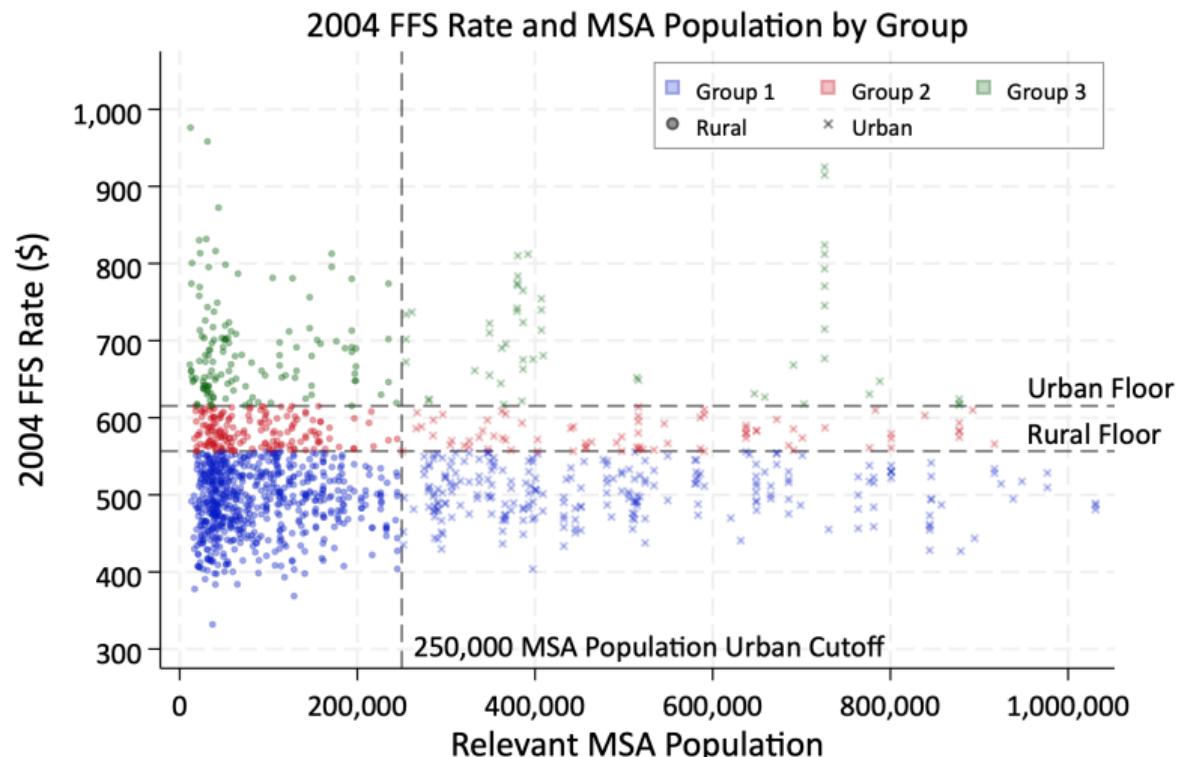


[Benchmark Details](#)

[ACA Policy Change Details](#)

[Post-ACA Benchmark Calculation Table](#)

# FFS Rates, MSA Populations, and County Group Definitions

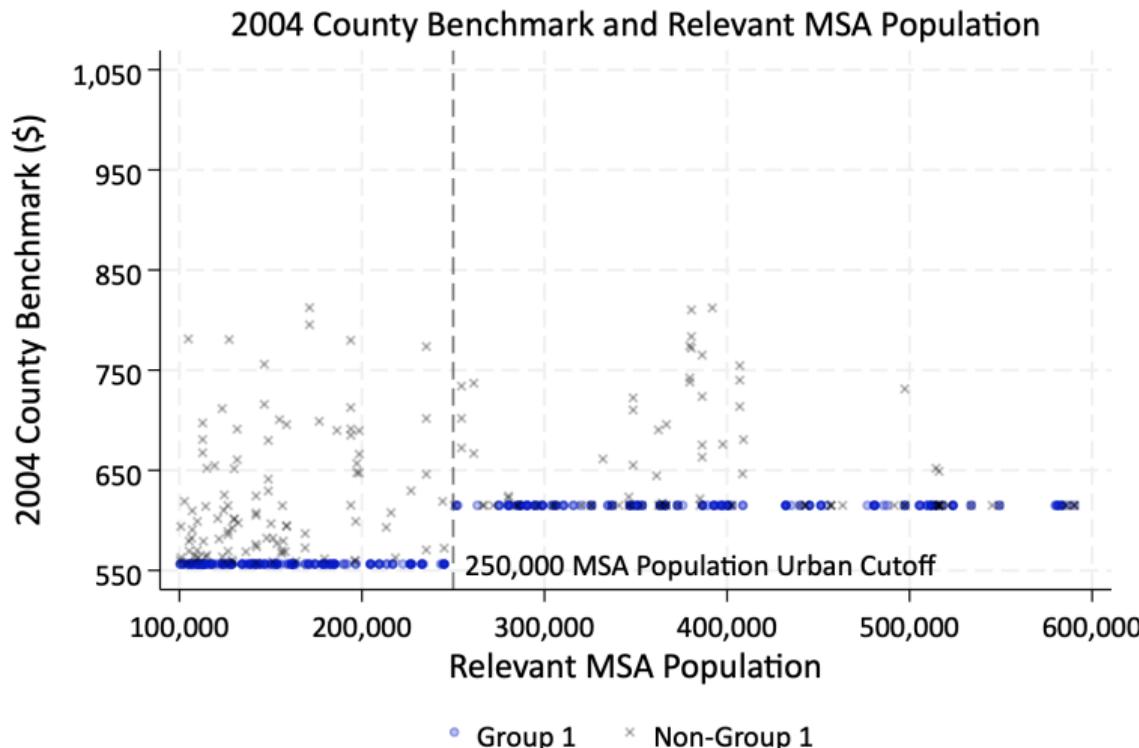


Sources: CMS, US Census Bureau.

Notes: Limited up to 75th percentile of MSA population. 886 Group 1 counties, 242 Group 2 counties, 183 Group 3 counties.

FFS Rates & Benchmarks

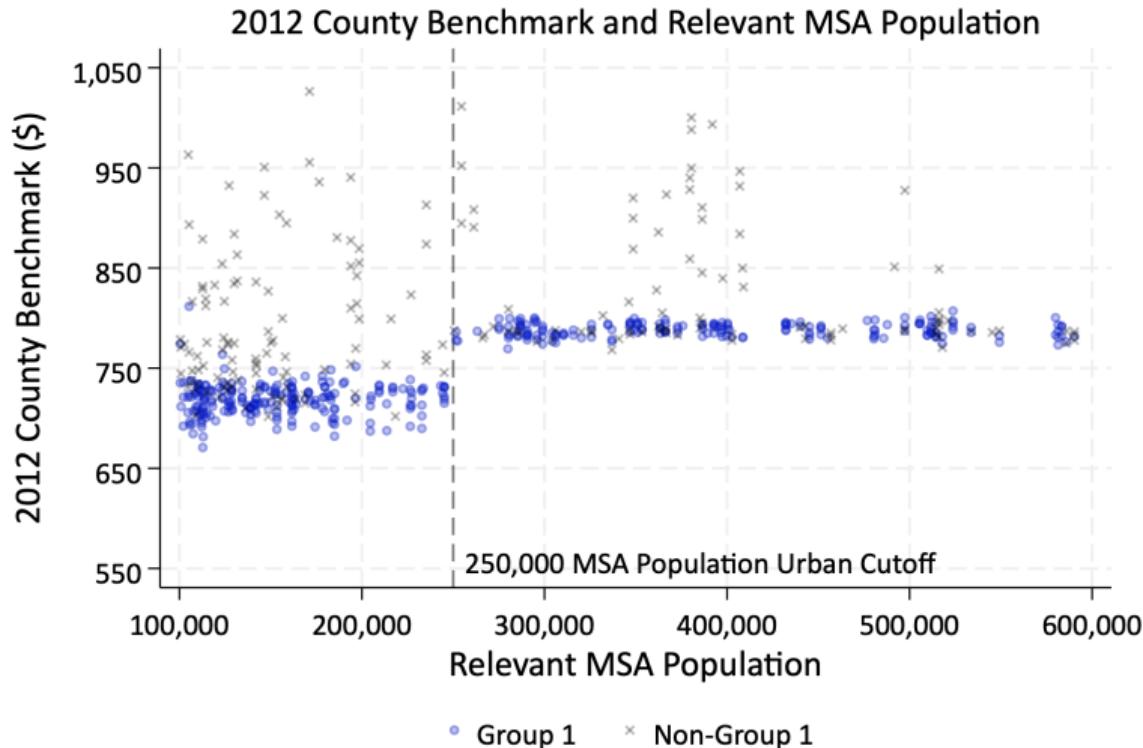
## 2004: There are 2 Defined Floors, Rural and Urban



Source: CMS, US Census Bureau.

Notes: Observations are at the county level. Benchmark amounts are per-enrollee month.

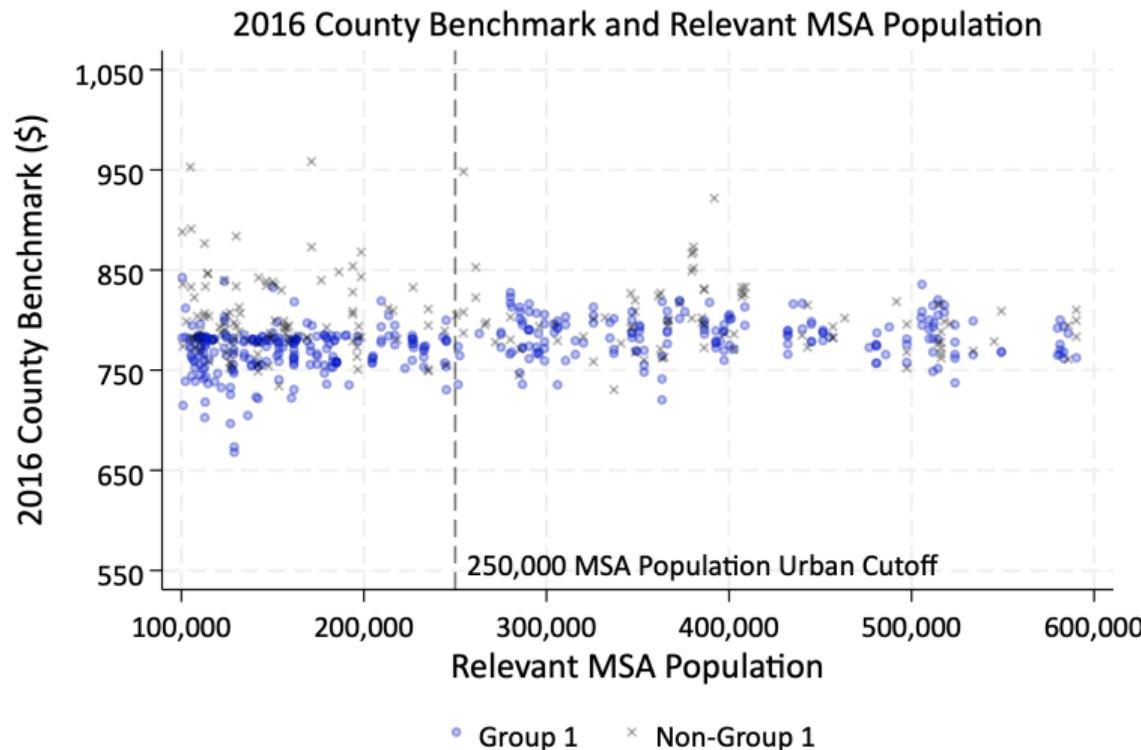
# 2012: ACA Changes Begin to Muddle Floors



Source: CMS, US Census Bureau.

Notes: Observations are at the county level. Benchmark amounts are per-enrollee month.

# 2016: Rural and Urban Counties Appear to Have Similar Benchmarks



Source: CMS, US Census Bureau.

Notes: Observations are at the county level. Benchmark amounts are per-enrollee month.

# MA Policies, Benchmarks, and Floors

## Summary

- MA policy institutes a rural floor of \$556.66, and a higher urban floor of \$615.25.
- We examine rural and urban counties that were bound below the rural floor in 2004 (“Group 1”).
- In 2012, ACA changes benchmark calculations and begin to phase out floors.

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# Data

- MA Price Index from Buchmueller, Kaye, Mandelkorn, and Miller (2022) [BKMM 2022]
  - We use a novel price index based on itemized MA claims from HCCI to measure relative price differences across counties.
- Centers for Medicare & Medicaid Services (CMS)
  - County-year MA benchmarks, FFS rates per enrollee-month.
  - County-year MA enrollees and penetration rates.
  - County-month MA plan-level enrollees and service areas.
- US Census Bureau
  - County-year population estimates.
  - Historical MSA delineation files.

County MA Summary Stats

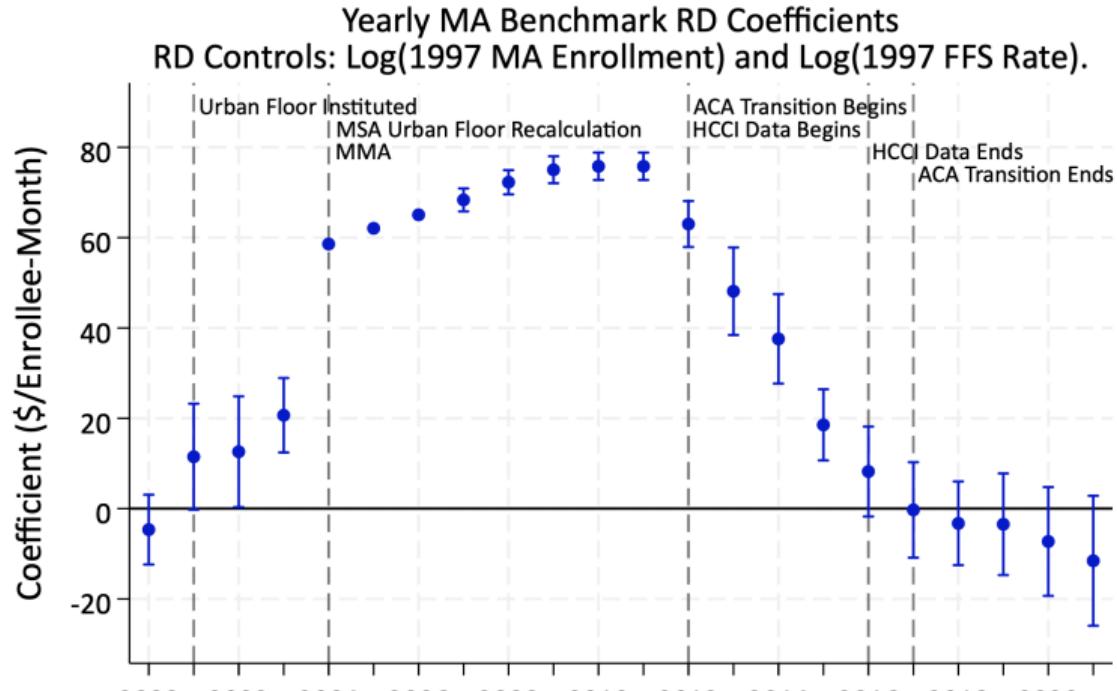
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# First Stage Result: Differences in Benchmarks



Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).



Without Controls

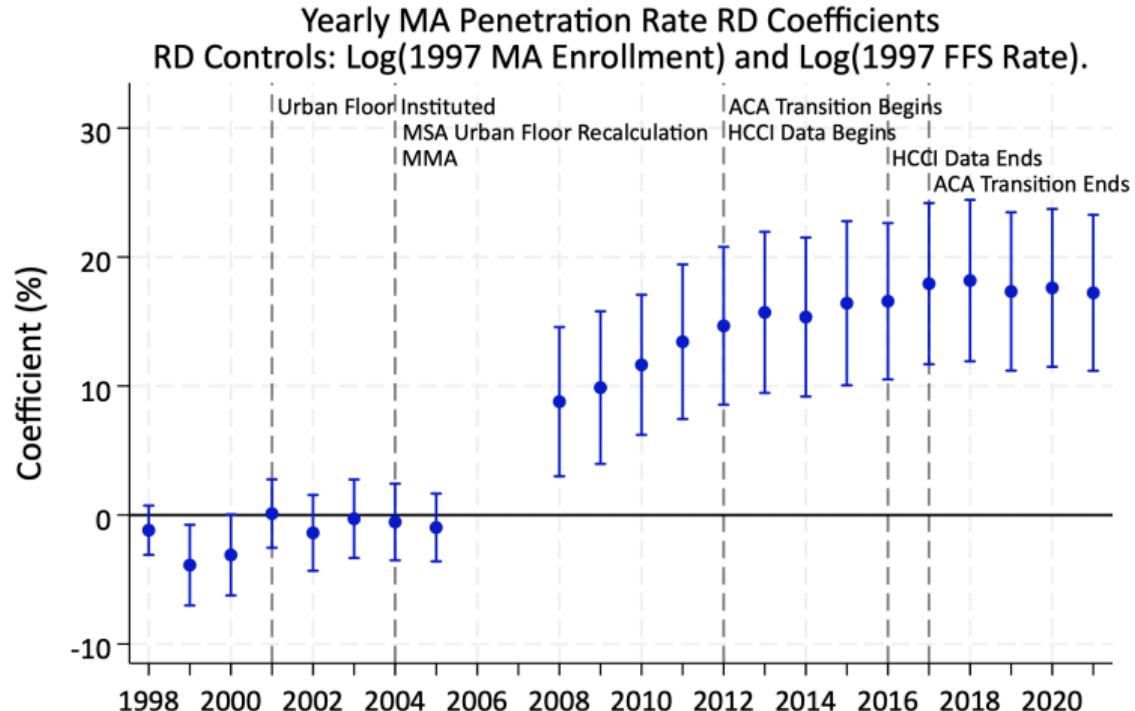
Est: 2012 - 2012 by Group

BWs: 2012 - 2012 by Group

2012 Group 3 Scatter

2016 Group 3 Scatter

# There is a Continuing Difference in MA Penetration Rates



Sources: CMS, US Census Bureau.

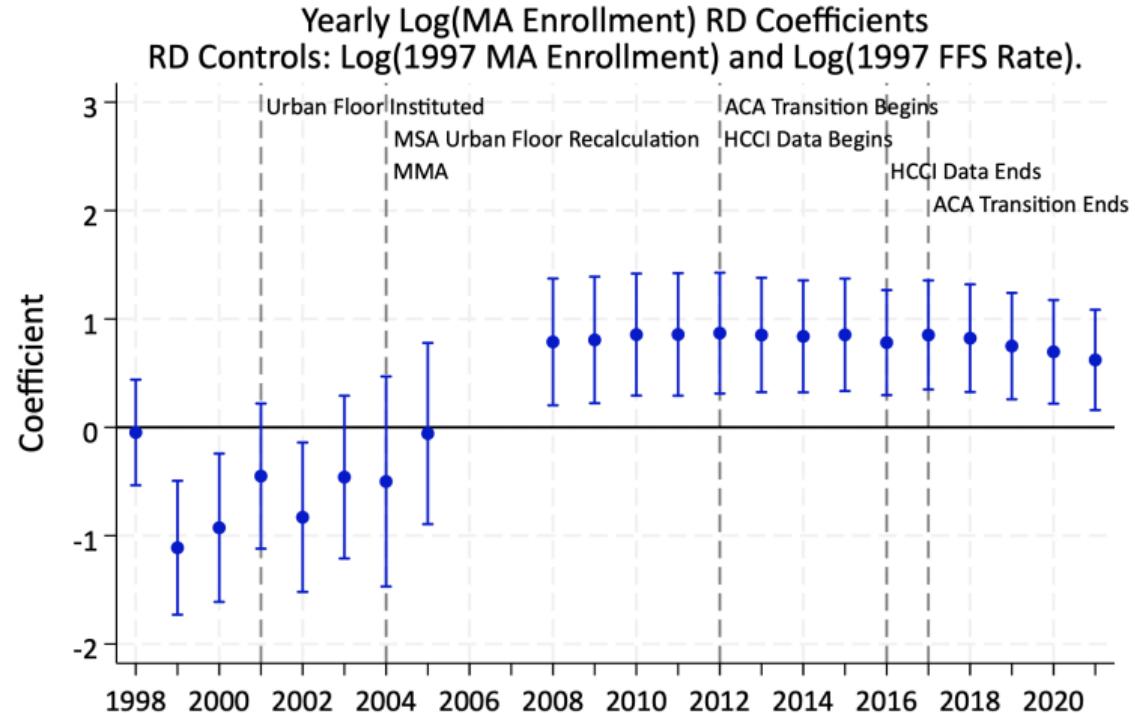
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).

Without Controls

# There is a Continuing Difference in MA Enrollment



Sources: CMS, US Census Bureau.

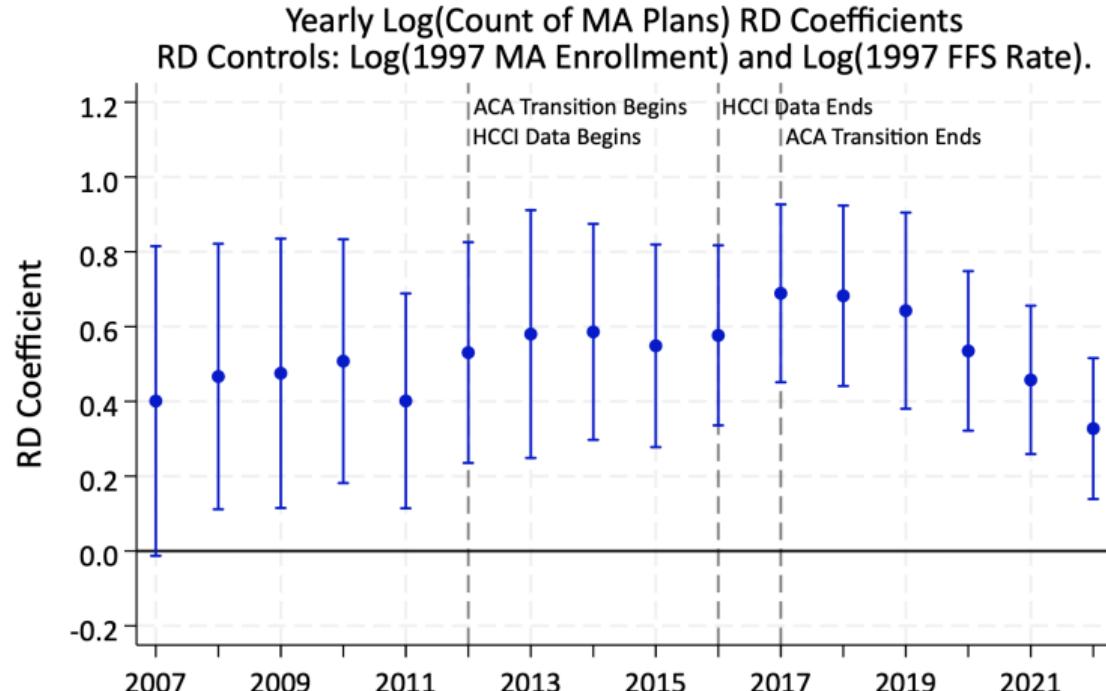
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).

Without Controls

# There is a Continuing Difference in the Count of MA Plans



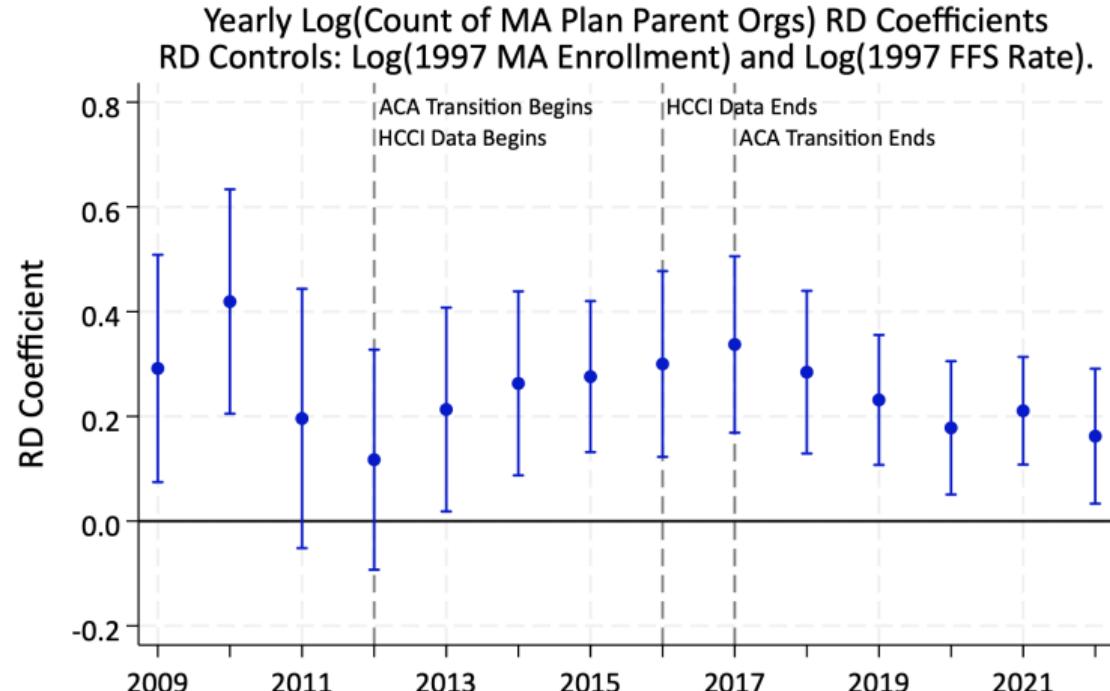
Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.  
RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).

Without Controls

# There is a Continuing Difference in the Count of MA Plan Parent Orgs



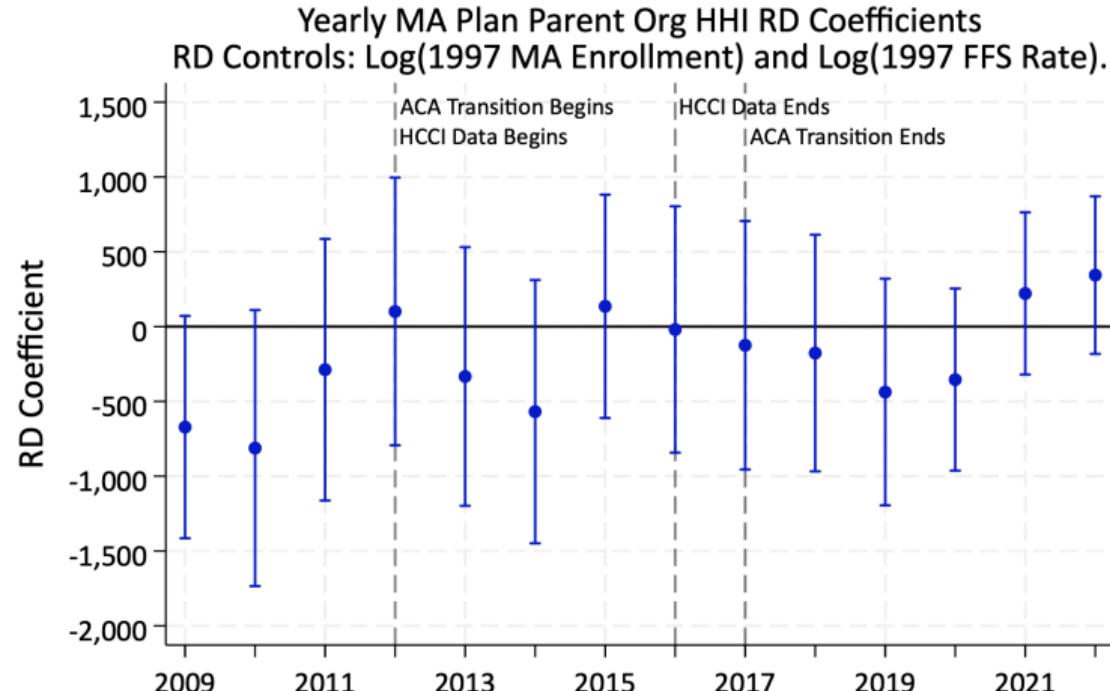
Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.  
RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).

Without Controls

# There is no Difference in MA Plan Parent Org HHI



Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 MA Enrollment) and Log(1997 FFS Rate).

Without Controls

# 2012 - 2016 RD Estimates: Benchmarks, Enrollment, and Plans

## Yearly MA Benchmark, Enrollment, and Plan RD Results

	<b>MA Benchmark</b> <b>(1)</b>	<b>Log(MA Enrollment)</b> <b>(2)</b>	<b>MA Penetration Rate</b> <b>(3)</b>	<b>Log(# of MA Plans)</b> <b>(4)</b>	<b>Log(# of MA Parent Orgs)</b> <b>(5)</b>	<b>MA Parent Org HHI</b> <b>(6)</b>
2012	63.012*** (2.593)	0.869*** (0.284)	14.663*** (3.122)	0.531*** (0.151)	0.117 (0.107)	101.075 (456.426)
2013	48.133*** (4.950)	0.852*** (0.270)	15.706*** (3.186)	0.580*** (0.169)	0.213** (0.099)	-333.362 (441.150)
2014	37.582*** (5.058)	0.839*** (0.264)	15.348*** (3.140)	0.586*** (0.147)	0.263*** (0.090)	-568.625 (449.023)
2015	18.536*** (4.016)	0.853*** (0.265)	16.418*** (3.244)	0.549*** (0.138)	0.276*** (0.074)	135.436 (380.735)
2016	8.214 (5.081)	0.781*** (0.247)	16.571*** (3.092)	0.577*** (0.123)	0.300*** (0.090)	-19.534 (420.213)
Counties:	400	400	400	400^	400^	400^
Controls:						
Log(1997 FFS Rate)	X	X	X	X	X	X
Log(1997 MA Enrollment)	X	X	X	X	X	X

Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth.

SEs NN clustered at the relevant MSA in parentheses.

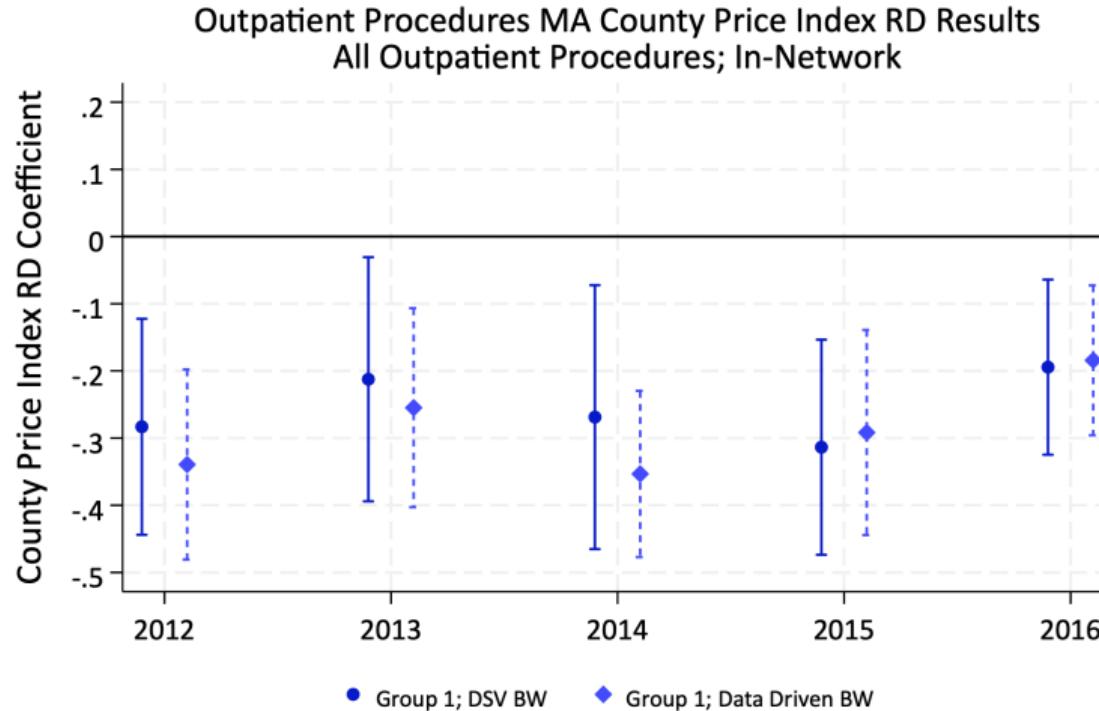
\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.001

^ 399 counties are present in the MA plan data for 2013 and 2014

# Benchmark and Enrollment Results

- Benchmarks (First Stage) - phaseout of differences
  - 2004: ~\$60 difference in benchmarks across the urban cutoff.
  - 2012: ~\$63 difference in benchmarks across the urban cutoff
  - 2016: **Reduction** to ~\$8 (ACA-phaseout)
- Enrollment - Approximately double enrollment across cutoff, persists after phaseout
  - 2004-2012: Increasing differences in penetration rates across cutoff.
  - 2012: ~15 percentage point difference
  - 2016: Effect on penetration rates **persists** at ~17 percentage point difference
- Plan Entry - Small plans enter, but no large changes to market structure.
  - Persistent increases in both the number of MA plans available and the number of parent organizations offering MA plans across the urban cutoff.
  - No change to MA plan parent organization HHI across the urban cutoff.

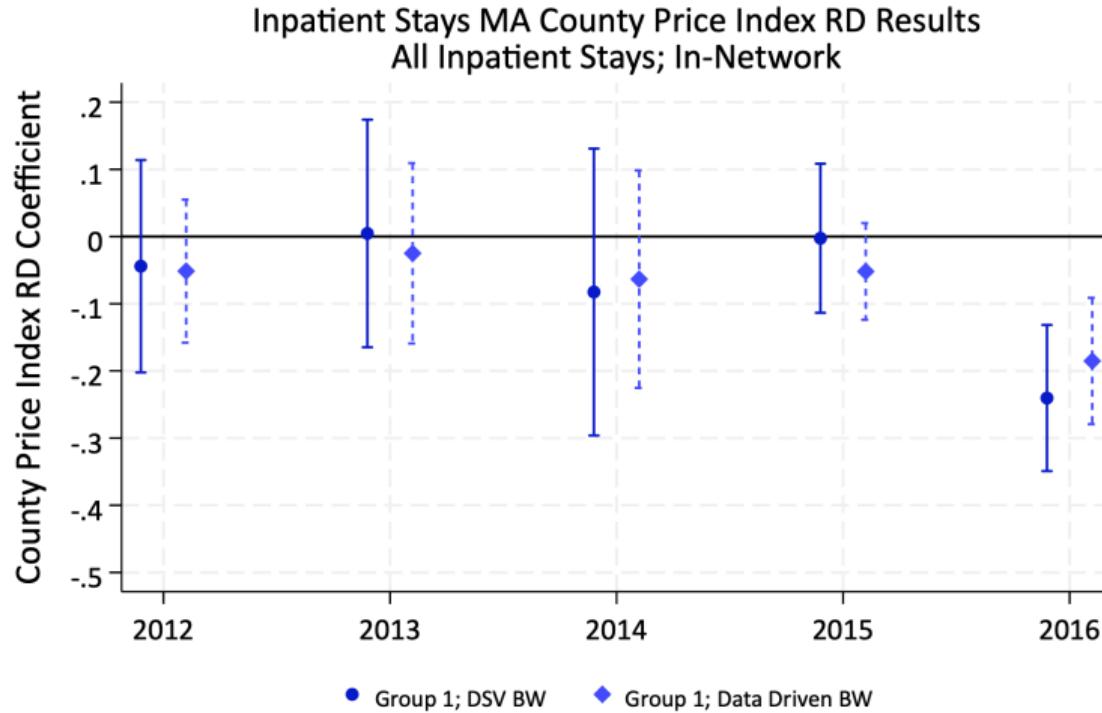
# Negative Effect on Outpatient In-Network Prices



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.  
Notes: SEs NN clustered at the relevant MSA. Bars represent 95% CIs.  
Price Index Controls: Procedure Code, Log(Units), Demographics.  
RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

- BW: Group 1 OP In
- Est: Group 1 OP Out
- BW: Group 1 OP Out
- Est: All Groups OP In
- BW: All Groups OP In
- Est: All Groups OP Out
- BW: All Groups OP Out

# No Effect on Inpatient In-Network Prices (but for 2016?)

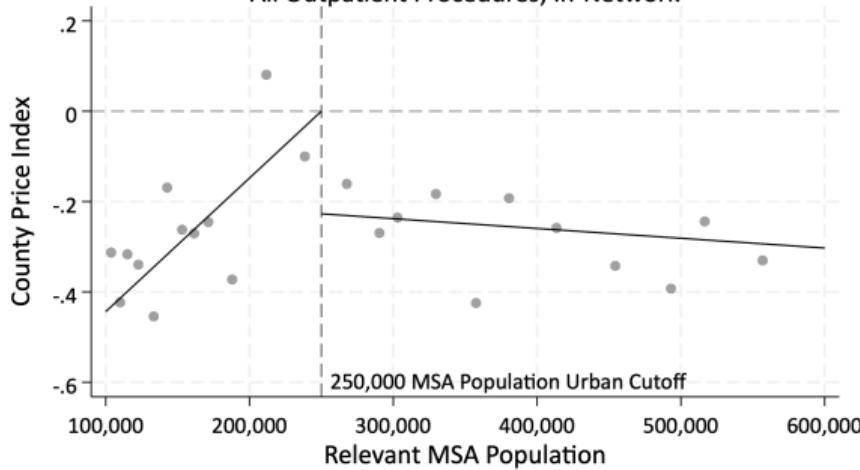


- BW: Group 1 IP In
- Est: Group 1 IP Out
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- Est: All Groups IP In
- BW: All Groups IP In
- Est: All Groups IP Out
- BW: All Groups IP Out

# Negative Effect on OP Prices: 2012

2012 Outpatient Procedures MA County Price Index RD Plot

All Outpatient Procedures; In-Network



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2012 Outpatient Procedures MA County Price Index RD Estimates  
All Outpatient Procedures; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.227*** (0.062)	-0.318*** (0.069)
Bias-Corrected	-0.283*** (0.062)	-0.339*** (0.069)
Robust	-0.283*** (0.082)	-0.339*** (0.072)
Bandwidth	(150k; 350k)	(97,509; 3,642,953)
Bias Bandwidth	(150k; 350k)	(236,739; 18,497,432)
Observations	(201; 174)	(609; 389)
Effective Observations	(201; 174)	(93; 352)
Clusters	(124; 70)	(49; 130)
Controls:	X	X

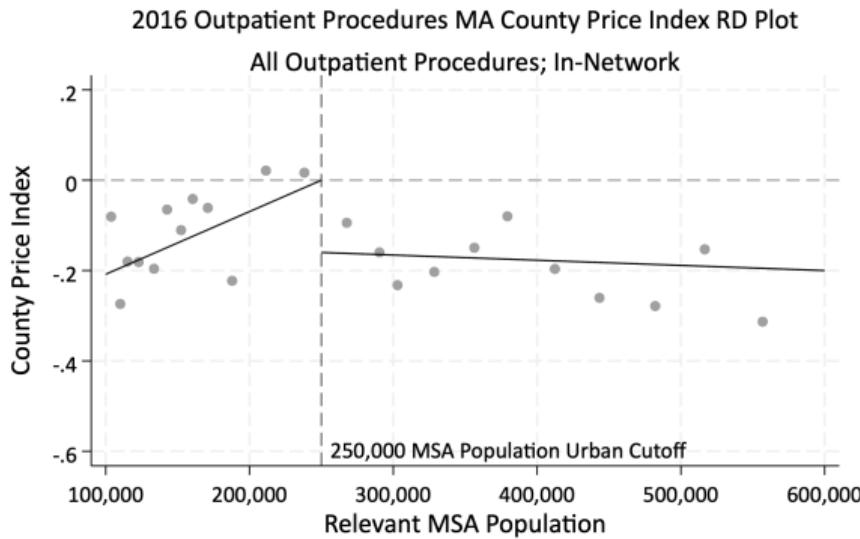
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Negative Effect on OP Prices: 2016



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2016 Outpatient Procedures MA County Price Index RD Estimates  
All Outpatient Procedures; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.160*** (0.047)	-0.170*** (0.053)
Bias-Corrected	-0.194*** (0.047)	-0.184*** (0.053)
Robust	-0.194*** (0.067)	-0.184*** (0.057)
Bandwidth	(150k; 350k)	(115,226; 2,568,870)
Bias Bandwidth	(150k; 350k)	(236,739; 18,497,432)
Observations	(201; 175)	(583; 389)
Effective Observations	(201; 175)	(122; 338)
Clusters	(124; 70)	(68; 124)
Controls:	X	X

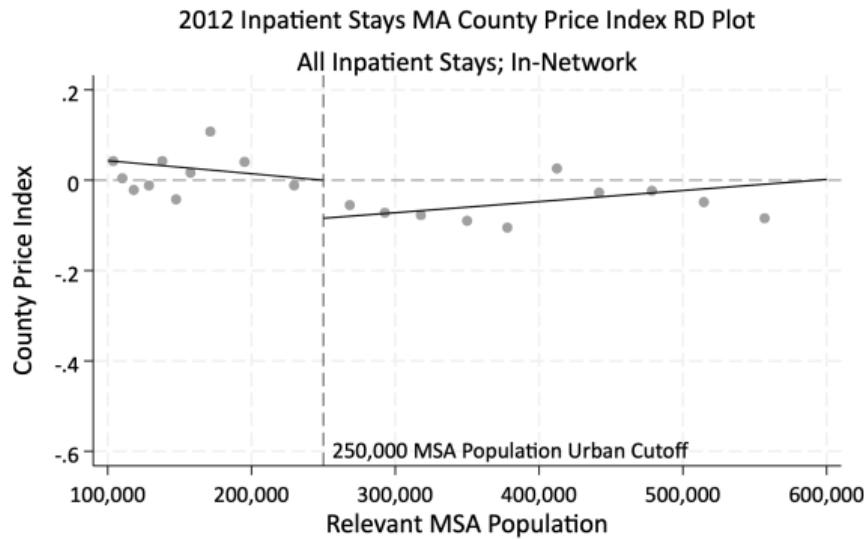
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Null Effect on IP Prices: 2012



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

2012 Inpatient Stays MA County Price Index RD Estimates  
All Inpatient Stays; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.084 (0.055)	-0.053 (0.048)
Bias-Corrected	-0.044 (0.055)	-0.051 (0.048)
Robust	-0.044 (0.081)	-0.051 (0.054)
Bandwidth	(150k; 350k)	(142,507; 4,394,190)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(168; 156)	(511; 353)
Effective Observations	(168; 156)	(151; 322)
Clusters	(119; 70)	(105; 129)
Controls:	X	X

Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

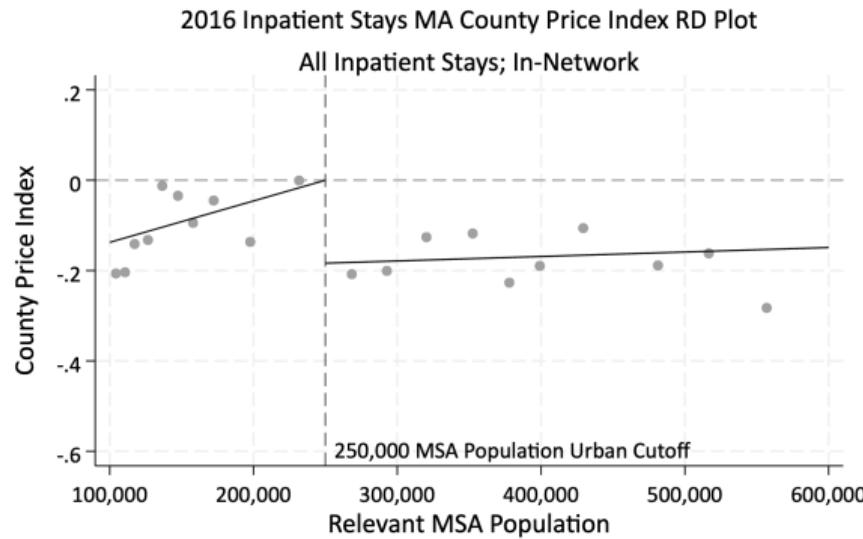
Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

# Negative Effect on IP Prices: 2016



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

2016 Inpatient Stays MA County Price Index RD Estimates  
All Inpatient Stays; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.184*** (0.042)	-0.174*** (0.042)
Bias-Corrected	-0.240*** (0.042)	-0.185*** (0.042)
Robust	-0.240*** (0.055)	-0.185*** (0.048)
Bandwidth	(150k; 350k)	(144,145; 3,765,497)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(135; 140)	(374; 301)
Effective Observations	(135; 140)	(126; 275)
Clusters	(108; 69)	(101; 123)
Controls:	X	X

Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

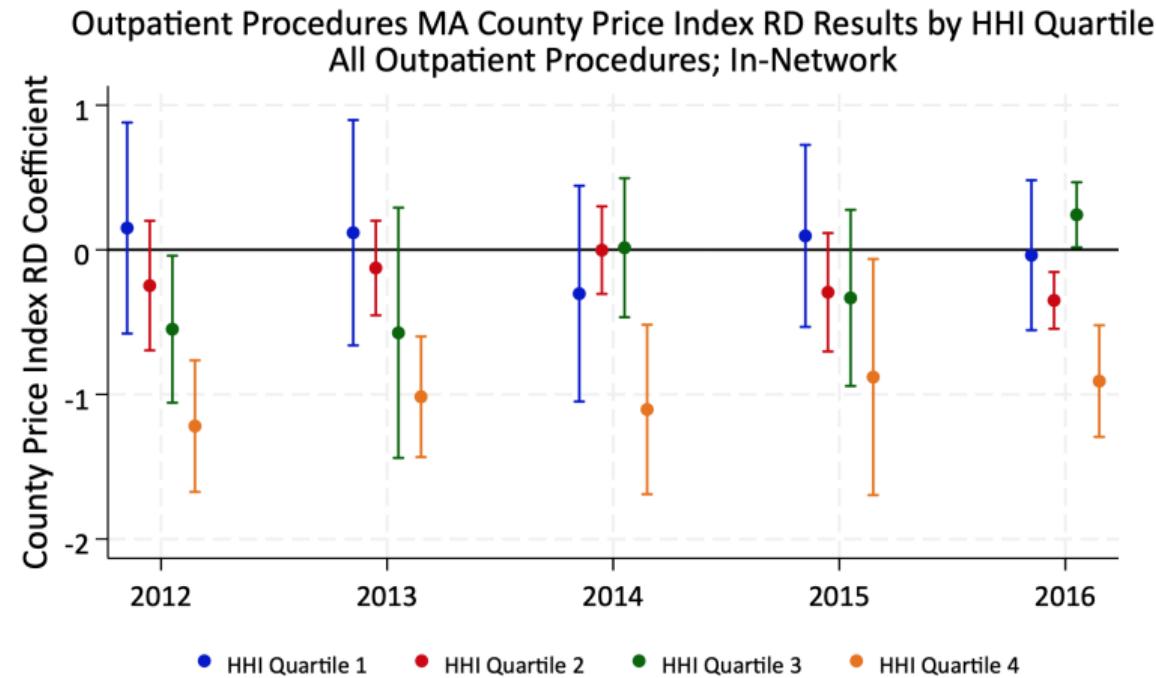
Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

# Price Effect is Larger in Highly Concentrated Counties



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: DSV [150k, 350k] MSA population RD bandwidth. SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

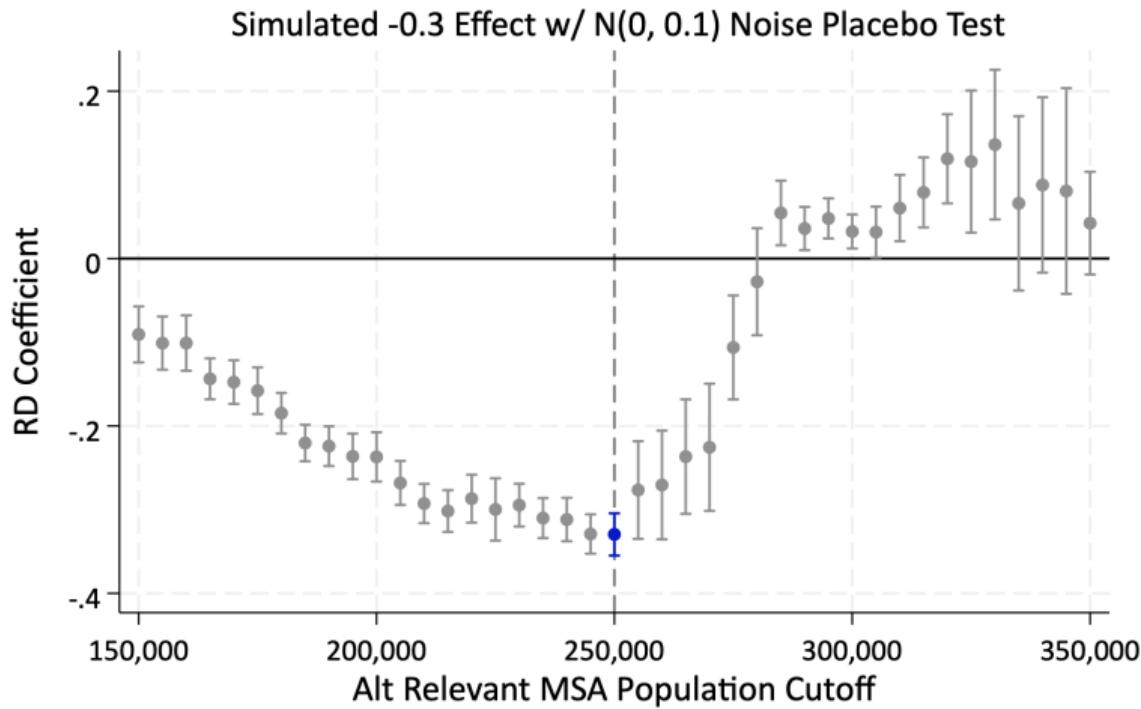
Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

HHI quartiles calculated using prior year county-level HHIs across Group 1 counties within DSV [150k; 350k] bandwidth with price index estimate.

- OP; Out-of-Network
- IP; In-Network
- IP; Out-of-Network

# Placebo Test: Simulated -0.3 Effect



Sources: US Census Bureau.

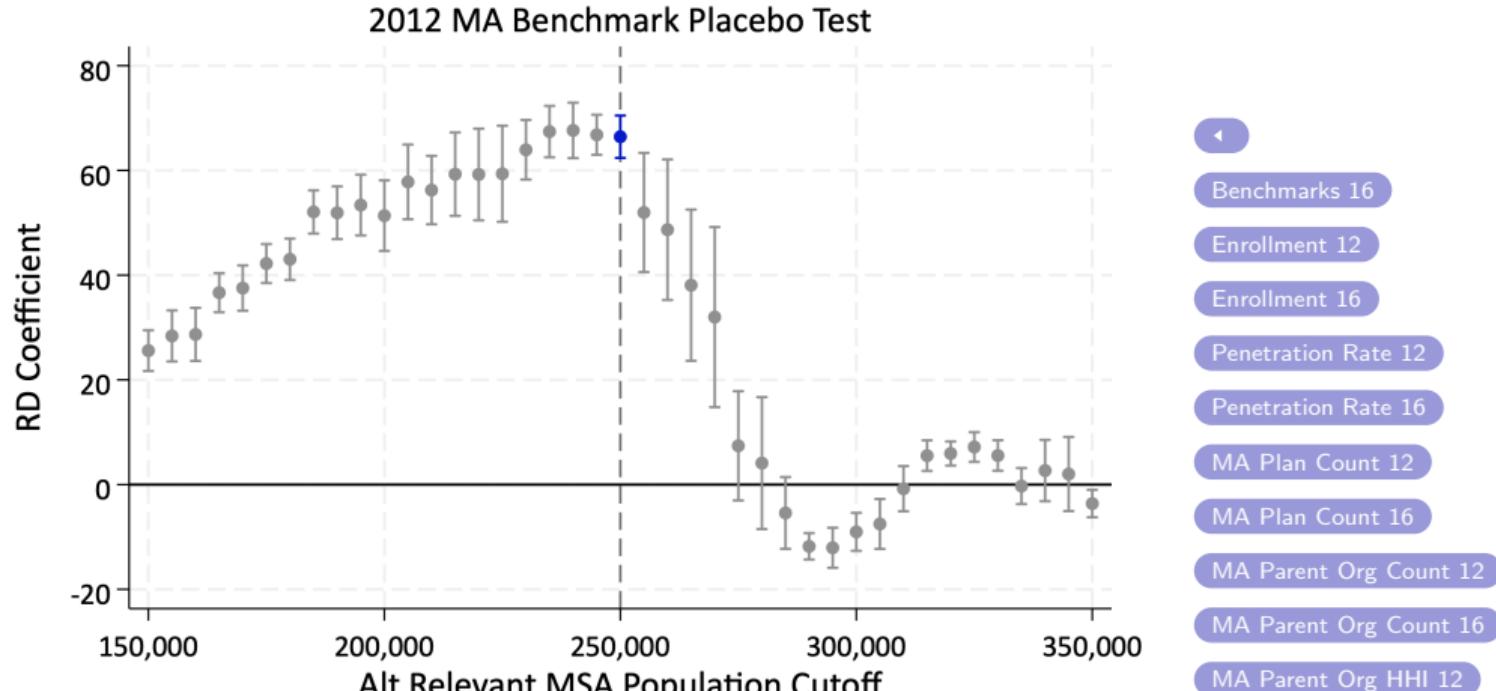
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Data simulated. Counties w/ MSA pop < 250k value =  $N(0, 0.1)$ . Counties w/ MSA pop > 250k =  $-0.3 + N(0, 0.1)$

# Placebo Test: 2012 MA Benchmark



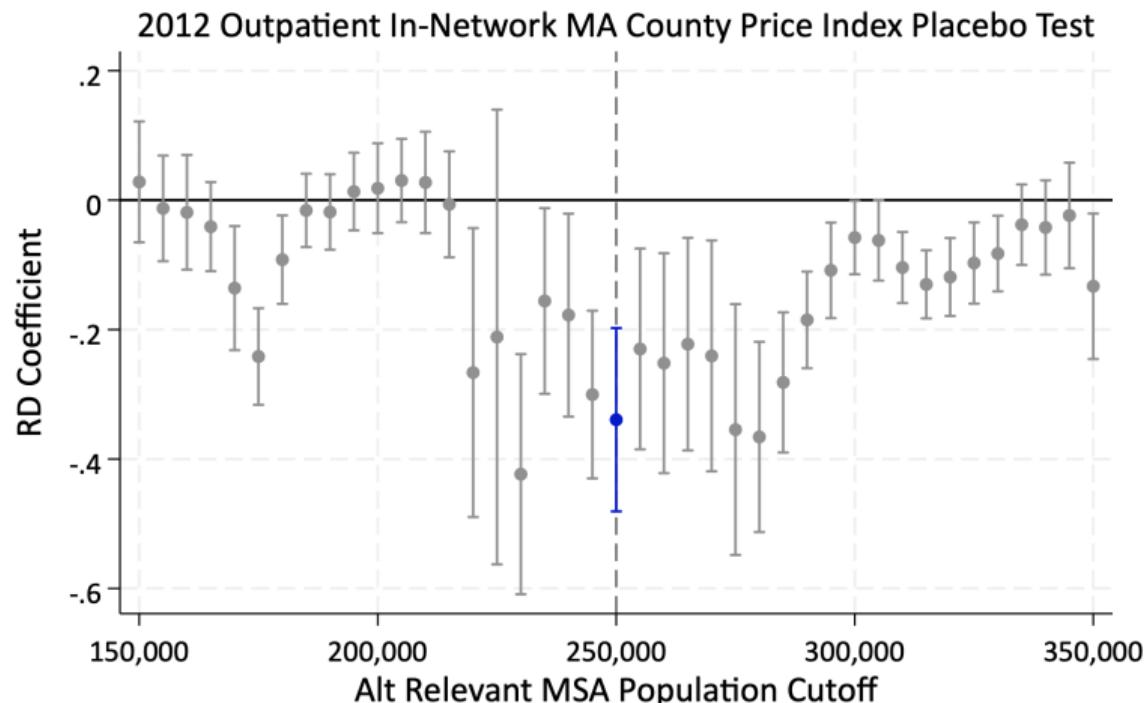
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 Outpatient In-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: Procedure Code, Log(Units), Demographics.

# Treatment Effect Interpretation

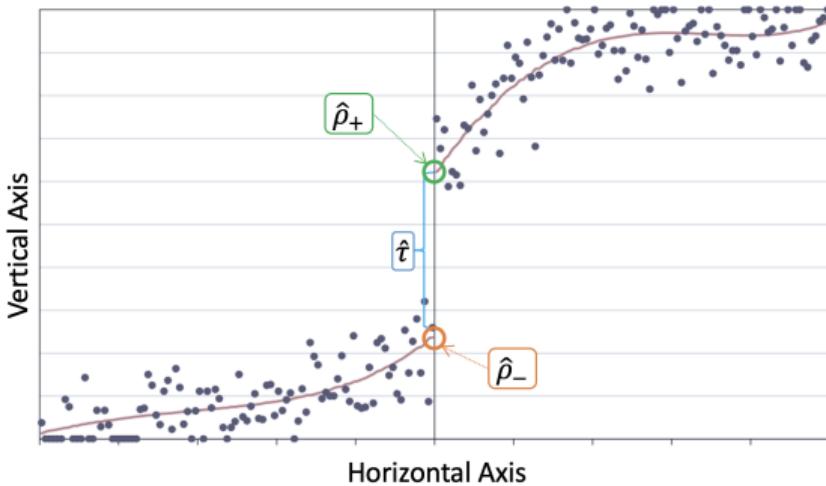


Figure: RD Example With Logs

# Treatment Effect Interpretation

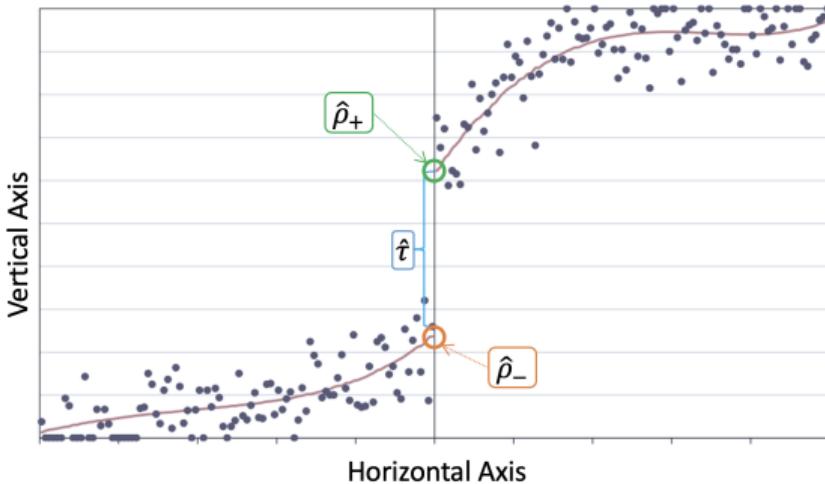


Figure: RD Example With Logs

To get a  $\% \Delta$  interpretation, we need to transform  $\hat{\tau}$ . Note that

$$\log(a) - \log(b) = c \quad (1)$$
$$\implies a = e^c b$$

$$\log(\hat{p}+) - \log(\hat{p}-) = \hat{\tau} \quad (2)$$
$$\implies \frac{\hat{p}+}{\hat{p}-} = e^{\hat{\tau}}$$

The RD estimate gives us

$$\% \Delta = e^{\hat{\tau}} - 1$$

# Price Index RD Results

- Outpatient
  - Persistent differences in price between ~18% and 30% lower across the cutoff.
  - Heterogeneous effects across market structure.
- Inpatient
  - No significant difference for 2012 - 2015.
  - Significant difference for 2016. Why?
- Mechanisms (Back of the Envelope) - price results driven by enrollment
  - “Pass-through Effect”: Decreasing across years
  - “Enrollment Effect”: Relatively constant across years
  - “Entry Effect”: No evidence of large changes to market structure

# Outline

- Motivation and Background
- Policy Context
- Data
- Estimation Strategy
- Results
- **Conclusion**

# Conclusion and Next Steps

## Conclusions

- Short-term subsidies can have long-term impacts on MA enrollment.
- Large differences in MA enrollment can have large effects on MA medical prices.
- “Enrollment effect” dominates “pass-through effect” and “entry effect”.
- Bargaining can have different effects on different types of care.
- Heterogenous effects across market structure underscore bargaining importance.

## Extensions and future work

- Who benefits?
- ACA introduced many new non-linearities in benchmarks
- Explicitly model bargaining problem

# Appendix

## Nash Bargaining Details

- Nash-Bargaining between providers and insurers (GNT, GHT).
- Nash-Bargaining objective:

$$NB^{m,s}(p_{mj_{J_s}} | \vec{p}_{m,-s}) = \underbrace{\left( \sum_{j \in J_s} q_{mj}(N_m, \vec{p}_m) [p_{mj} - mc_{mj}] \right)^{b_{s(m)}}}_{\text{Provider Surplus}} \underbrace{(V_m(N_m, \vec{p}_m) - V_m(N_m \setminus J_s, \vec{p}_m))^{b_{m(s)}}}_{\text{Insurer Surplus}} \quad (3)$$

- Impact of subsidy on  $NB^{m,s}(p_{mj_{J_s}} | \vec{p}_{m,-s})$ 
  - $N_m$  increased enrollment
  - $V_m$  Different premiums (not in eq)
  - $mc_{mj}$  Provider investment decisions (medium-long run)

◀ Nash Bargaining Intuition

## Benchmark Details

- Maximum capitated payment to plans per enrollee.
- 1997: Balanced Budget Act of 1997 established one benchmark floor for all counties in 1998.
- 2000: Benefits Improvement and Protection Act of 2000 established urban floor for counties with MSA populations over 250,000 effective 2001 and raised rural floor.
- 2003: Medicare Modernization Act raises benchmarks and slightly changes benchmark calculation process effective 2004.
- New definition of micropolitan and metropolitan statistical areas - some rural counties reclassified as urban. All previously urban floor counties were grandfathered in.

[◀ Policy Timeline](#)

# ACA Policy Changes

- Pre-ACA Benchmarks.
  - 2004: max [floor, mean county FFS costs, minimum update over prior year's benchmark, blended rate].
  - 2005-2010: max [prior year's benchmark increased by national MA growth rate, per capita county FFS spending (in rebasing years)].
  - Result: MA benchmarks quickly rise, outpace FFS costs.
- ACA Changes to MA Benchmarks.
  - Intent: Bring MA rates more in line with FFS costs.
  - Over a set number of transition years, counties move from pre-ACA rate to a post-ACA rate: the product of per capita county FFS spending and a county cost level-based bonus.
  - Result: MA benchmarks pull more in line with FFS costs, effect of 250k MSA population threshold on benchmarks fade.

◀ Policy Timeline

# Post-ACA Benchmark Calculation Table; Morgan (2015)

**Table 1. The Two Possible Bases for the 2016 MA Benchmark Calculation**

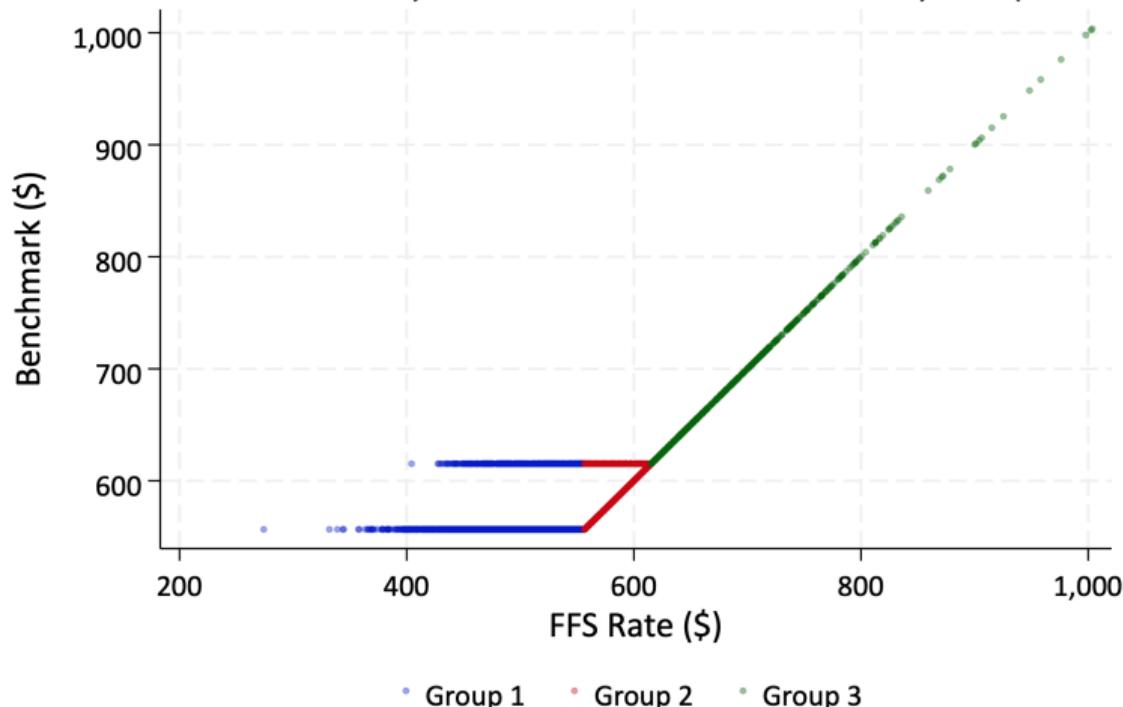
<b>The Pre-ACA Methodology</b> <b>Greatest of ...</b>	<b>And/Or Only</b>	<b>The ACA Methodology</b>		
		<b>Base Benchmark Amount</b>	<b>AND</b>	<b>Applicable Percentage for the Year Specified</b>
<b>I. Capitation Rate for the Previous Year Increased by "National MA Growth Percentage"</b>  <b>OR</b>  <b>2. Per Capita Fee-for-Service Spending in the County as measured by the "Average Adjusted per Capita Cost" in years when the Secretary rebases Fee-for-Service Costs</b>		Product of ...  which is equal to Per Capita FFS Spending in the County as measured by the "Average Adjusted per Capita Cost"		
				which is either 95%, 100%, 107.5%, or 115% and subject to a star quality rating adjustment if the plan qualifies

**Source:** Table created by the Congressional Research Service.

**Notes:** For counties with a two-year or four-year phase-in to the ACA methodology, their benchmarks are fully phased in to the ACA methodology described on the right side of the figure and only that part of the figure is relevant for the calculation of their benchmark. Counties with a six-year phase-in have benchmarks that use both methods in 2016, so both the pre-ACA methodology and the ACA methodology are used to calculate those benchmarks. The Secretary indicated that 2016 will be a rebasing year. In non-rebasing years, the pre-ACA methodology consists only of an increase in the previous year's benchmark.

# MA Benchmarks, FFS Rates, and County Definitions

2004 County MA Benchmarks and FFS Rates by Group



Sources: CMS.

Notes: 1899 Group 1 counties, 600 Group 2 counties, 554 Group 3 counties.

◀ FFS Rates & MSA Pops

## Summary Statistics

	All Counties			Group 1 Counties within DSV Bandwidth		
	Counties	Mean	SD	Counties	Mean	SD
Relevant MSA Population	1,778	1,117,889.375	2,578,086.750	400	264,137.594	139,944.562
2012 County Population	3,124	100,396.172	320,221.750	400	108,354.914	111,560.500
2016 County Population	3,124	103,309.242	331,068.250	400	111,172.430	116,814.844
1997 FFS Rate	3,124	371.550	62.306	400	359.051	39.185
2004 FFS Rate	3,124	546.251	89.342	400	498.648	36.310
2004 Benchmark	3,124	597.357	58.619	400	583.026	29.185
2012 Benchmark	3,124	771.934	70.779	400	750.190	37.045
2016 Benchmark	3,124	796.721	50.362	400	776.402	23.055
2012 Pre-ACA Rate	3,124	789.905	77.066	400	768.352	37.713
2016 Pre-ACA Rate	3,124	851.438	88.398	400	819.534	40.859
2012 Post-ACA Rate	3,124	726.935	49.263	400	706.235	32.898
2016 Post-ACA Rate	3,124	797.173	48.231	400	778.593	27.405
1997 MA Enrollees	3,122	1,749.883	10,693.746	400	799.565	2,622.735
2004 MA Enrollees*	1,739	3,017.135	13,962.115	291	1,102.220	2,860.608
2012 MA Enrollees*	3,074	4,186.712	15,638.675	400	4,317.842	6,041.667
2016 MA Enrollees*	3,034	5,819.414	20,780.037	400	6,101.353	7,924.410
1997 MA Penetration Rate	3,122	4.113	8.148	400	3.350	6.698
2004 MA Penetration Rate*	1,739	6.454	9.577	291	5.083	7.628
2012 MA Penetration Rate*	3,074	17.725	12.248	400	21.528	11.915
2016 MA Penetration Rate*	3,034	22.967	13.427	400	27.424	12.204

Sources: CMS, US Census Bureau

Notes: \*Censored if below 11 MA enrollees

Benchmarks and rates are per enrollee-month

## ◀ Data Sources



# Estimation Strategy

- Outcomes of interest
  - Benchmarks (first stage)
  - Enrollment
  - Insurers
  - Inpatient and outpatient prices
- Why construct a price index?
  - Treatment is set at the county level
  - We want to measure county level prices
- Price index set up
  - Using 235 million OP procedure charges from itemized claims and 7 million IP stays, we constructed a low variance price index
  - Our set up allows us to borrow strength from claims outside of our target counties to learn about the costs of procedures
  - Does not require assumption about representative bundle

# Estimation Strategy: Price Index Estimation

Review of price index from BKMM 2022.

$$\log(p_{ijct}) = \rho_{ct} + \kappa_{jt} + \alpha x_{it} + \epsilon_{ijct} \quad (4)$$

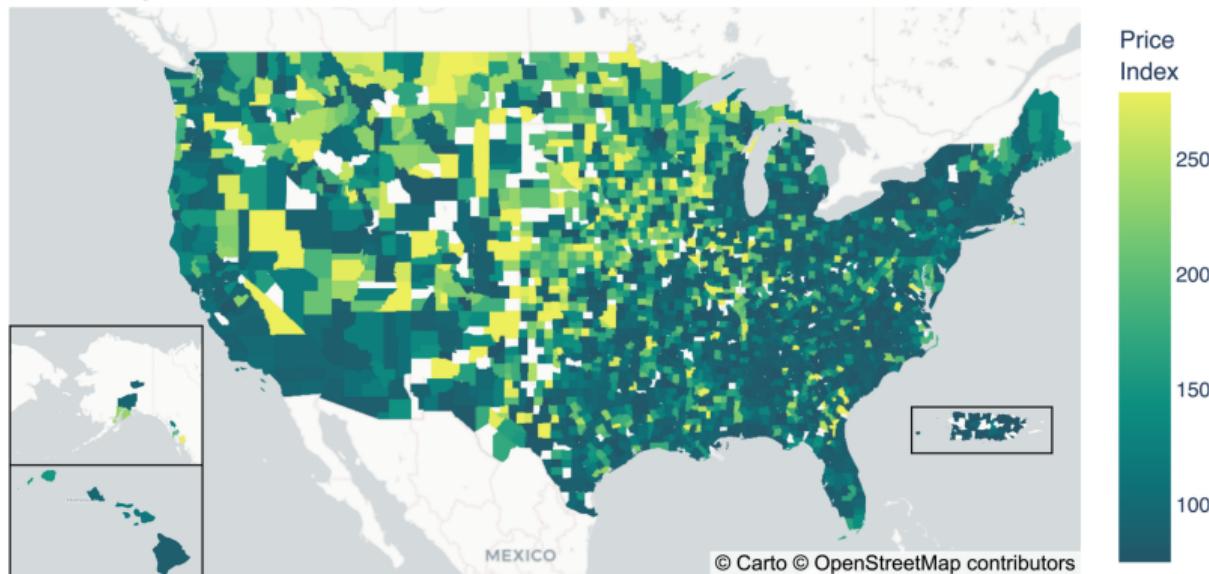
- $j$  denotes procedures for the outpatient index, and DRG code for the inpatient price index
- $\log(p_{ijct})$ , the log price of claim  $i$  for procedure  $j$  in county  $c$  during year  $t$
- $\rho_{ct}$  is the county-year fixed effect (price index)
- $\kappa_{jt}$  is the procedure specific parameter.
- $x_{it}$  are a set of controls, including log of units.

Parameters of interest

- $\hat{\rho}_{ct}$ : county-year price index estimate
- $\hat{\sigma}_{ct}^{-2}$ : inverse-variance estimate of  $\hat{\rho}_{ct}$

# There is Large Geographic Variation in County Price Indices: Outpatient

2012 Outpatient County MA Price Index  
All Outpatient Procedures; In-Network



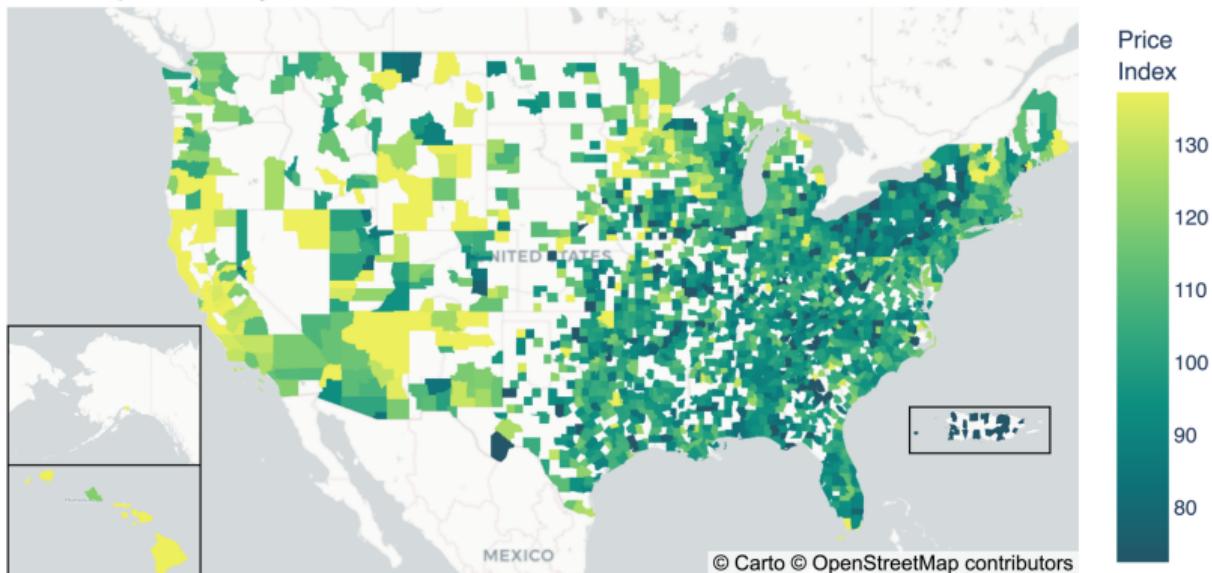
Source: Authors' calculations from HCCI outpatient claims dataset.

Note(s): Recentered at the median. Bottom-coded at 5% (75.018), top-coded at 95% (278.906).

Controls: Procedure code, log(units), demographics.

# There is Large Geographic Variation in County Price Indices: Inpatient

2012 Inpatient County MA Price Index  
All Inpatient Stays; In-Network



Source: Authors' calculations from HCCI outpatient claims dataset.

Note(s): Recentered at the median. Bottom-coded at 5% (72.458), top-coded at 95% (137.185).

Controls: DRG, log(length of stay), demographics.

## Estimation Strategy: Sharp RDD

Sharp regression discontinuity design

$$y_{ct} = \begin{cases} y_{ct}(0), & \text{if MSA Pop} < 250,000 \\ y_{ct}(1), & \text{if MSA Pop} \geq 250,000 \end{cases} \quad (5)$$

Outcomes:

- MA Benchmark (first stage), MA penetration rate, log MA enrollment, and price indexes ( $\hat{\rho}_{ct}$ )

Specification details

- Sample: Group 1 from DSV - bound by rural floor
- Weights: triangular kernel with inverse variance ( $\hat{\sigma}_{ct}^{-2}$ ) of price index
- Clustering: nearest-neighbor and relevant MSA id-year
- Pre-Treatment covariates: 1997 log FFS rate, 1997 log MA enrollment

◀ Main

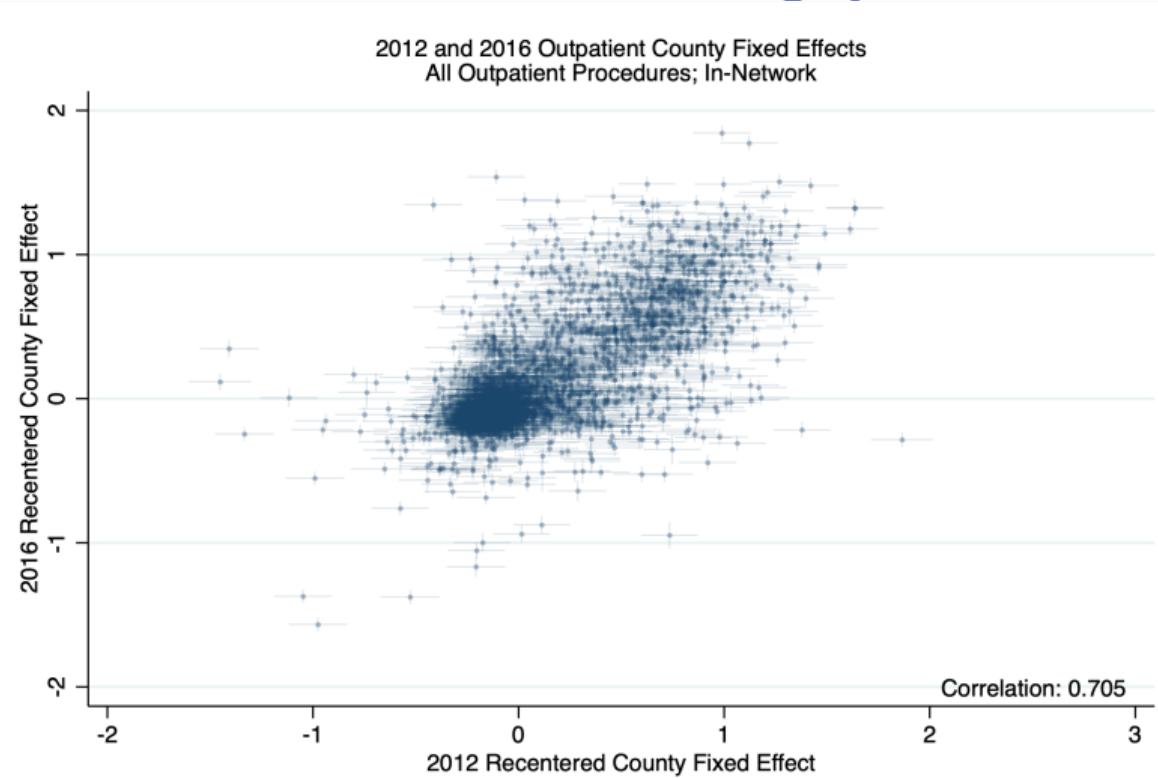
# Price Index Versions

OP Base:  $\alpha x_{it} = \alpha_1 \log (\text{units}_{ijct})$

With demographics:  $\alpha x_{it} = \alpha_1 \log (\text{units}_{ijct}) + \alpha_2 \text{age}_{it} + \alpha_3 \text{gender}_{it}$  (6)

With demographics and mods:  $\alpha x_{it} = \alpha_1 \log (\text{units}_{ijct}) + \alpha_2 \text{age}_{it} + \alpha_3 \text{gender}_{it} + \alpha_4 \text{mods}_{it}$

# Outpatient Price Index Estimates Are Highly Correlated Across Years



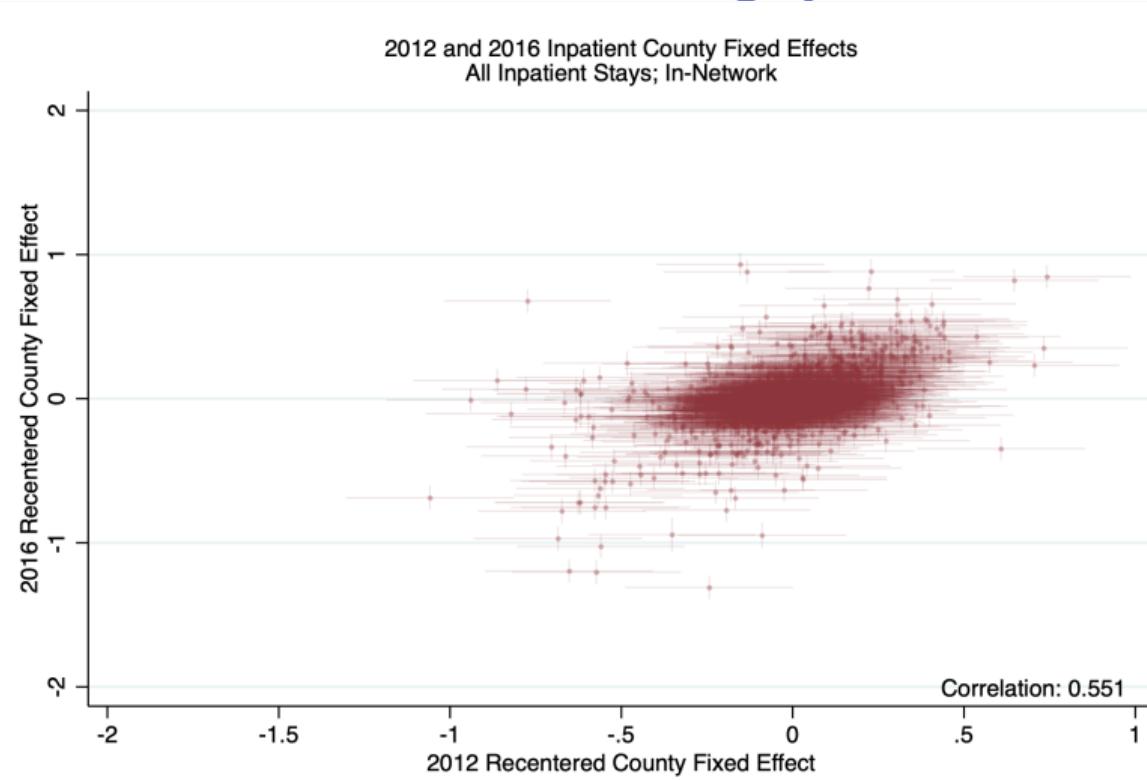
Source: Authors' calculations from HCCI outpatient claims dataset.

Notes: Controls: Procedure code, log(units), demographics. Number of counties: 2653.

Bars show 95% confidence intervals for each estimate.

◀ 2012 OP Map

# Inpatient Price Index Estimates Are Highly Correlated Across Years



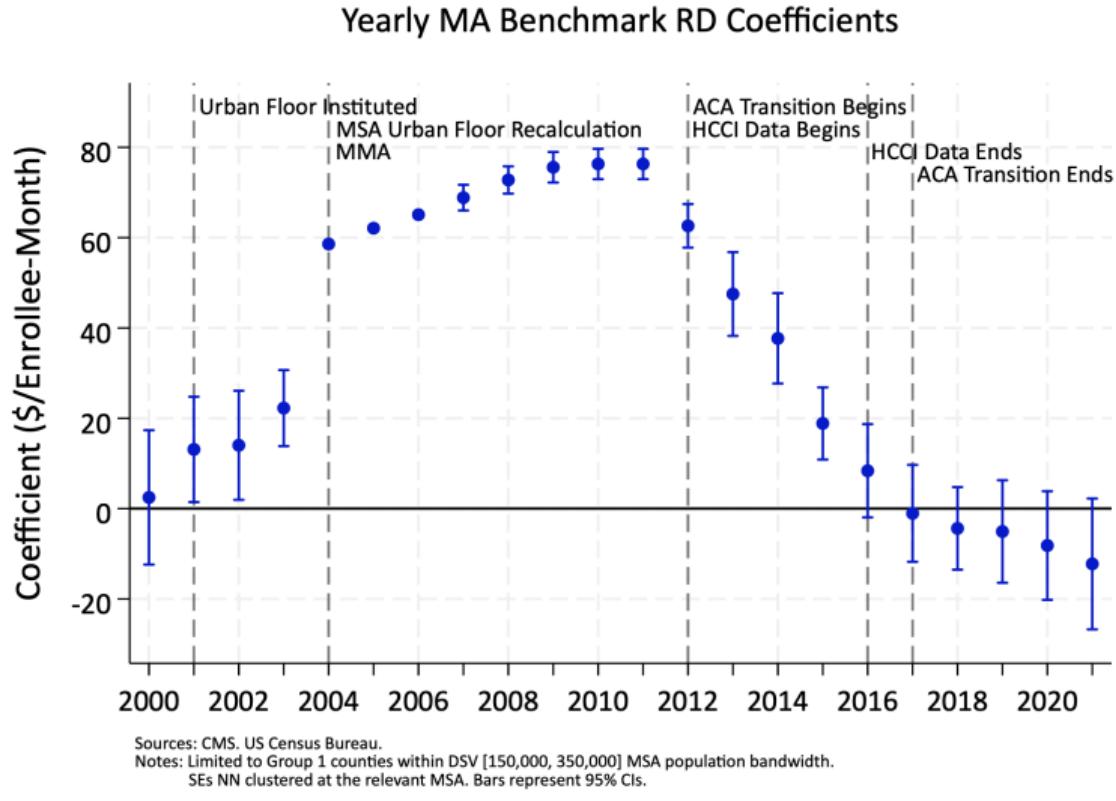
Source: Authors' calculations from HCCI inpatient claims dataset.

Notes: Controls: DRG, log(length of stay), demographics. Number of counties: 1514.

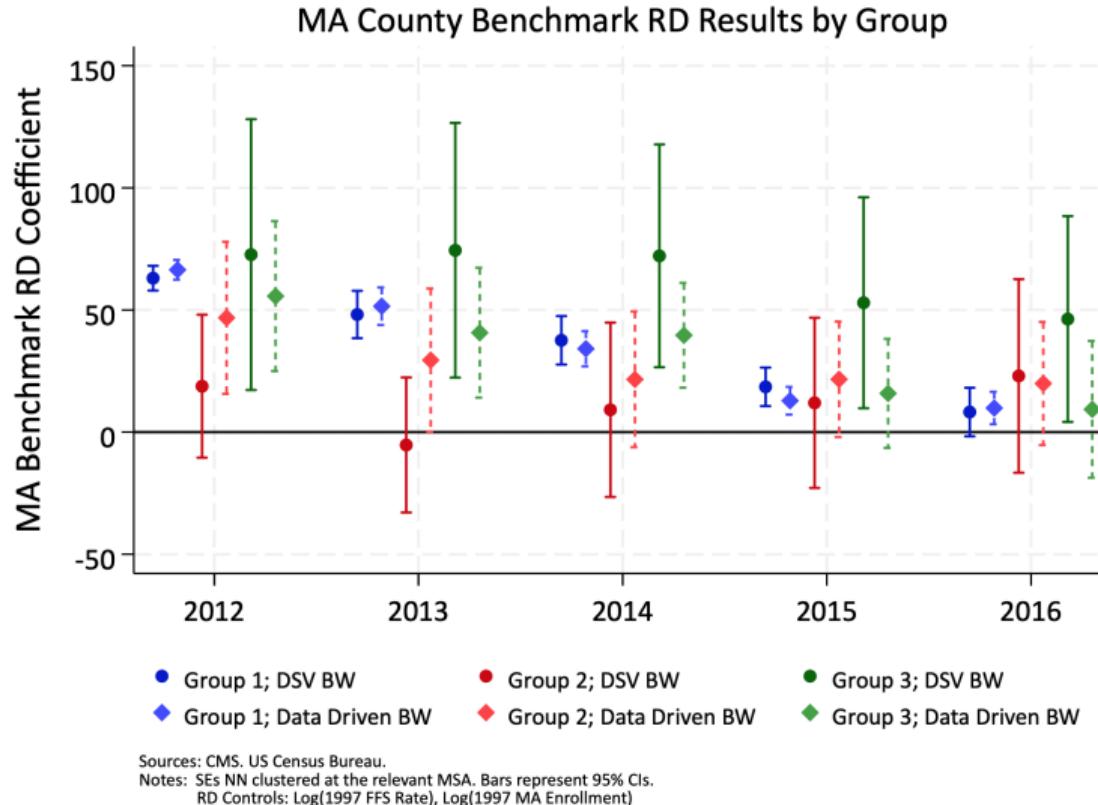
Bars show 95% confidence intervals for each estimate.

◀ 2012 IP Map

# Yearly Benchmark RD Results Without Controls



# 2012 - 2016 Benchmark RD Results for All Groups



Without Controls

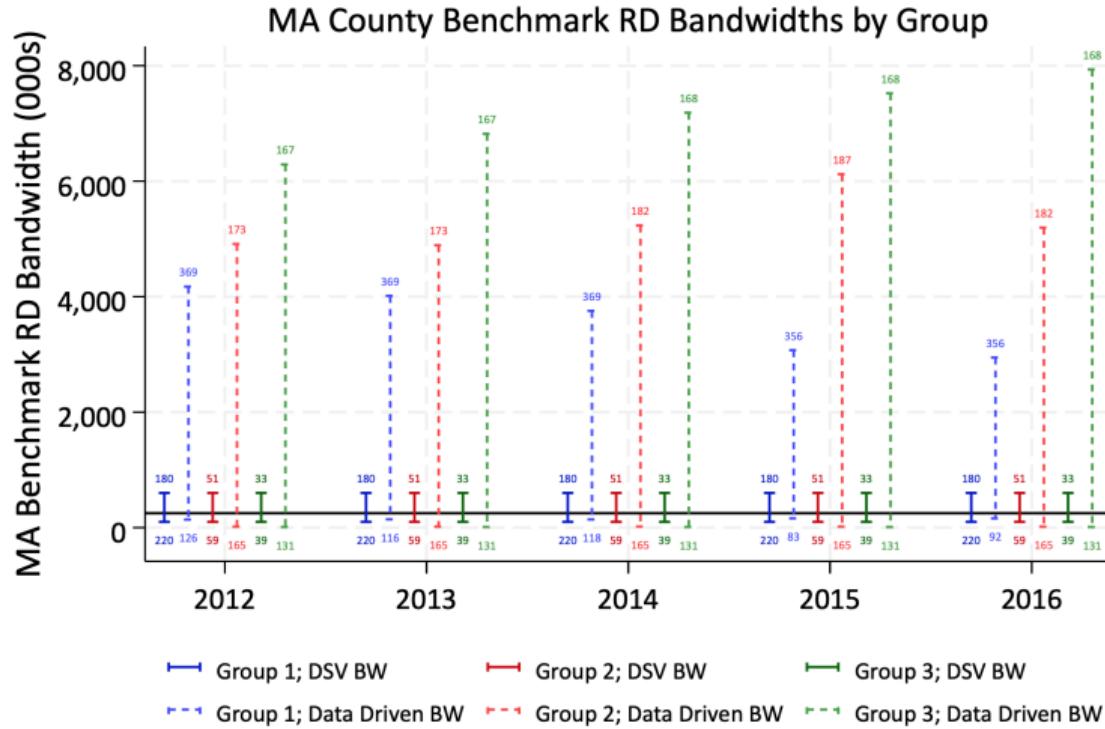
Est: 2012 - 2012 by Group

BWs: 2012 - 2012 by Group

2012 Group 3 Scatter

2016 Group 3 Scatter

# 2012 - 2016 Benchmark RD Bandwidths for All Groups



Sources: CMS, US Census Bureau.

Notes: Bars show bandwidths. Number of counties on either side of bandwidth shown above and below.  
RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)



Without Controls

Est: 2012 - 2012 by Group

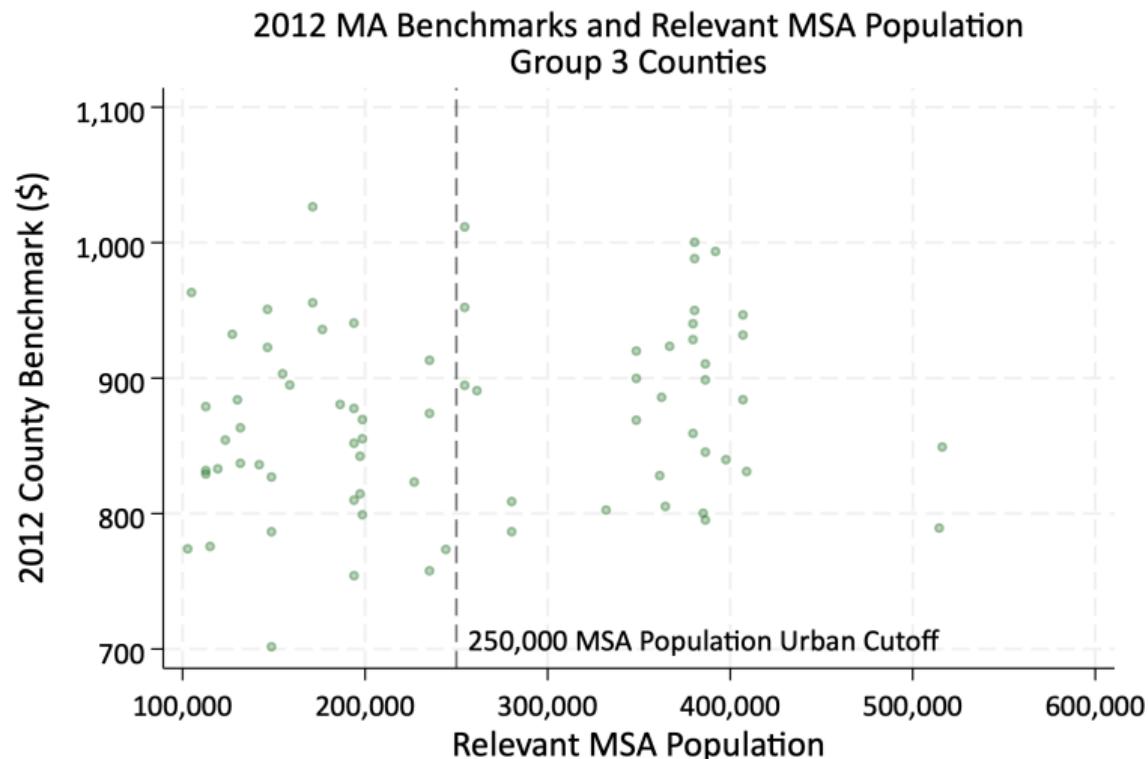
BWs: 2012 - 2012 by Group

2012 Group 3 Scatter

2016 Group 3 Scatter



# Group 3 Benchmark and MSA Population Scatters: 2012



Source: CMS, US Census Bureau.

Notes: Observations are at the county level. Benchmark amounts are per-enrollee month.



Without Controls

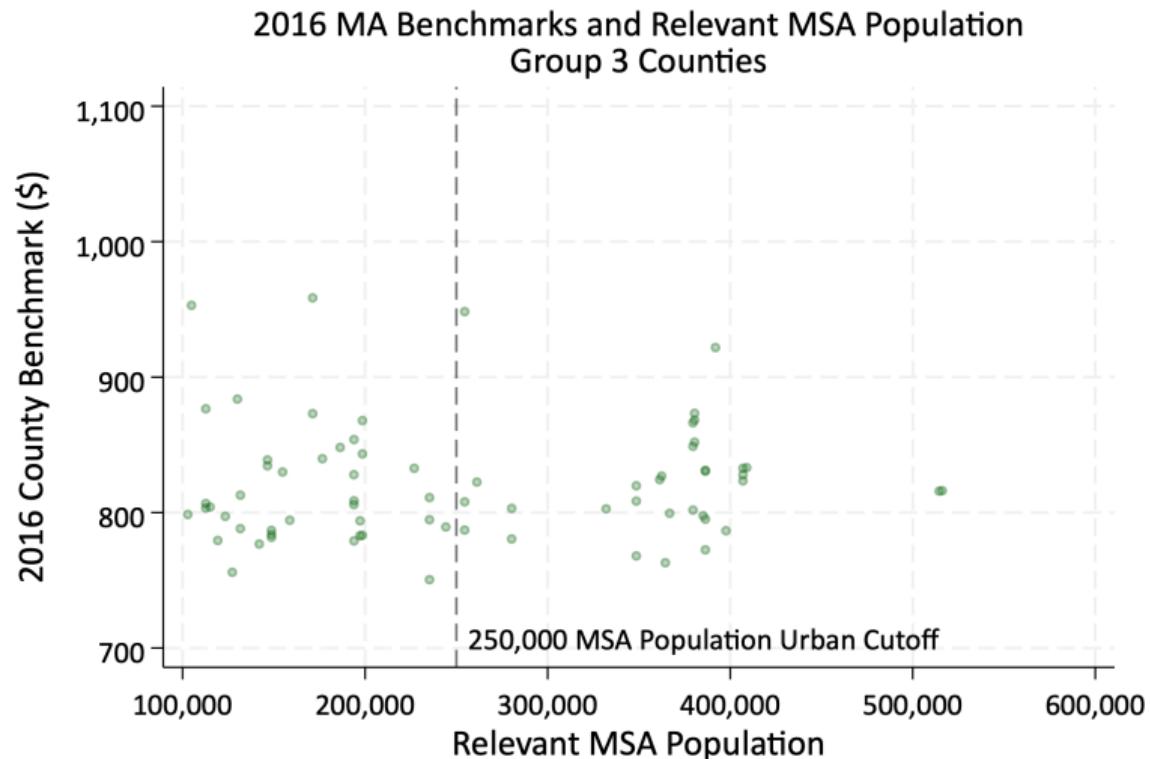
Est: 2012 - 2012 by Group

BWs: 2012 - 2012 by Group

2012 Group 3 Scatter

2016 Group 3 Scatter

# Group 3 Benchmark and MSA Population Scatters: 2016



Source: CMS, US Census Bureau.

Notes: Observations are at the county level. Benchmark amounts are per-enrollee month.



Without Controls

Est: 2012 - 2012 by Group

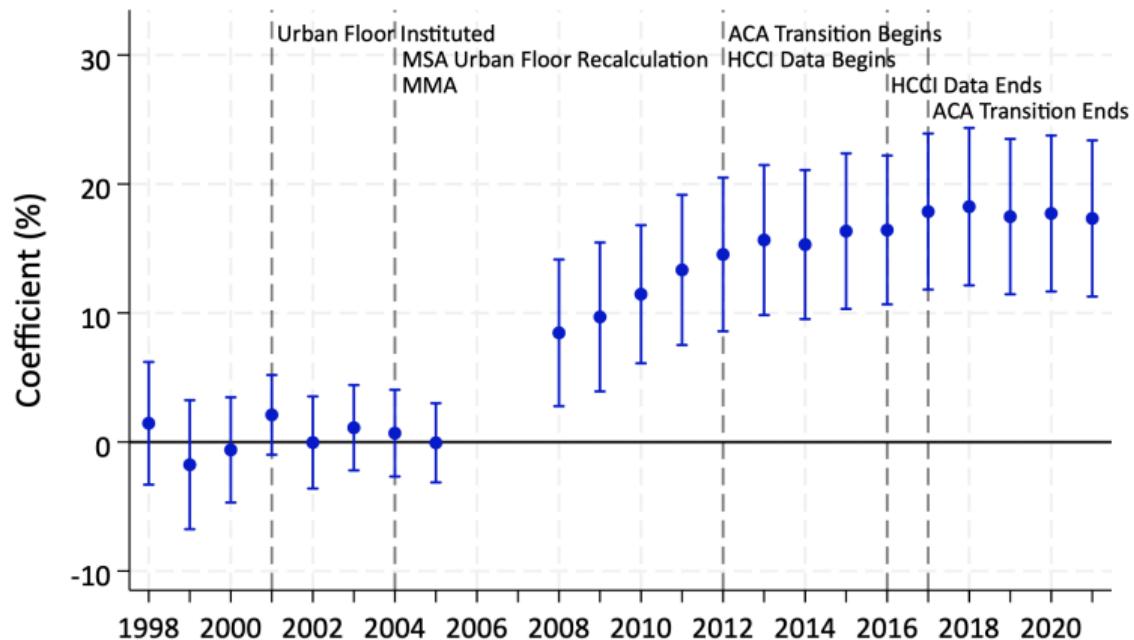
BWs: 2012 - 2012 by Group

2012 Group 3 Scatter

2016 Group 3 Scatter

# Yearly Penetration Rate RD Results Without Controls

## Yearly MA Penetration Rate RD Coefficients



Sources: CMS, US Census Bureau.

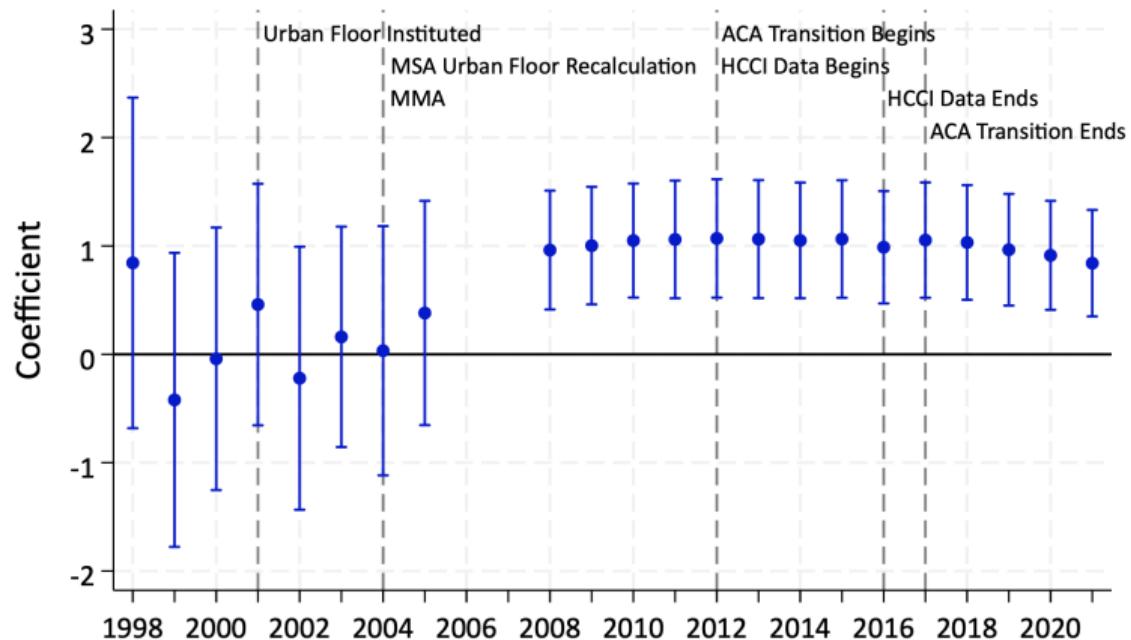
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

◀ With Controls

# Yearly Log MA Enrollment RD Results Without Controls

## Yearly Log(MA Enrollment) RD Coefficients



Sources: CMS, US Census Bureau.

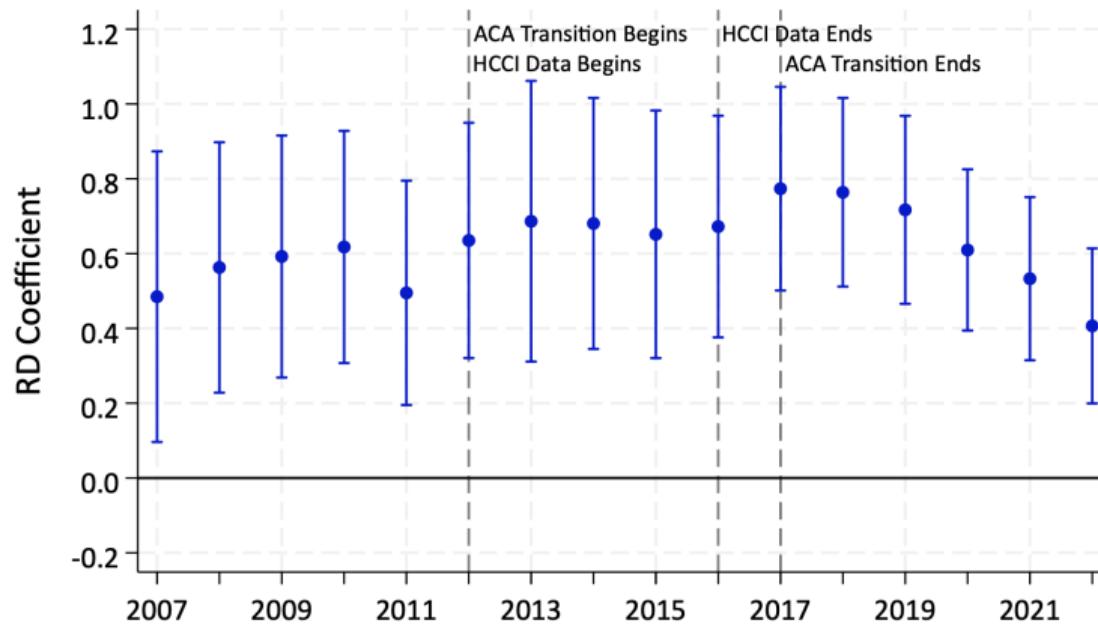
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

◀ With Controls

# Yearly Log MA Plan Count RD Results Without Controls

Yearly Log(Count of MA Plans) RD Coefficients



Sources: CMS, US Census Bureau.

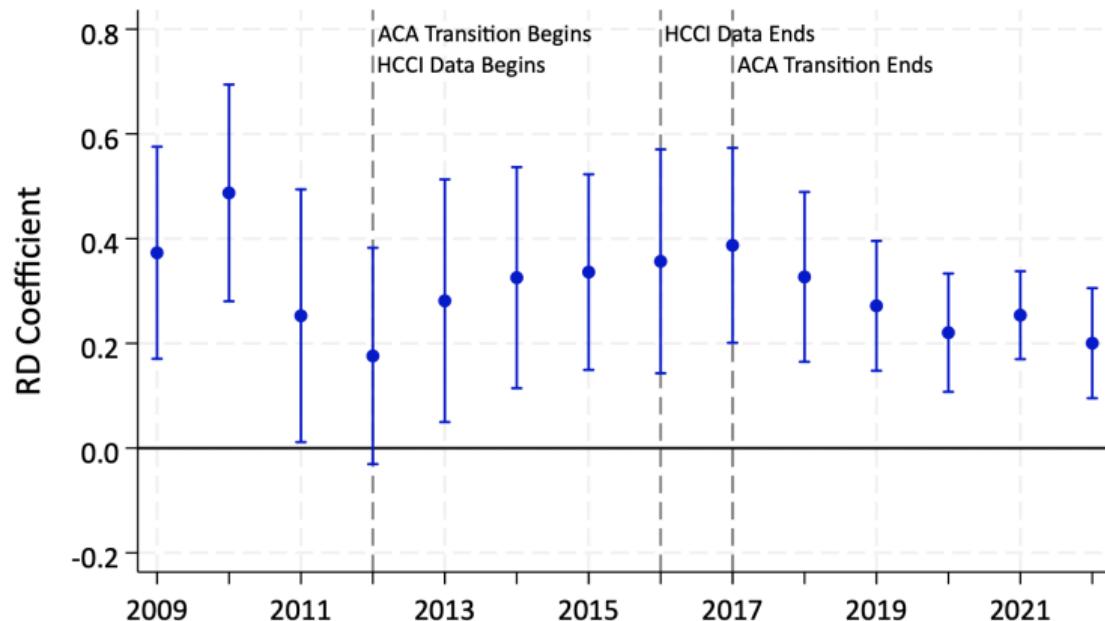
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

◀ With Controls

# Yearly Log MA Plan Parent Org Count RD Results Without Controls

## Yearly Log(Count of MA Plan Parent Orgs) RD Coefficients



Sources: CMS, US Census Bureau.

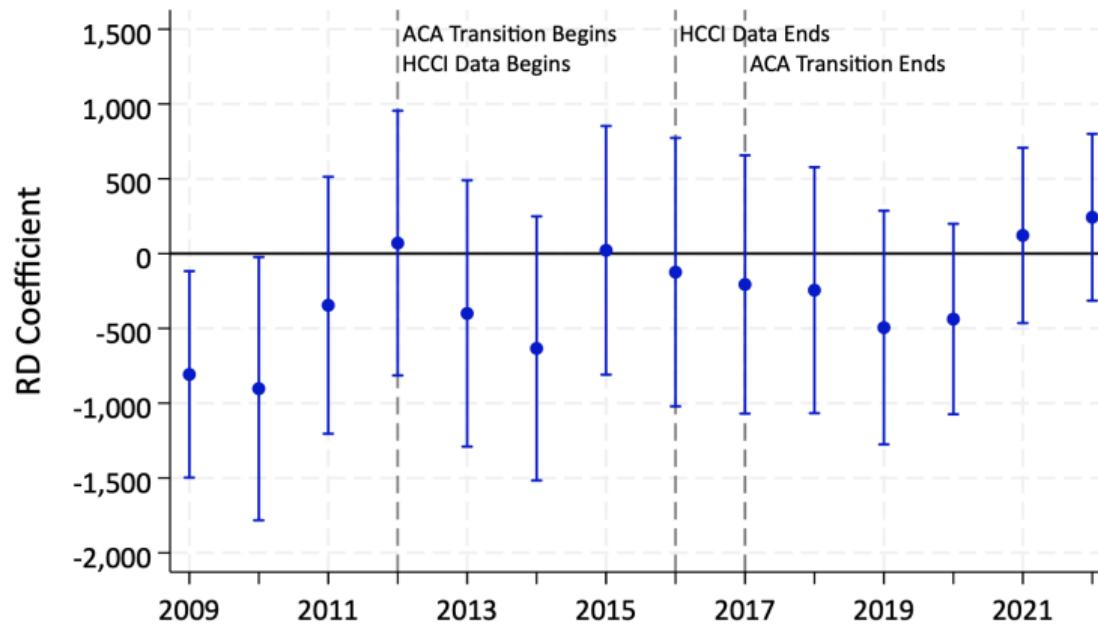
Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

◀ With Controls

# Yearly MA Plan Parent Org HHI RD Results Without Controls

## Yearly MA Plan Parent Org HHI RD Coefficients



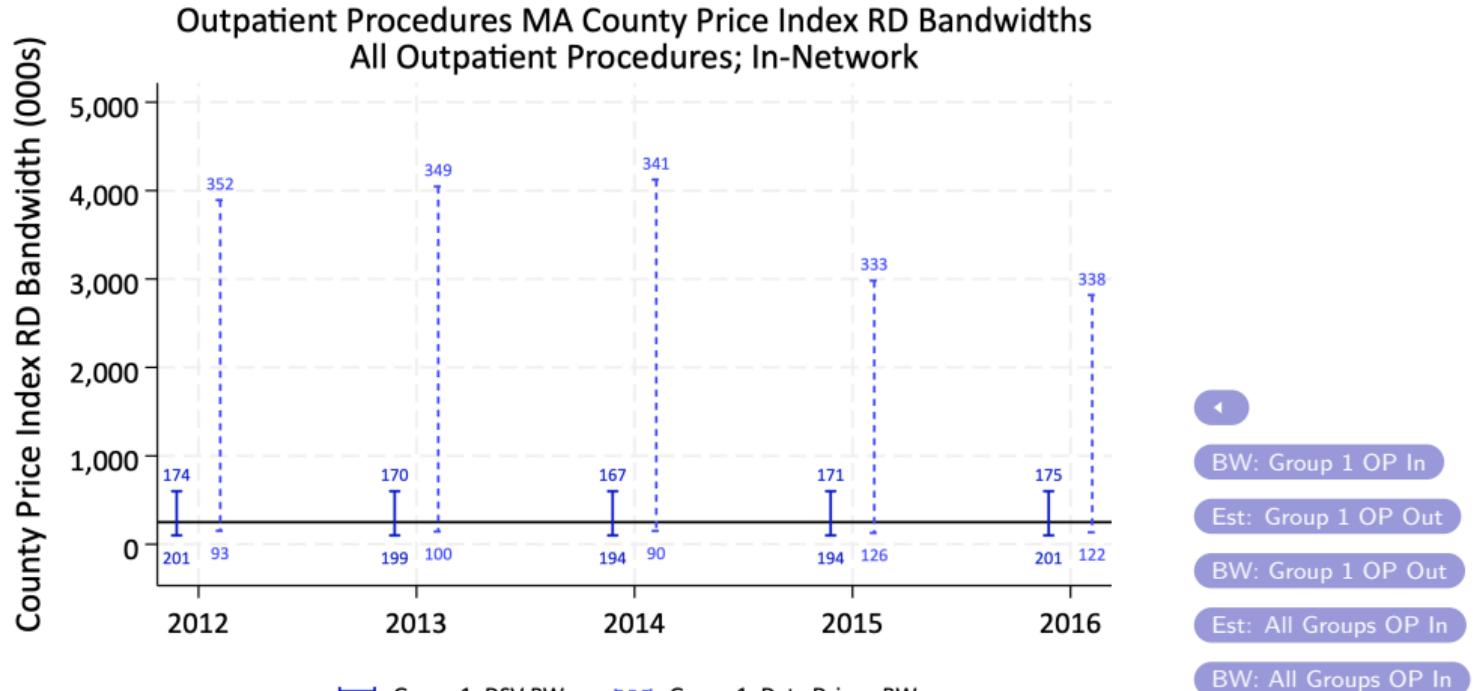
Sources: CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150,000, 350,000] MSA population bandwidth and county-plans with greater than 10 enrollees.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

◀ With Controls

# Outpatient Price Index RD Bandwidths; Group 1, In-Network



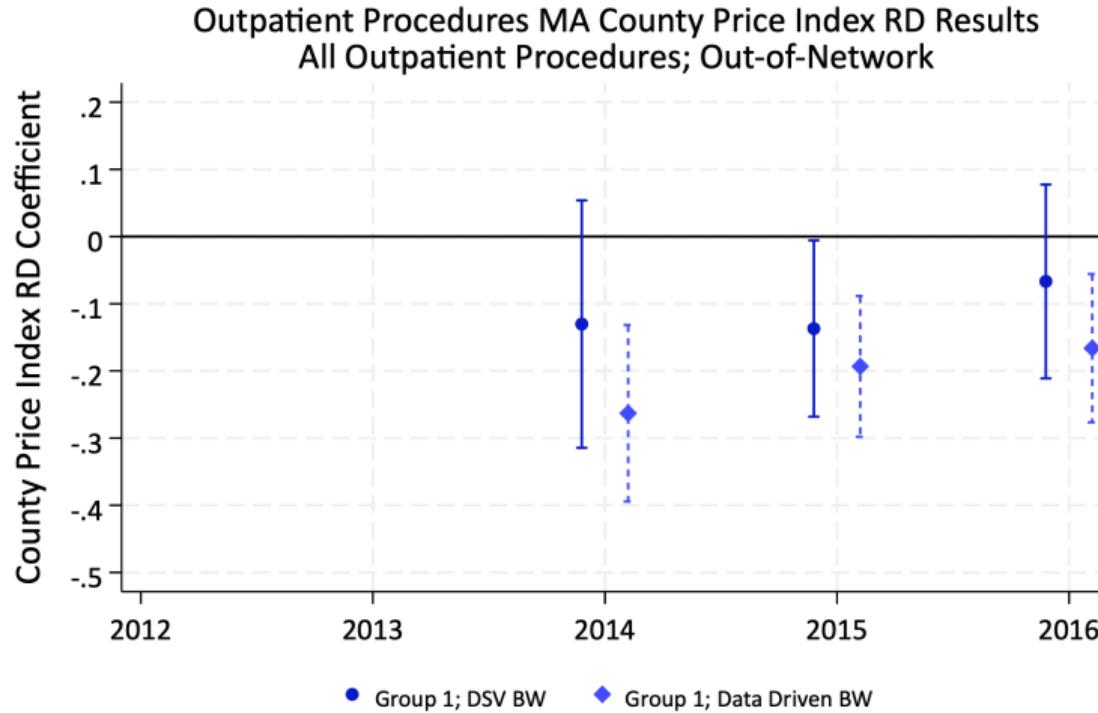
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Bars show bandwidths. Number of counties on either side of bandwidth shown above and below.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Outpatient Price Index RD Results; Group 1, Out-of-Network



BW: Group 1 OP In

Est: Group 1 OP Out

BW: Group 1 OP Out

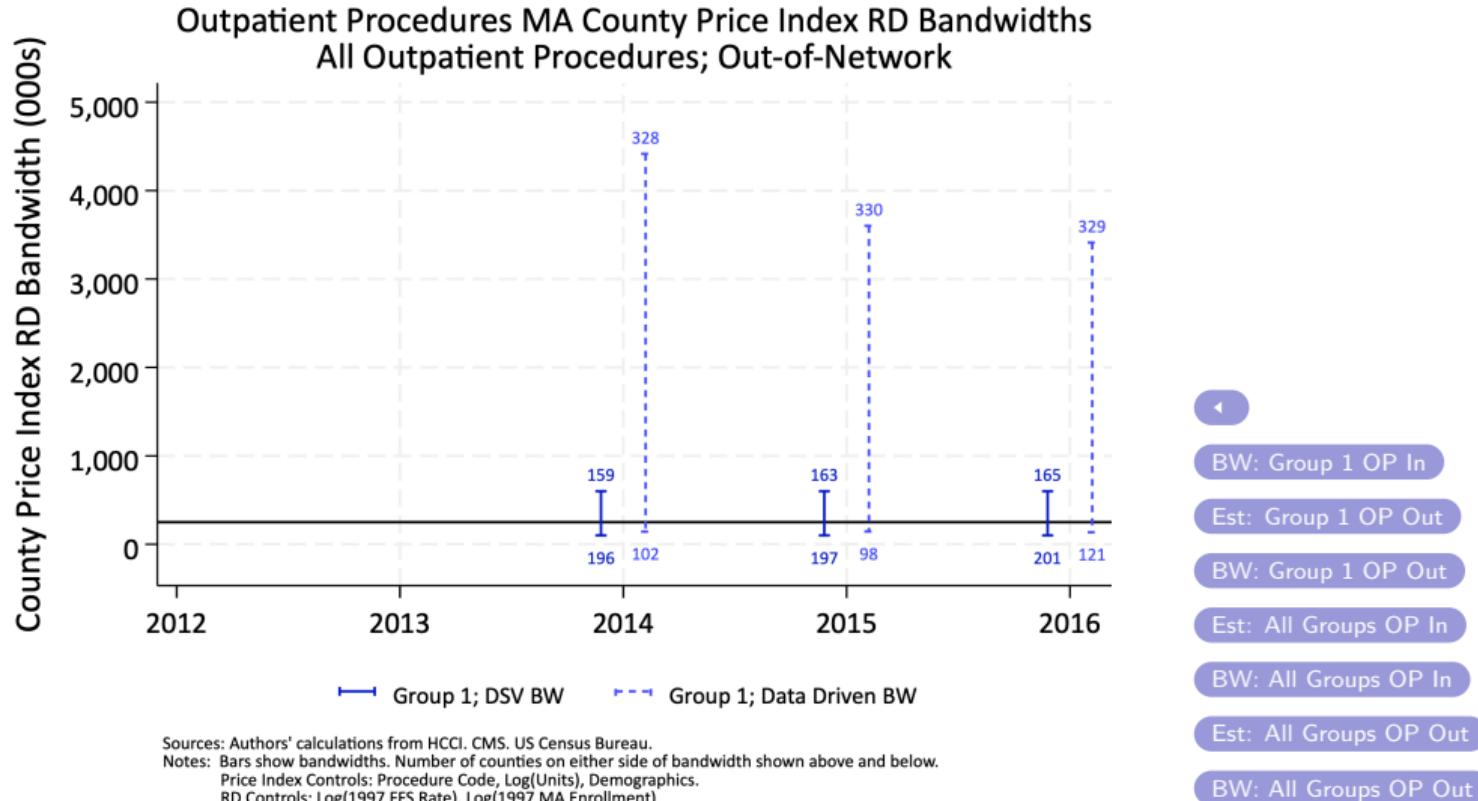
Est: All Groups OP In

BW: All Groups OP In

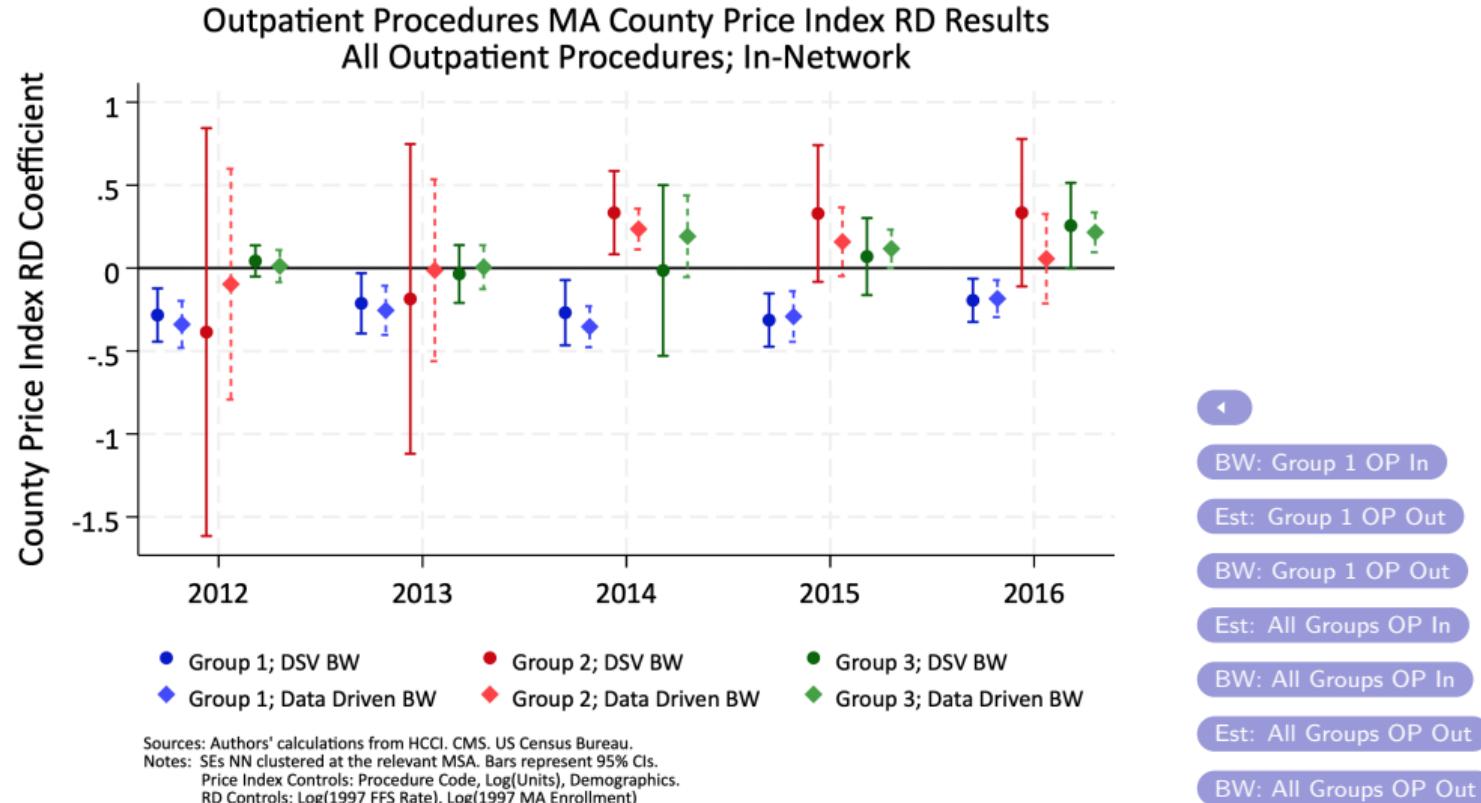
Est: All Groups OP Out

BW: All Groups OP Out

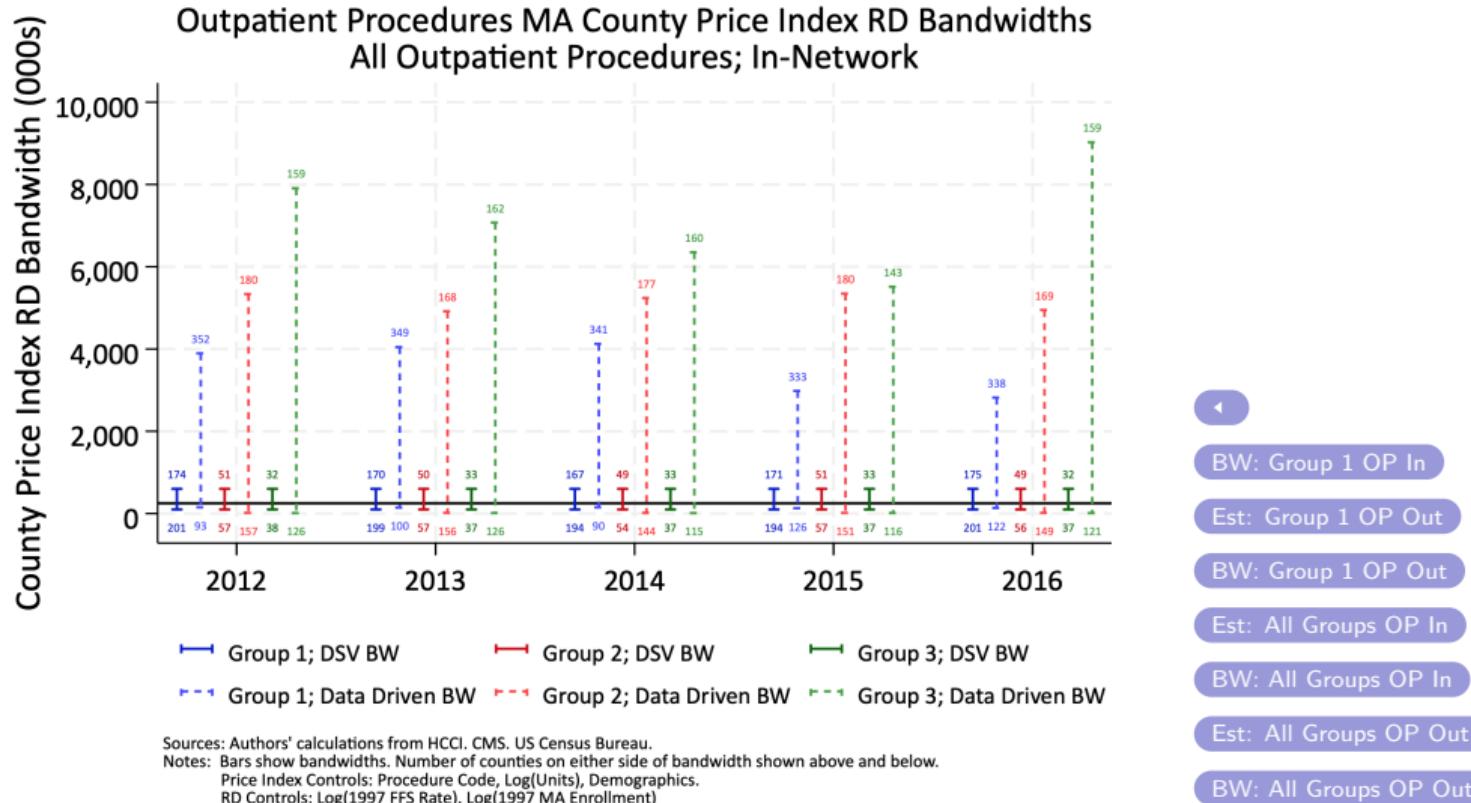
# Outpatient Price Index RD Bandwidths; Group 1, Out-of-Network



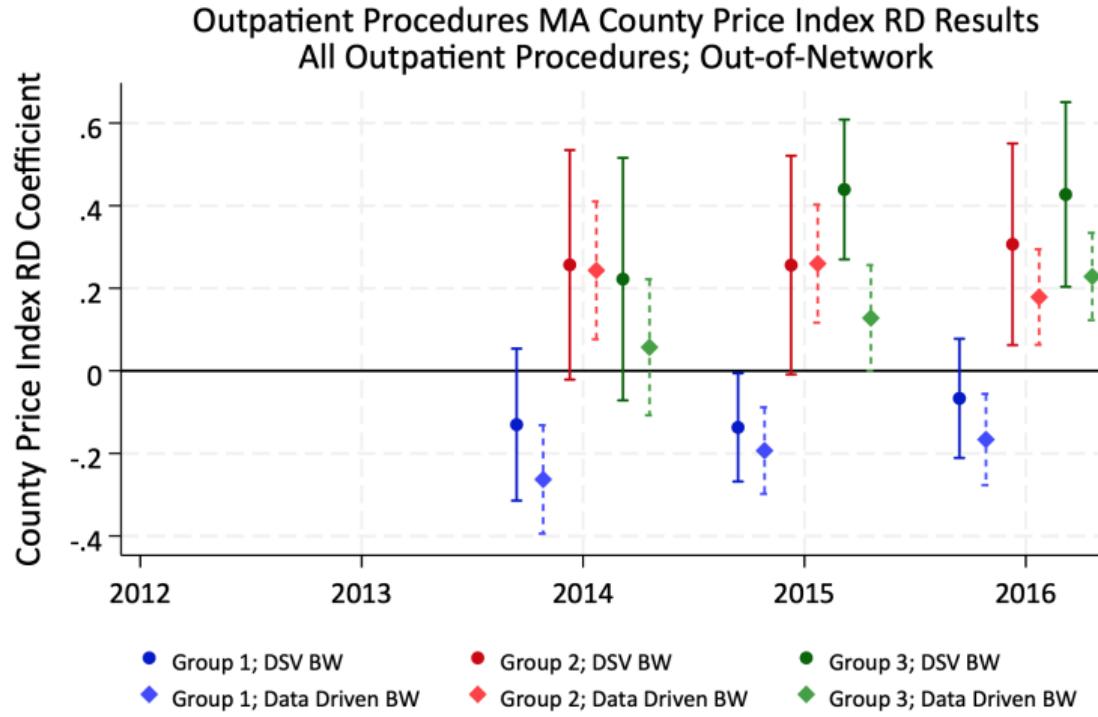
# Outpatient Price Index RD Results; All Groups, In-Network



# Outpatient Price Index RD Bandwidths; All Groups, In-Network



# Outpatient Price Index RD Results; All Groups, Out-of-Network



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

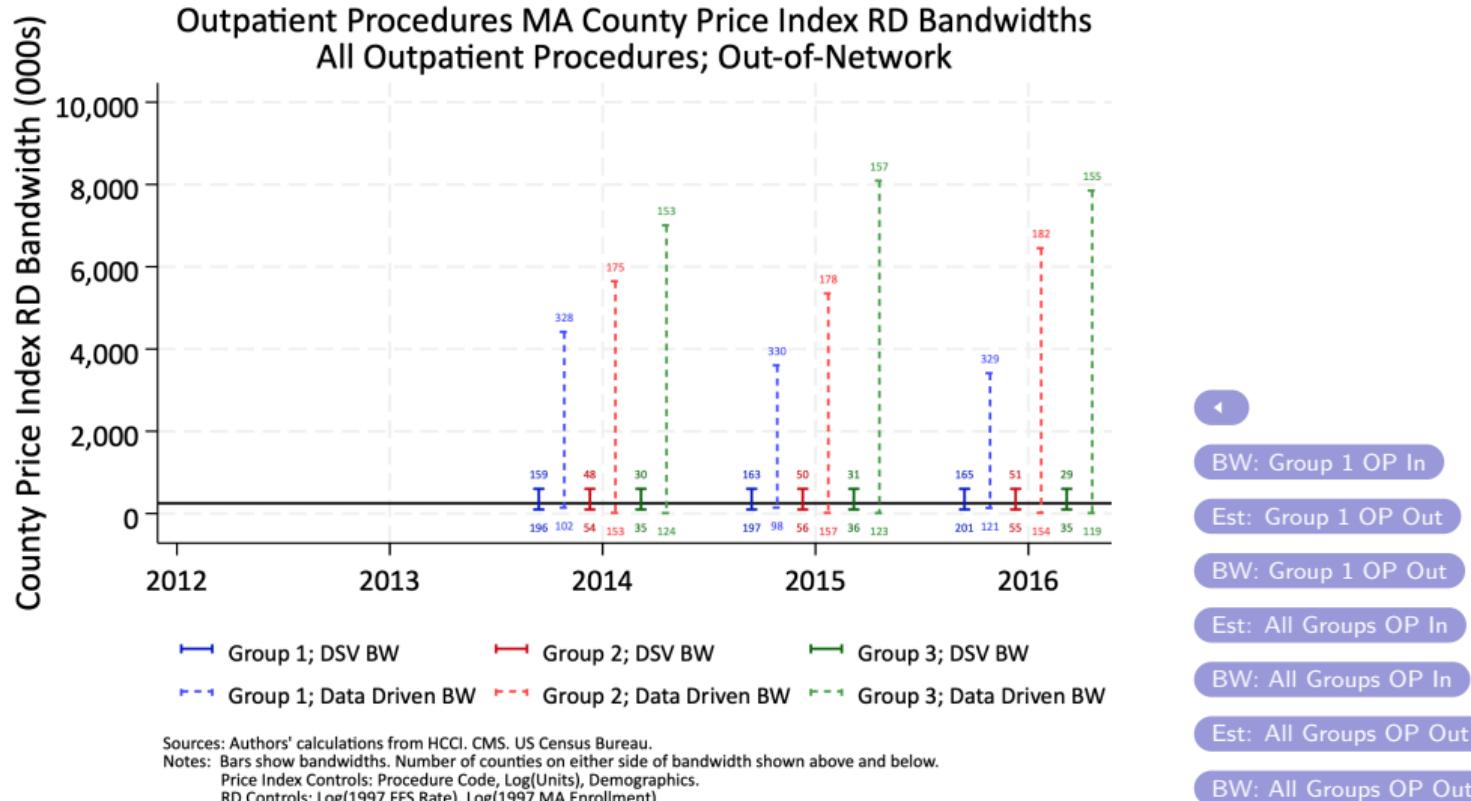
Notes: SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

Price Index Controls: Procedure Code, Log(Units), Demographics.

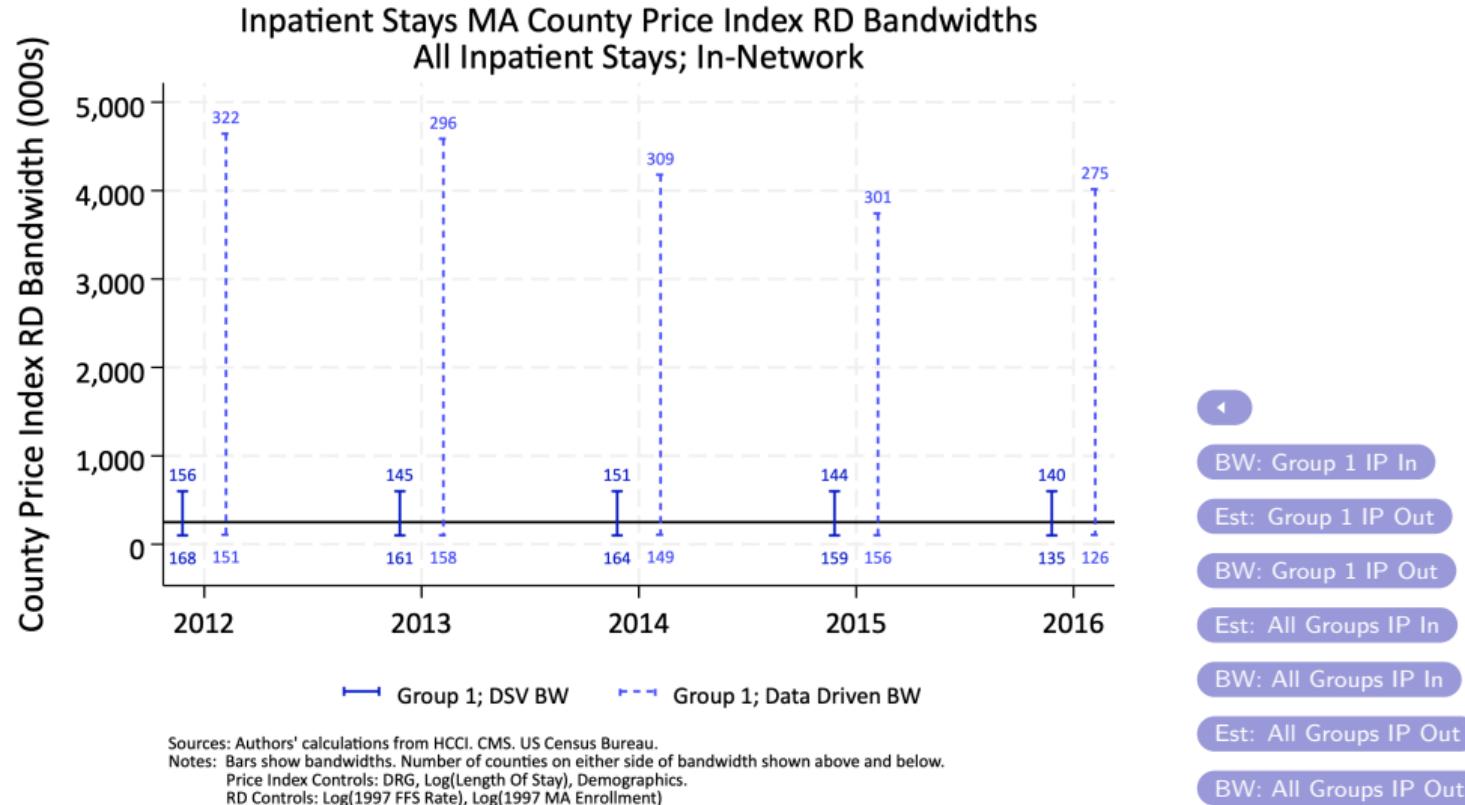
RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

- BW: Group 1 OP In
- Est: Group 1 OP Out
- BW: Group 1 OP Out
- Est: All Groups OP In
- BW: All Groups OP In
- Est: All Groups OP Out
- BW: All Groups OP Out

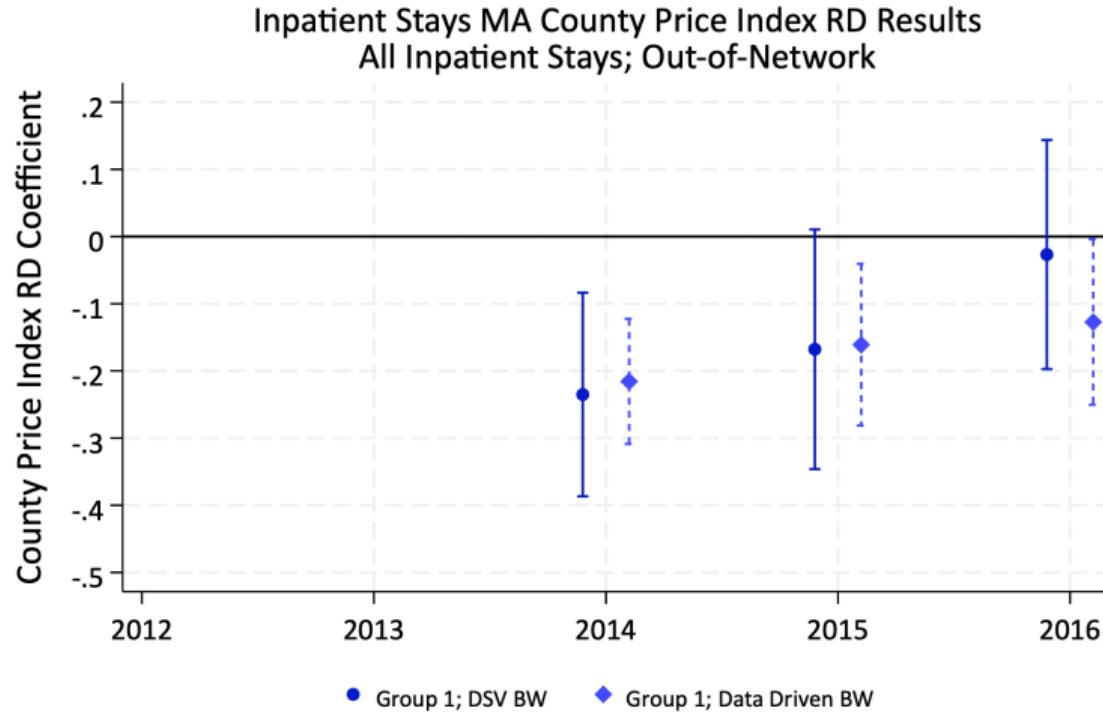
# Outpatient Price Index RD Bandwidths; All Groups, Out-of-Network



# Inpatient Price Index RD Bandwidths; Group 1, In-Network



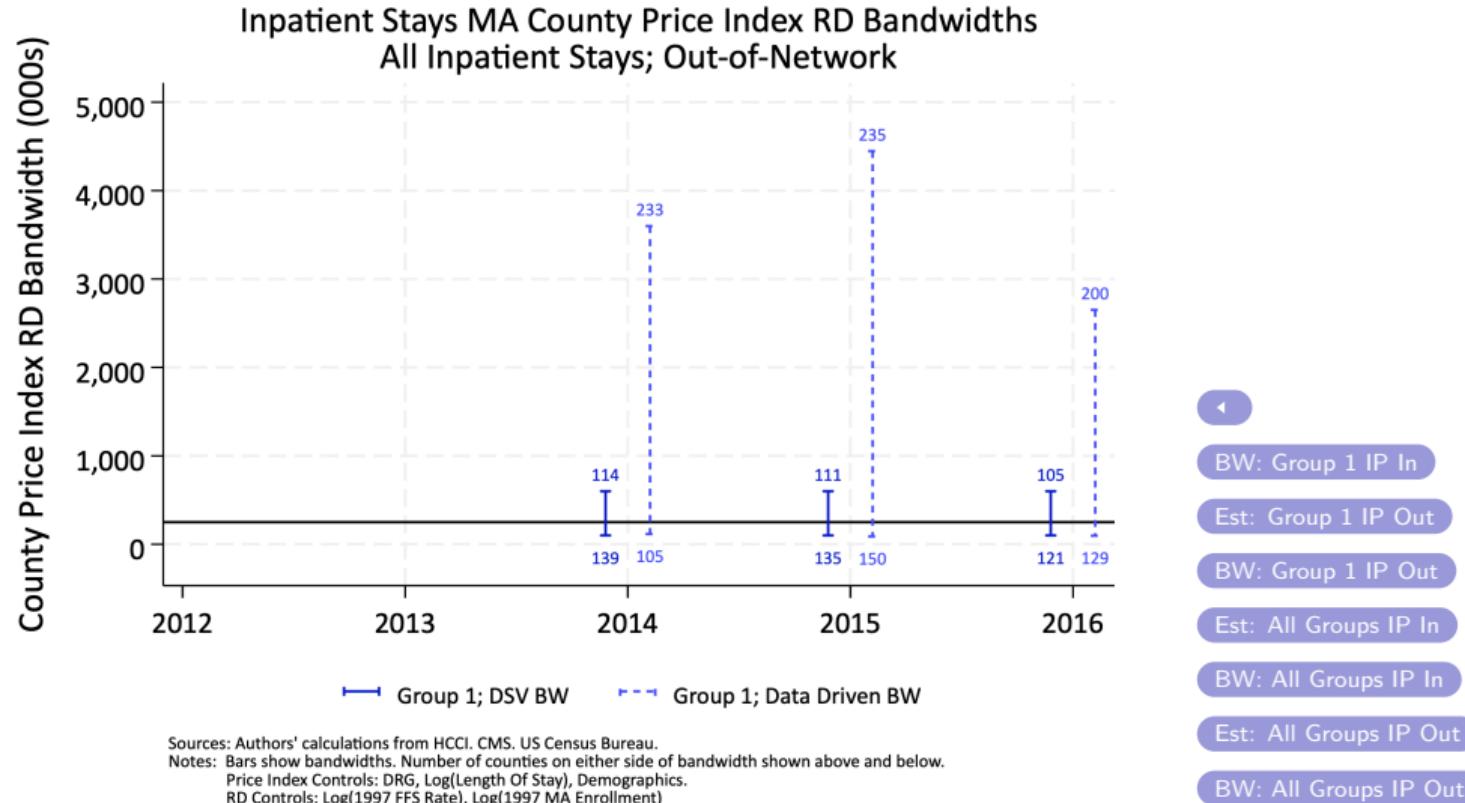
# Inpatient Price Index RD Results; Group 1, Out-of-Network



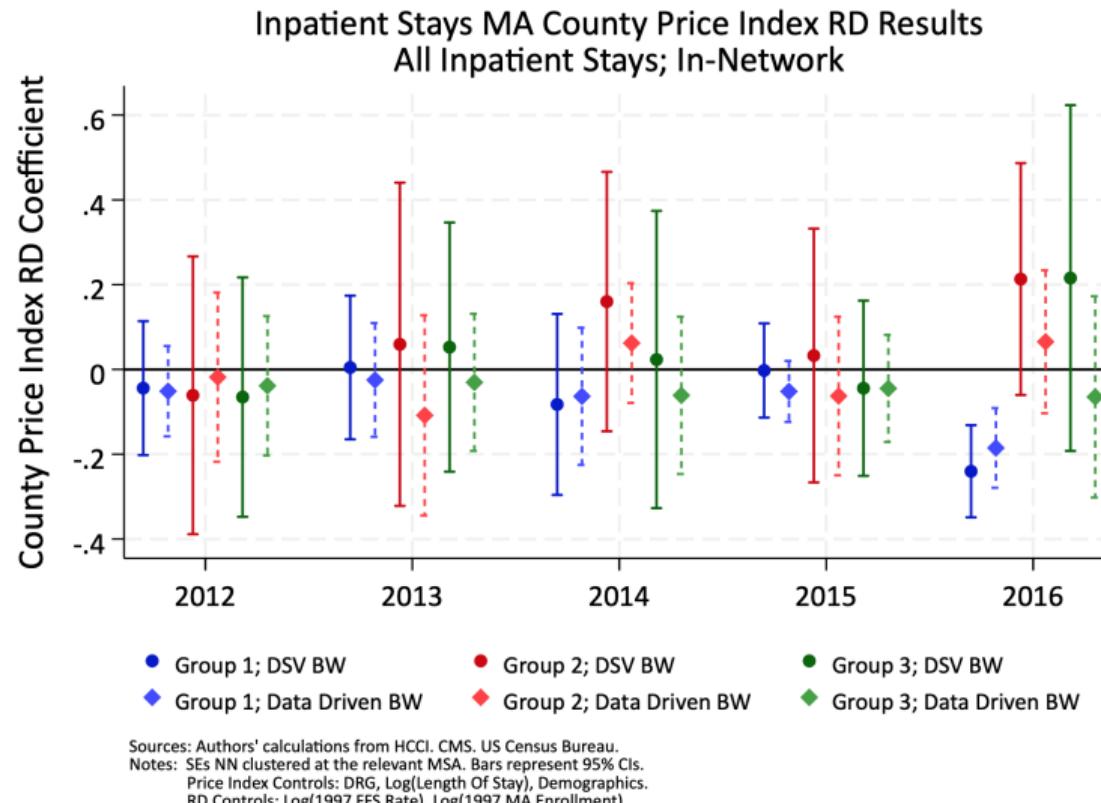
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.  
Notes: SEs NN clustered at the relevant MSA. Bars represent 95% CIs.  
Price Index Controls: DRG, Log(Length Of Stay), Demographics.  
RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

- BW: Group 1 IP In
- Est: Group 1 IP Out
- BW: Group 1 IP Out
- Est: All Groups IP In
- BW: All Groups IP In
- Est: All Groups IP Out
- BW: All Groups IP Out

# Inpatient Price Index RD Bandwidths; Group 1, Out-of-Network

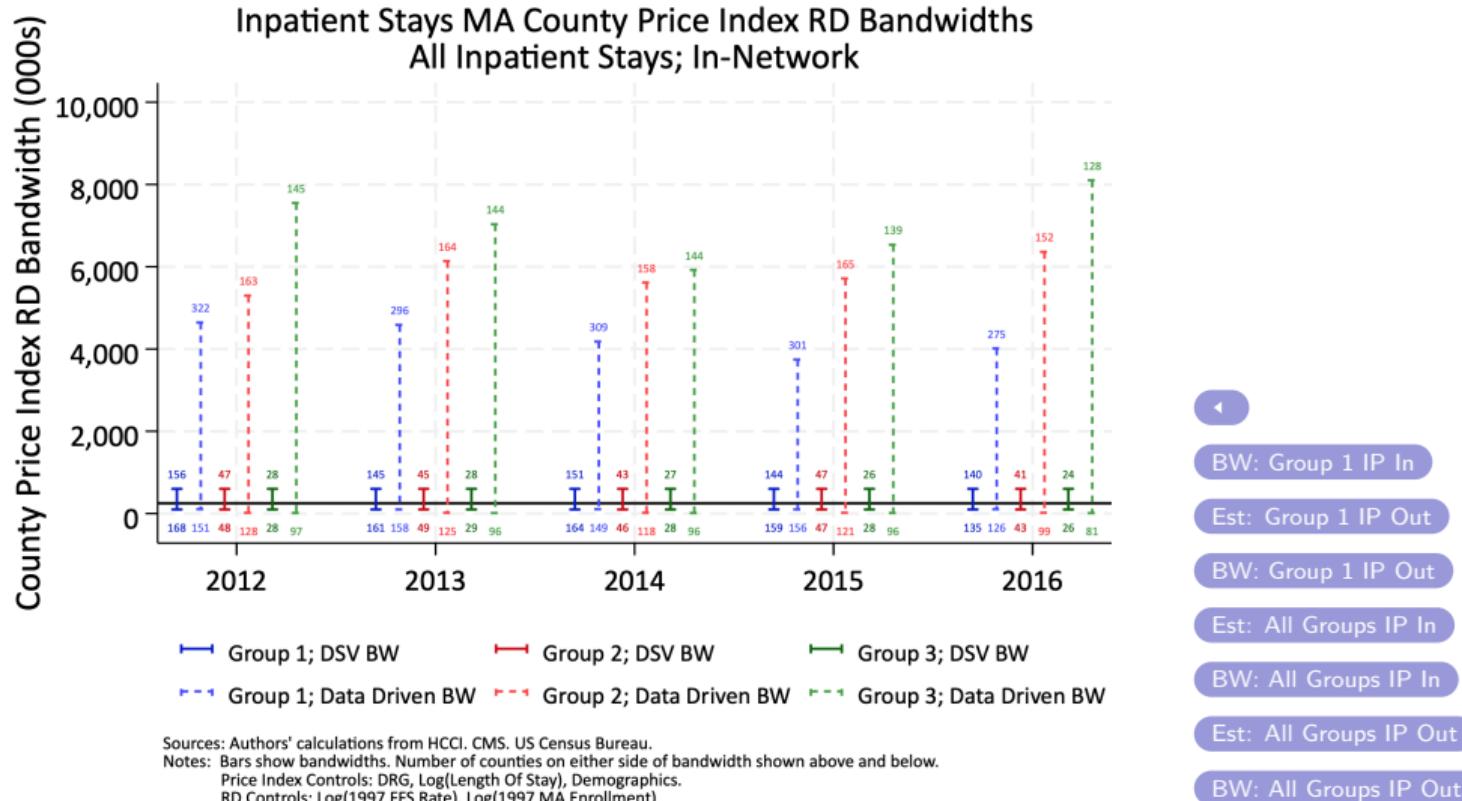


# Inpatient Price Index RD Results; All Groups, In-Network

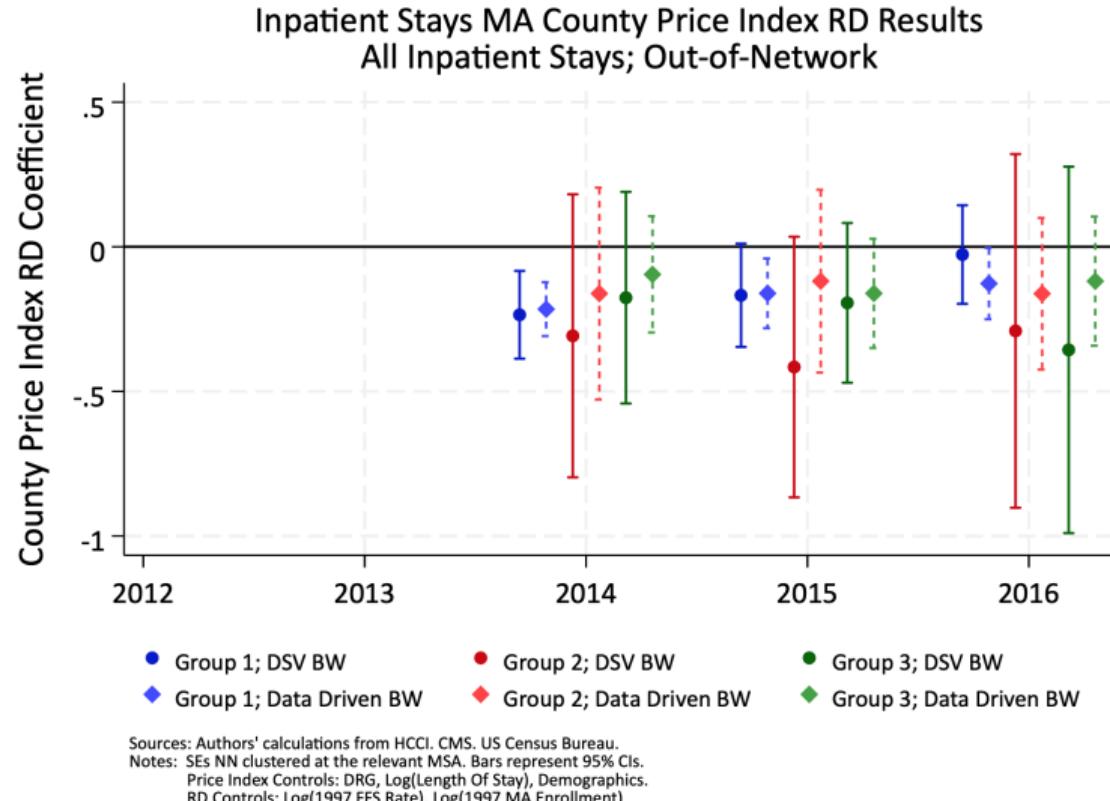


- BW: Group 1 IP In
- Est: Group 1 IP Out
- BW: Group 1 IP Out
- Est: All Groups IP In
- BW: All Groups IP In
- Est: All Groups IP Out
- BW: All Groups IP Out

# Inpatient Price Index RD Bandwidths; All Groups, In-Network

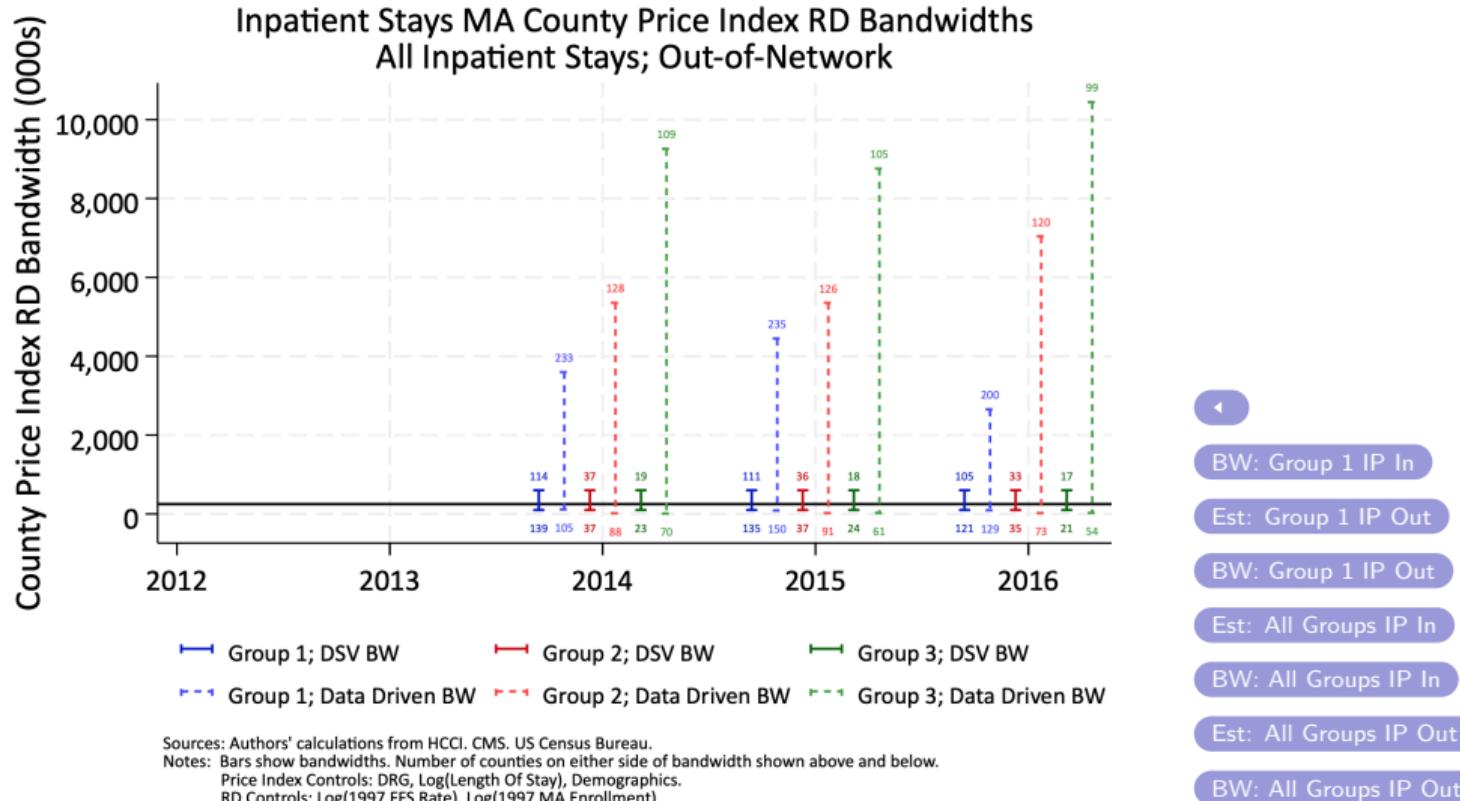


# Inpatient Price Index RD Results; All Groups, Out-of-Network

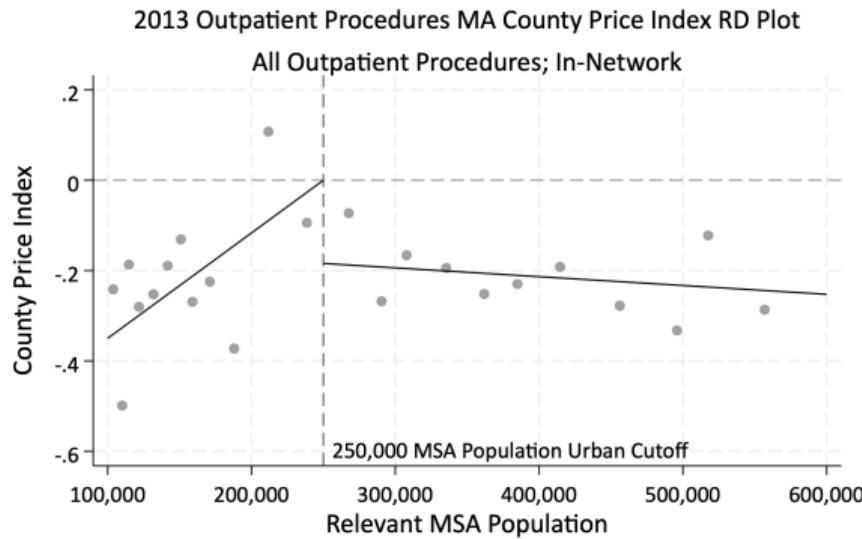


- BW: Group 1 IP In
- Est: Group 1 IP Out
- BW: Group 1 IP Out
- Est: All Groups IP In
- BW: All Groups IP In
- Est: All Groups IP Out
- BW: All Groups IP Out

# Inpatient Price Index RD Bandwidths; All Groups, Out-of-Network



### Negative Effect on OP Prices: 2013



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP 2013 OP 2014 OP 2015 OP ▶ 2016 OP

2012 ER 2013 ER 2014 ER 2015 ER 2016 ER

## 2013 Outpatient Procedures MA County Price Index RD Estimates All Outpatient Procedures: In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.184*** (0.062)	-0.238*** (0.071)
Bias-Corrected	-0.212*** (0.062)	-0.255*** (0.071)
Robust	-0.212** (0.093)	-0.255*** (0.076)
Bandwidth	(150k; 350k)	(105,413; 3,795,756)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(199; 170)	(604; 386)
Effective Observations	(199; 170)	(100; 349)
Clusters	(124; 70)	(57; 130)
Controls:	X	X

Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

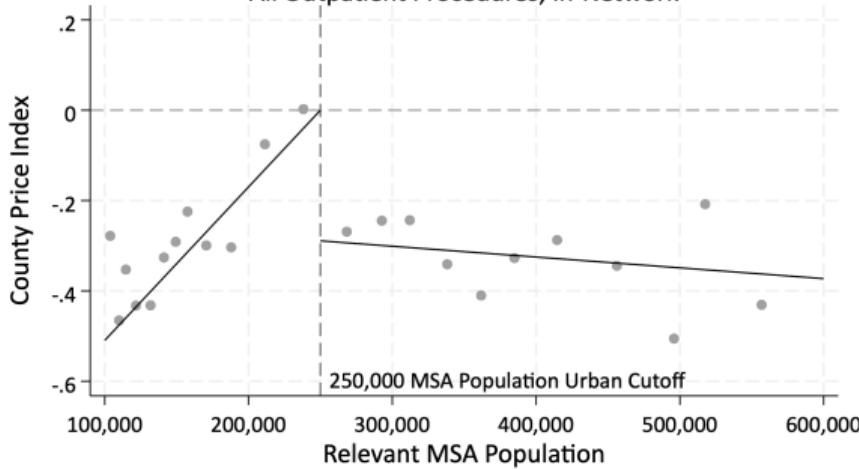
#### Price Index Controls: Procedure Code, Log(Units), Demographics

BD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment)

# Negative Effect on OP Prices: 2014

2014 Outpatient Procedures MA County Price Index RD Plot

All Outpatient Procedures; In-Network



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2014 Outpatient Procedures MA County Price Index RD Estimates  
All Outpatient Procedures; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.289*** (0.062)	-0.333*** (0.060)
Bias-Corrected	-0.269*** (0.062)	-0.353*** (0.060)
Robust	-0.269*** (0.100)	-0.353*** (0.063)
Bandwidth	(150k; 350k)	(99,259; 3,874,260)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(194; 167)	(561; 378)
Effective Observations	(194; 167)	(90; 341)
Clusters	(124; 70)	(51; 130)
Controls:	X	X

Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

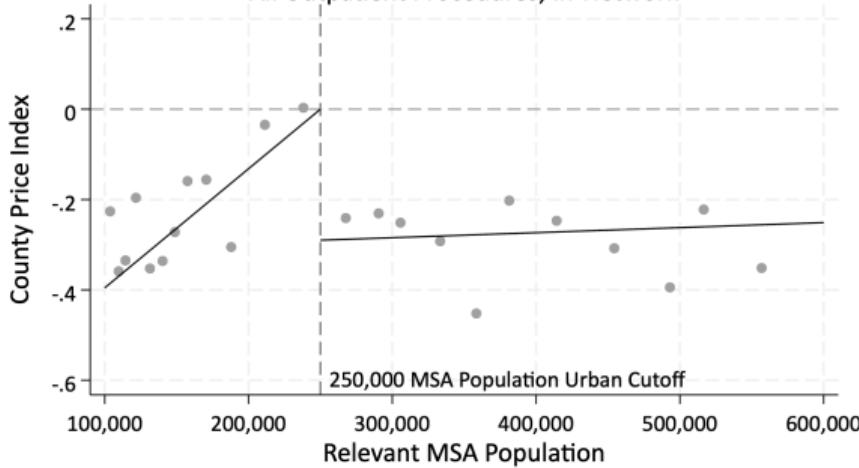
Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Negative Effect on OP Prices: 2015

2015 Outpatient Procedures MA County Price Index RD Plot

All Outpatient Procedures; In-Network



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment).

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2015 Outpatient Procedures MA County Price Index RD Estimates  
All Outpatient Procedures; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.290*** (0.073)	-0.272*** (0.073)
Bias-Corrected	-0.314*** (0.073)	-0.292*** (0.073)
Robust	-0.314*** (0.082)	-0.292*** (0.078)
Bandwidth	(150k; 350k)	(121,836; 2,731,588)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(194; 171)	(574; 383)
Effective Observations	(194; 171)	(126; 333)
Clusters	(123; 70)	(74; 126)
Controls:	X	X

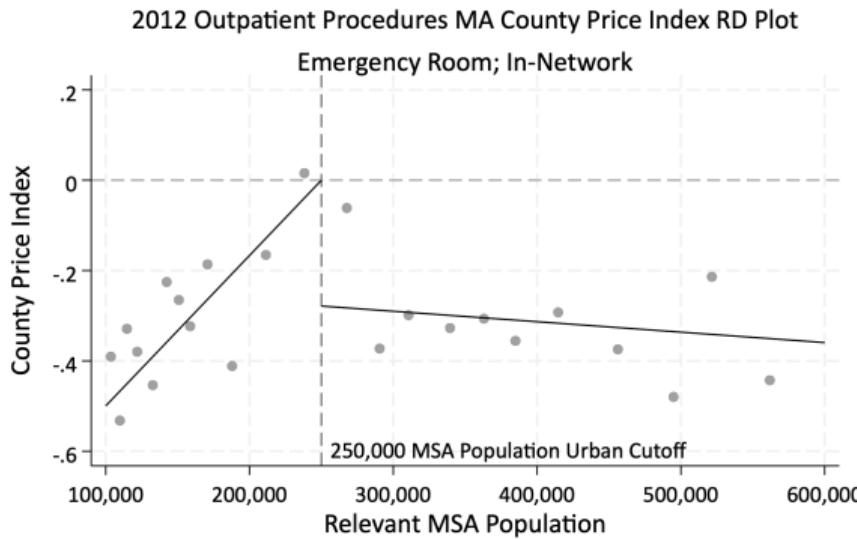
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Negative Effect on ER Prices: 2012



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2012 Outpatient Procedures MA County Price Index RD Estimates  
Emergency Room; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.279*** (0.075)	-0.378*** (0.074)
Bias-Corrected	-0.283*** (0.075)	-0.400*** (0.074)
Robust	-0.283** (0.116)	-0.400*** (0.078)
Bandwidth	(150k; 350k)	(94,536; 4,439,133)
Bias Bandwidth	(150k; 350k)	(236,739; 18,497,432)
Observations	(186; 160)	(580; 363)
Effective Observations	(186; 160)	(77; 331)
Clusters	(123; 70)	(45; 131)
Controls:	X	X

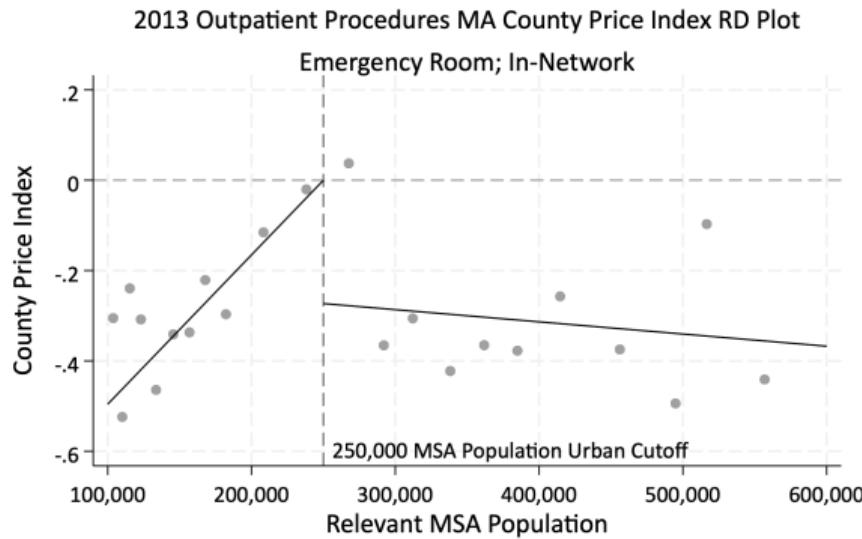
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

## Negative Effect on ER Prices: 2013



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

<a href="#">◀ 2012 OP</a>	<a href="#">2013 OP</a>	<a href="#">2014 OP</a>	<a href="#">2015 OP</a>	<a href="#">◀ 2016 OP</a>
<a href="#">2012 ER</a>	<a href="#">2013 ER</a>	<a href="#">2014 ER</a>	<a href="#">2015 ER</a>	<a href="#">2016 ER</a>

## 2013 Outpatient Procedures MA County Price Index RD Estimates Emergency Room: In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.273*** (0.094)	-0.330*** (0.099)
Bias-Corrected	-0.214** (0.094)	-0.356*** (0.099)
Robust	-0.214 (0.158)	-0.356*** (0.105)
Bandwidth	(150k; 350k)	(104,301; 5,185,812)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(184; 155)	(573; 360)
Effective Observations	(184; 155)	(91; 349)
Clusters	(122; 70)	(55; 134)
Controls:	X	X

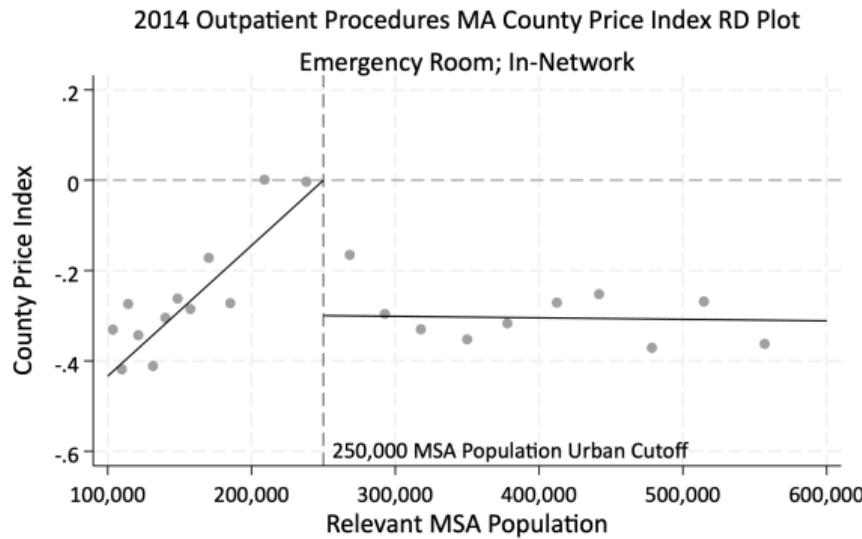
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics

RD Controls: Log(1997 MA FES Rate), Log(1997 MA Enrollment)

## Negative Effect on ER Prices: 2014



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP 2013 OP 2014 OP 2015 OP ▶ 2016 OP

2012 EB 2013 EB 2014 EB 2015 EB 2016 EB

## 2014 Outpatient Procedures MA County Price Index RD Estimates Emergency Room; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.300*** (0.068)	-0.314*** (0.062)
Bias-Corrected	-0.257*** (0.068)	-0.334*** (0.062)
Robust	-0.257** (0.112)	-0.334*** (0.065)
Bandwidth	(150k; 350k)	(106,901; 4,202,431)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(172; 153)	(490; 348)
Effective Observations	(172; 153)	(88; 313)
Clusters	(119; 70)	(56; 126)
Controls:	X	X

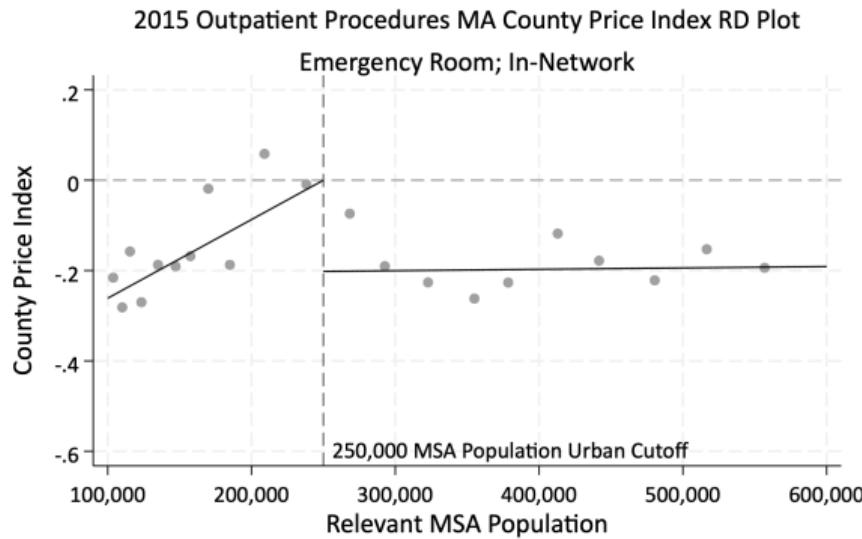
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics

BD Controls: Log(1997 MA FES Rate), Log(1997 MA Enrollment)

## Negative Effect on ER Prices: 2015



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP 2013 OP 2014 OP 2015 OP ▶ 2016 OP

2012 ER 2013 ER 2014 ER 2015 ER 2016 ER

## 2015 Outpatient Procedures MA County Price Index RD Estimates Emergency Room: In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.202*** (0.064)	-0.199*** (0.061)
Bias-Corrected	-0.154** (0.064)	-0.215*** (0.061)
Robust	-0.154 (0.104)	-0.215*** (0.066)
Bandwidth	(150k; 350k)	(122,702; 3,574,634)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(171; 154)	(507; 353)
Effective Observations	(171; 154)	(115; 317)
Clusters	(118; 70)	(73; 127)
Controls:	X	X

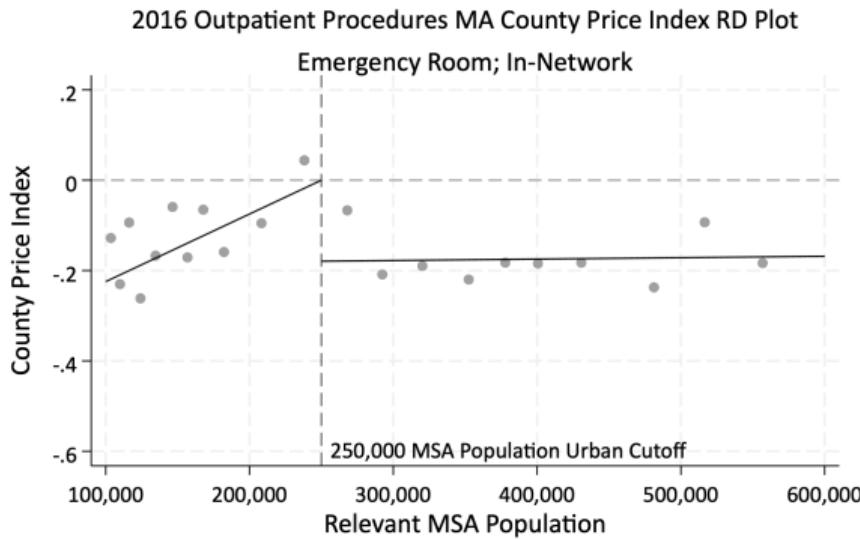
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

#### Price Index Controls: Procedure Code, Log(Units), Demographics

BD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment)

# Negative Effect on ER Prices: 2016



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 OP □ 2013 OP □ 2014 OP □ 2015 OP □ 2016 OP

2012 ER □ 2013 ER □ 2014 ER □ 2015 ER □ 2016 ER

2016 Outpatient Procedures MA County Price Index RD Estimates  
Emergency Room; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.179*** (0.052)	-0.212*** (0.043)
Bias-Corrected	-0.188*** (0.052)	-0.228*** (0.043)
Robust	-0.188*** (0.072)	-0.228*** (0.046)
Bandwidth	(150k; 350k)	(105,467; 3,634,939)
Bias Bandwidth	(150k; 350k)	(236,739; 18,497,432)
Observations	(163; 150)	(469; 332)
Effective Observations	(163; 150)	(80; 301)
Clusters	(118; 70)	(54; 127)
Controls:	X	X

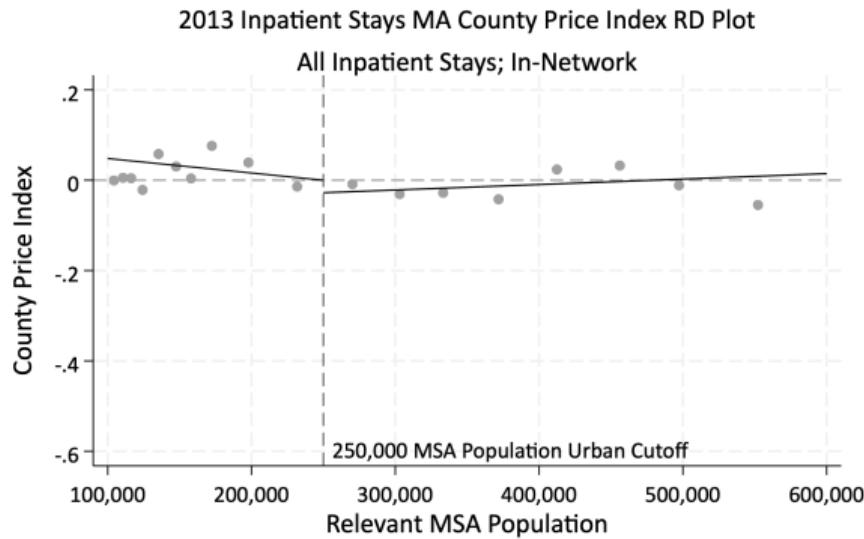
Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Null Effect on IP Prices: 2013



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

2013 Inpatient Stays MA County Price Index RD Estimates  
All Inpatient Stays; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.028 (0.064)	-0.029 (0.060)
Bias-Corrected	0.005 (0.064)	-0.025 (0.060)
Robust	0.005 (0.086)	-0.025 (0.068)
Bandwidth	(150k; 350k)	(148,467; 4,336,271)
Bias Bandwidth	(150k; 350k)	(233,084; 18,497,432)
Observations	(161; 145)	(478; 325)
Effective Observations	(161; 145)	(158; 296)
Clusters	(117; 70)	(114; 126)
Controls:	X	X

Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

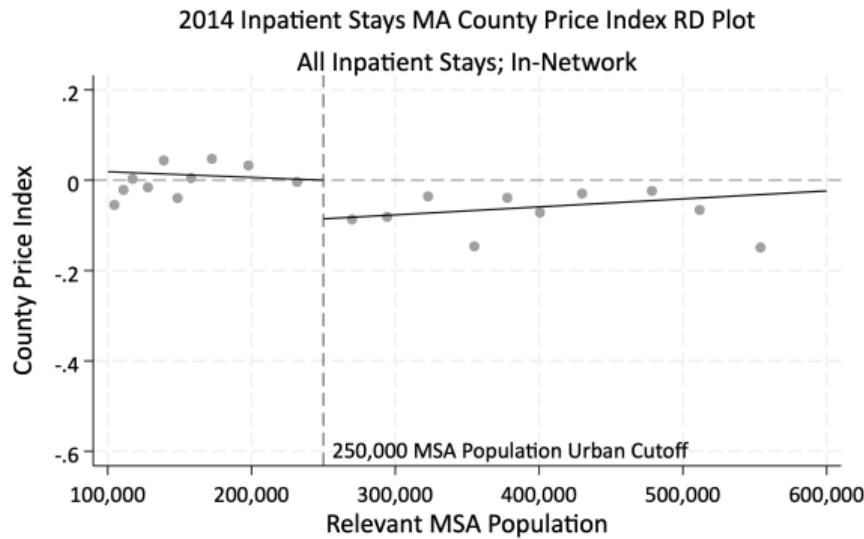
Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

# Null Effect on IP Prices: 2014



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

2014 Inpatient Stays MA County Price Index RD Estimates  
All Inpatient Stays; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.086 (0.075)	-0.069 (0.073)
Bias-Corrected	-0.083 (0.075)	-0.063 (0.073)
Robust	-0.083 (0.109)	-0.063 (0.083)
Bandwidth	(150k; 350k)	(142,268; 3,929,258)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(164; 151)	(464; 341)
Effective Observations	(164; 151)	(149; 309)
Clusters	(118; 70)	(106; 125)
Controls:	X	X

Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

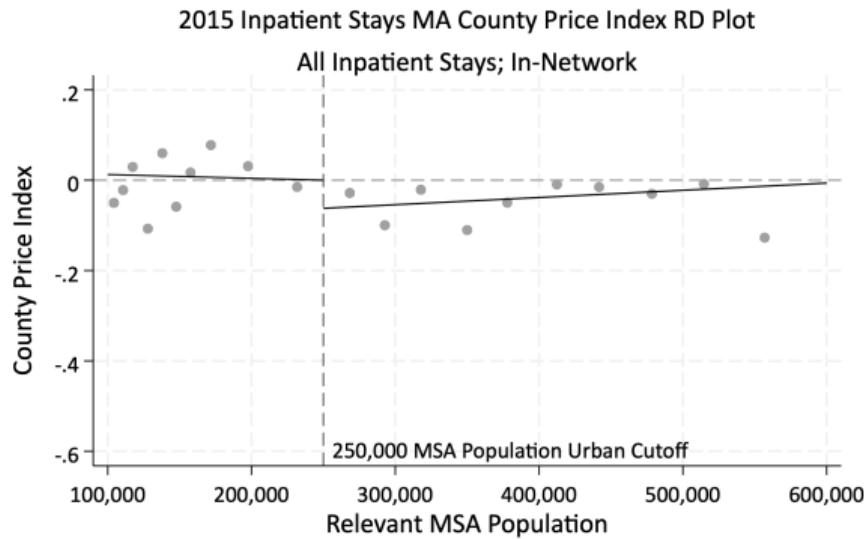
Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

◀ 2012 IP 2013 IP 2014 IP 2015 IP 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

# Null Effect on IP Prices: 2015



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

2015 Inpatient Stays MA County Price Index RD Estimates  
All Inpatient Stays; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.062* (0.036)	-0.054* (0.031)
Bias-Corrected	-0.003 (0.036)	-0.052* (0.031)
Robust	-0.003 (0.057)	-0.052 (0.037)
Bandwidth	(150k; 350k)	(148,284; 3,491,561)
Bias Bandwidth	(150k; 350k)	(234,079; 18,497,432)
Observations	(159; 144)	(458; 332)
Effective Observations	(159; 144)	(156; 301)
Clusters	(117; 70)	(114; 126)
Controls:	X	X

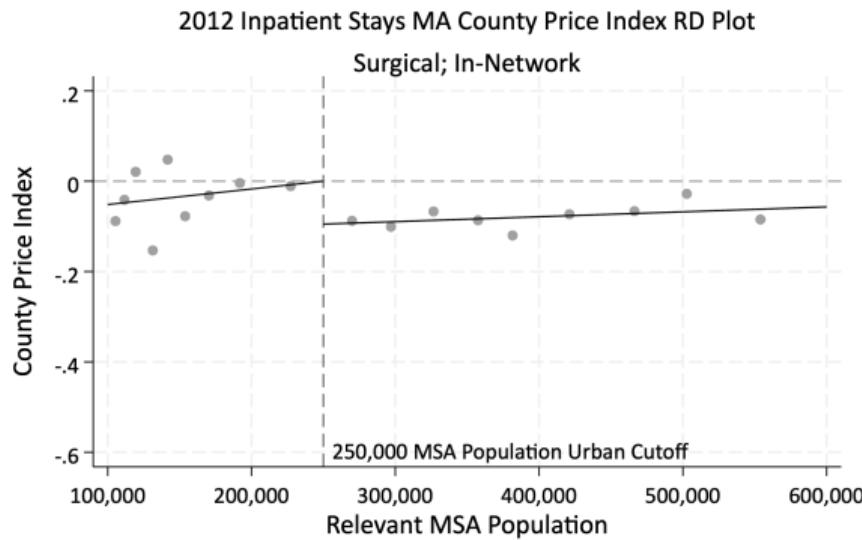
Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

## Null Effect on Surgical Prices: 2012



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

1 2012 | P 2013 | P 2014 | P 2015 | P 1 2016 | P

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

## 2012 Inpatient Stays MA County Price Index RD Estimates Surgical: In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.095* (0.051)	-0.078 (0.049)
Bias-Corrected	-0.063 (0.051)	-0.083* (0.049)
Robust	-0.063 (0.079)	-0.083 (0.060)
Bandwidth	(150k; 350k)	(153,230; 3,162,027)
Bias Bandwidth	(150k; 350k)	(233,084; 18,497,432)
Observations	(129; 119)	(326; 265)
Effective Observations	(129; 119)	(138; 240)
Clusters	(107; 68)	(115; 118)
Controls:	X	X

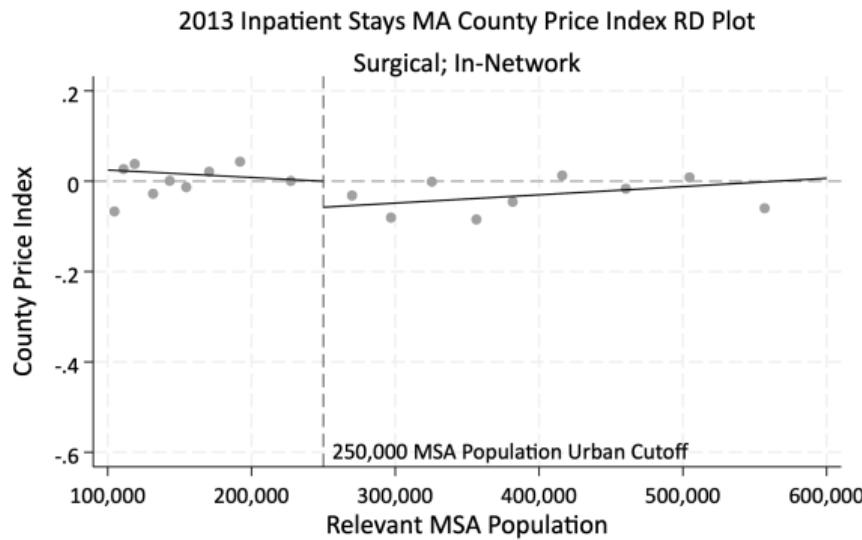
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors NN clustered at the relevant MSA

#### Price Index Controls: DRG, Log(Length Of Stay), Demographics

RD Controls: Log(1997 MA FES Rate), Log(1997 MA Enrollment)

## Null Effect on Surgical Prices: 2013



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

1 2012 | P 2013 | P 2014 | P 2015 | P 1 2016 | P

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

2013 Inpatient Stays MA County Price Index RD Estimates Surgical; In-Network		
	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.058* (0.033)	-0.031 (0.030)
Bias-Corrected	-0.014 (0.033)	-0.027 (0.030)
Robust	-0.014 (0.050)	-0.027 (0.035)
Bandwidth	(150k; 350k)	(142,228; 2,931,716)
Bias Bandwidth	(150k; 350k)	(230,410; 18,497,432)
Observations	(126; 115)	(305; 243)
Effective Observations	(126; 115)	(114; 219)
Clusters	(100; 66)	(90; 112)
Controls:	X	X

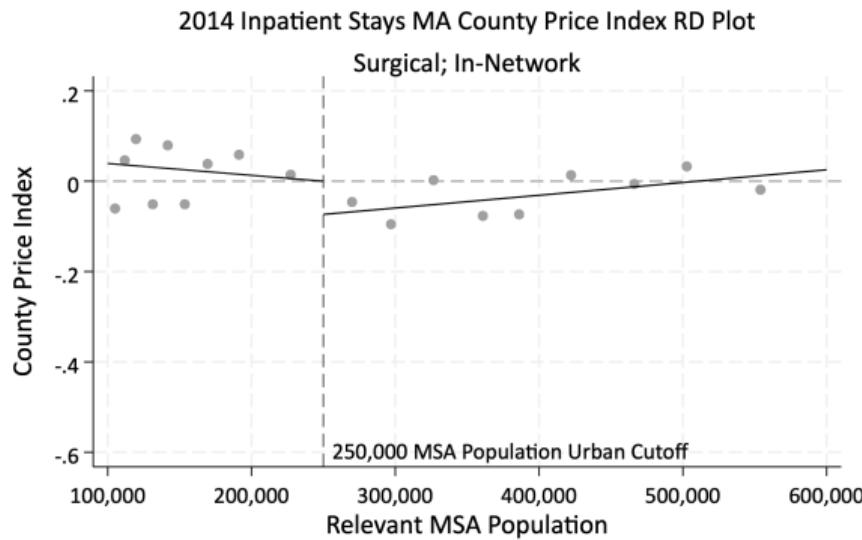
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

Price Index Controls: DRG, Length Of Stay, Demographics

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment)

## Null Effect on Surgical Prices: 2014



Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

1 2012 | P 2013 | P 2014 | P 2015 | P 1 2016 | P

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

2014 Inpatient Stays MA County Price Index RD Estimates Surgical; In-Network		
	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.073** (0.032)	-0.039 (0.028)
Bias-Corrected	-0.025 (0.032)	-0.029 (0.028)
Robust	-0.025 (0.048)	-0.029 (0.033)
Bandwidth	(150k; 350k)	(152,773; 3,355,987)
Bias Bandwidth	(150k; 350k)	(232,173; 18,497,432)
Observations	(138; 118)	(315; 263)
Effective Observations	(138; 118)	(146; 237)
Clusters	(111; 69)	(119; 118)
Controls:	X	X

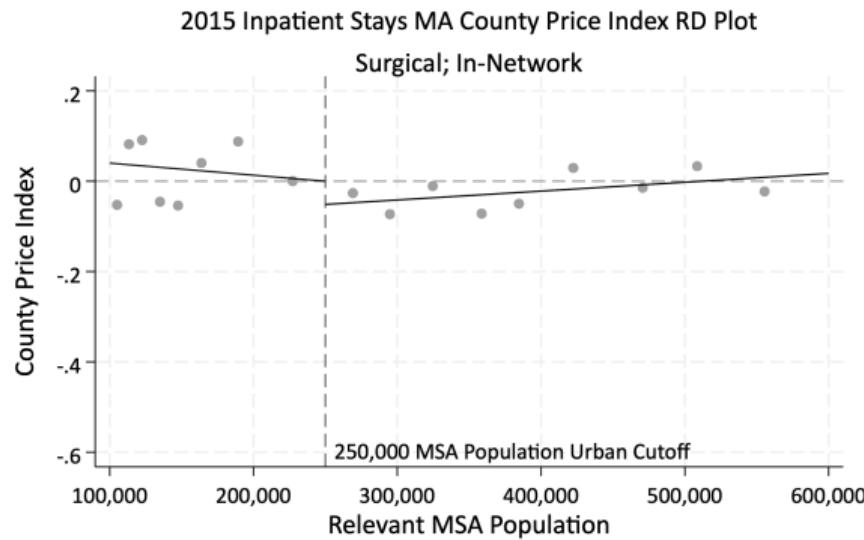
Sources: Authors' calculations from HCCI, CMS, US Census Bureau

Notes: Standard errors are clustered at the relevant MSA.

#### Price Index Controls: DRG, Length Of Stay, Demographics

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment)

# Null Effect on Surgical Prices: 2015



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg 2016 Surg

2015 Inpatient Stays MA County Price Index RD Estimates  
Surgical; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.051* (0.027)	-0.039* (0.023)
Bias-Corrected	0.011 (0.027)	-0.029 (0.023)
Robust	0.011 (0.038)	-0.029 (0.028)
Bandwidth	(150k; 350k)	(158,682; 3,136,773)
Bias Bandwidth	(150k; 350k)	(230,410; 18,497,432)
Observations	(133; 117)	(315; 269)
Effective Observations	(133; 117)	(146; 240)
Clusters	(106; 67)	(119; 117)
Controls:	X	X

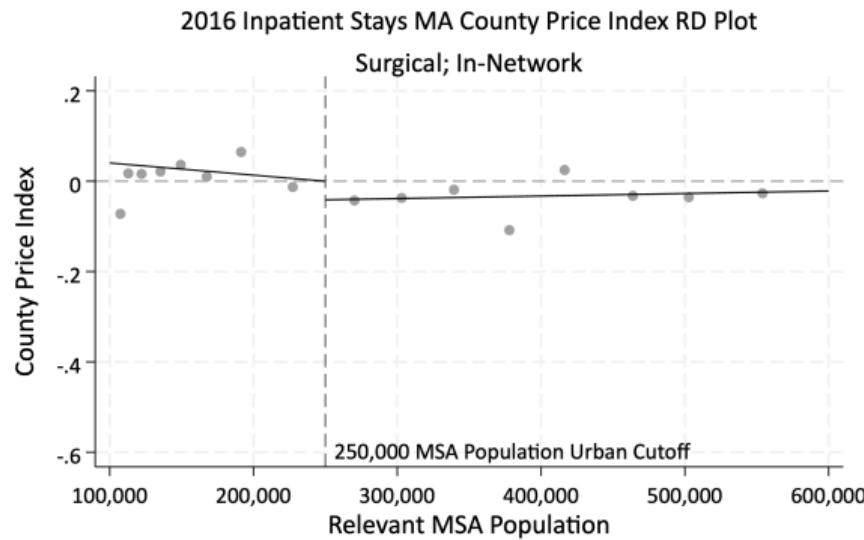
Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Null Effect on Surgical Prices: 2016



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Limited to Group 1 counties within DSV [150k, 350k] bandwidth with a valid price index estimate.

County price index recentered at the left RD cutoff.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

◀ 2012 IP 2013 IP 2014 IP 2015 IP ▶ 2016 IP

2012 Surg 2013 Surg 2014 Surg 2015 Surg ▶ 2016 Surg

2016 Inpatient Stays MA County Price Index RD Estimates  
Surgical; In-Network

	DSV Bandwidth	Data-Driven Bandwidth
Conventional	-0.041 (0.041)	-0.037 (0.037)
Bias-Corrected	-0.002 (0.041)	-0.029 (0.037)
Robust	-0.002 (0.063)	-0.029 (0.045)
Bandwidth	(150k; 350k)	(148,743; 2,724,995)
Bias Bandwidth	(150k; 350k)	(228,330; 18,497,432)
Observations	(104; 113)	(257; 234)
Effective Observations	(104; 113)	(104; 209)
Clusters	(94; 69)	(94; 118)
Controls:	X	X

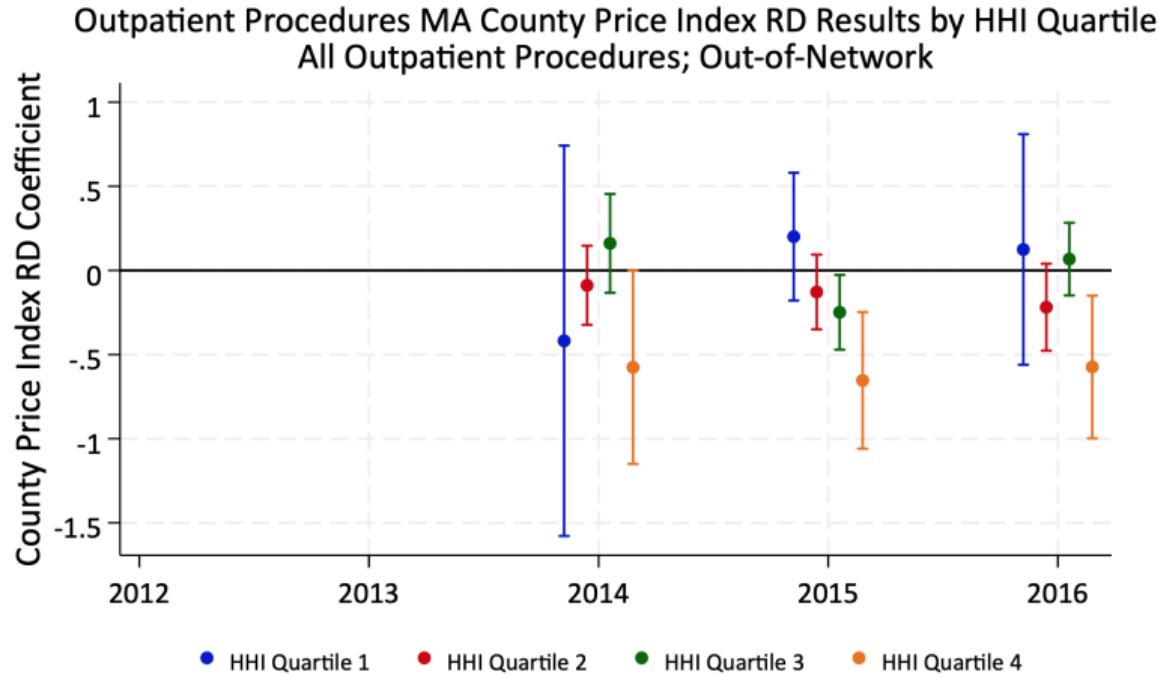
Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: Standard errors NN clustered at the relevant MSA.

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 MA FFS Rate), Log(1997 MA Enrollment).

# Heterogeneous Price Effects by HHI Quartile; OP Out-of-Network



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: DSV [150k, 350k] MSA population RD bandwidth. SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

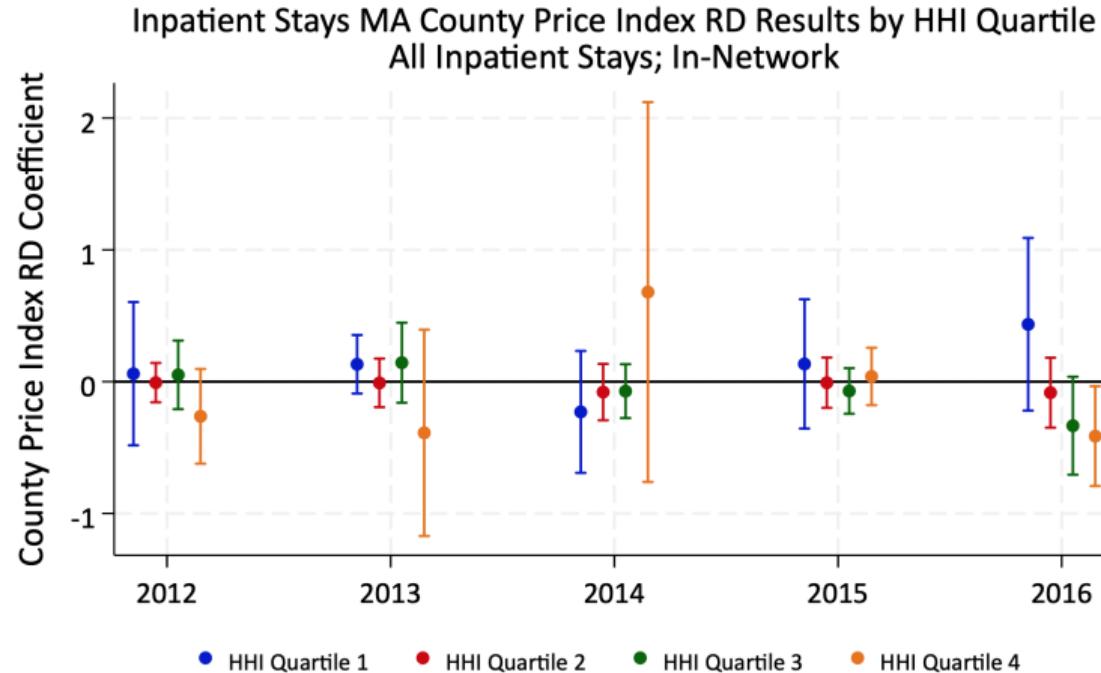
Price Index Controls: Procedure Code, Log(Units), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

HHI quartiles calculated using prior year county-level HHIs across Group 1 counties within DSV [150k; 350k] bandwidth with price index estimate.

- OP; In-Network
- OP; Out-of-Network
- IP; In-Network
- IP; Out-of-Network

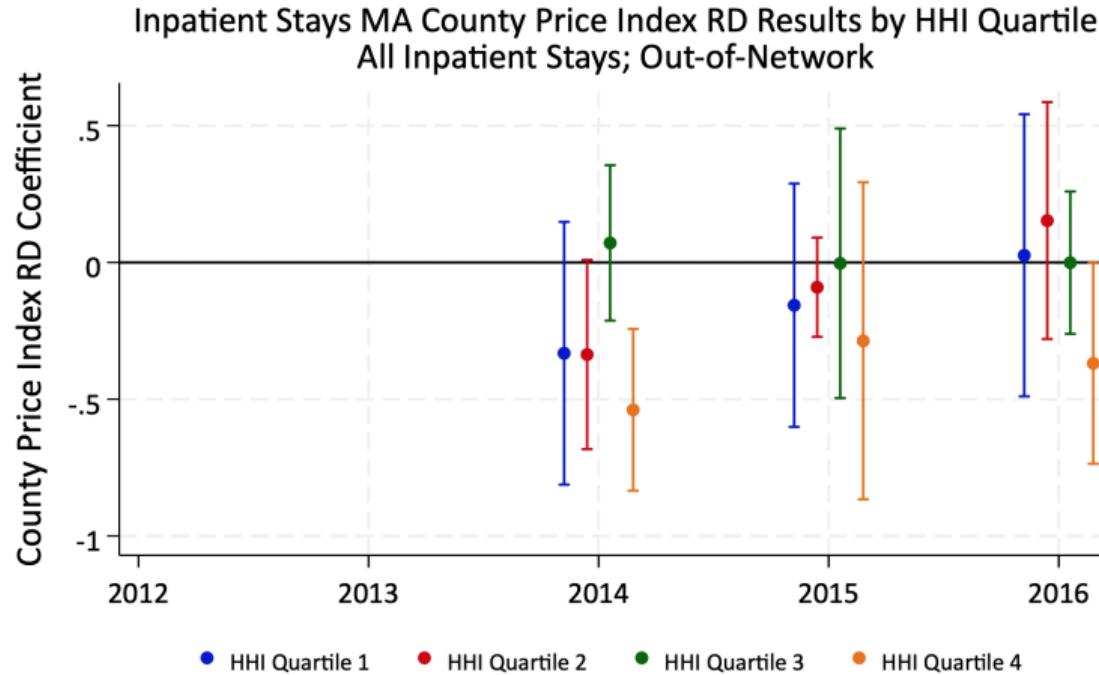
# Heterogeneous Price Effects by HHI Quartile; IP In-Network



- OP; In-Network
- OP; Out-of-Network
- IP; In-Network
- IP; Out-of-Network

Sources: Authors' calculations from HCCI. CMS. US Census Bureau.  
Notes: DSV [150k, 350k] MSA population RD bandwidth. SEs NN clustered at the relevant MSA. Bars represent 95% CIs.  
Price Index Controls: DRG, LogLength Of Stay, Demographics.  
RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)  
HHI quartiles calculated using prior year county-level HHIs across Group 1 counties within DSV [150k; 350k] bandwidth with price index estimate.

# Heterogeneous Price Effects by HHI Quartile; IP Out-of-Network



Sources: Authors' calculations from HCCI. CMS. US Census Bureau.

Notes: DSV [150k, 350k] MSA population RD bandwidth. SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

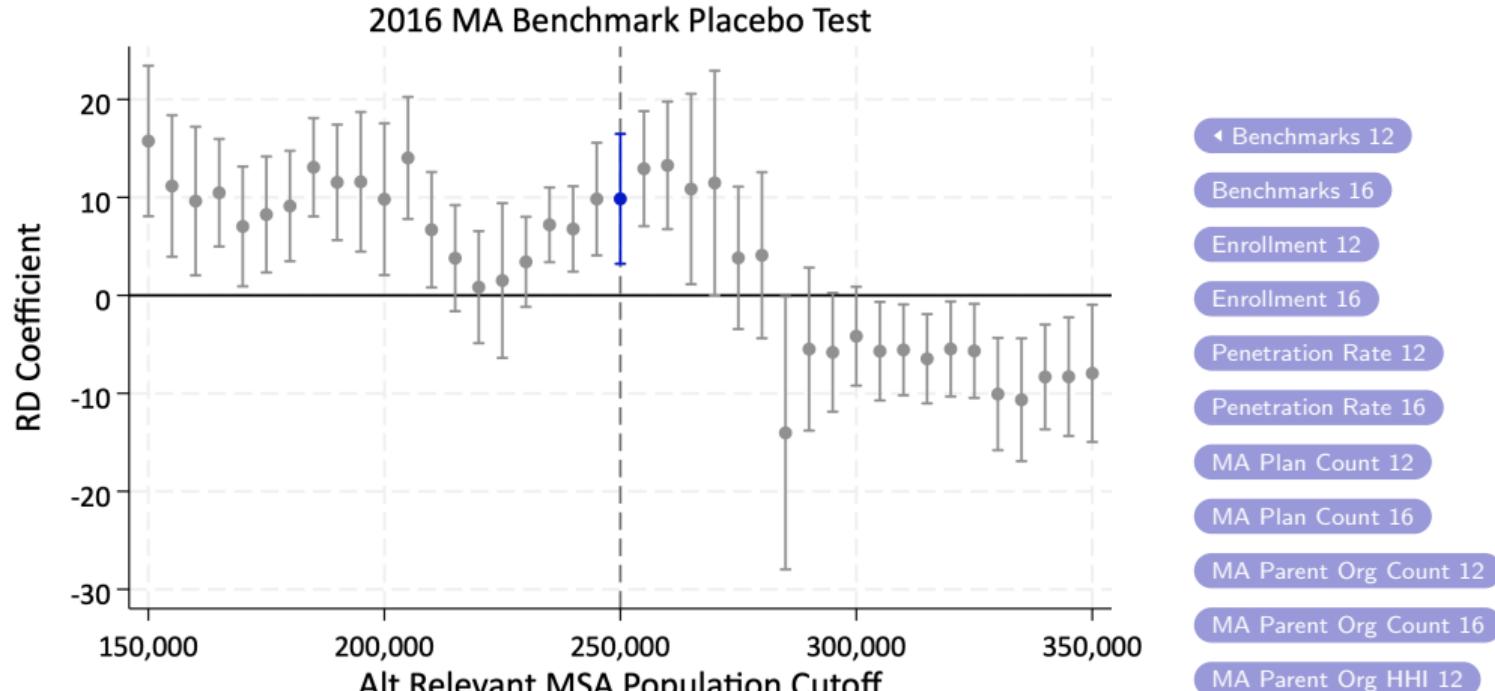
Price Index Controls: DRG, Log(Length Of Stay), Demographics.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

HHI quartiles calculated using prior year county-level HHIs across Group 1 counties within DSV [150k; 350k] bandwidth with price index estimate.

- ◀ OP; In-Network
- OP; Out-of-Network
- IP; In-Network
- IP; Out-of-Network

# Placebo Test: 2016 MA Benchmark



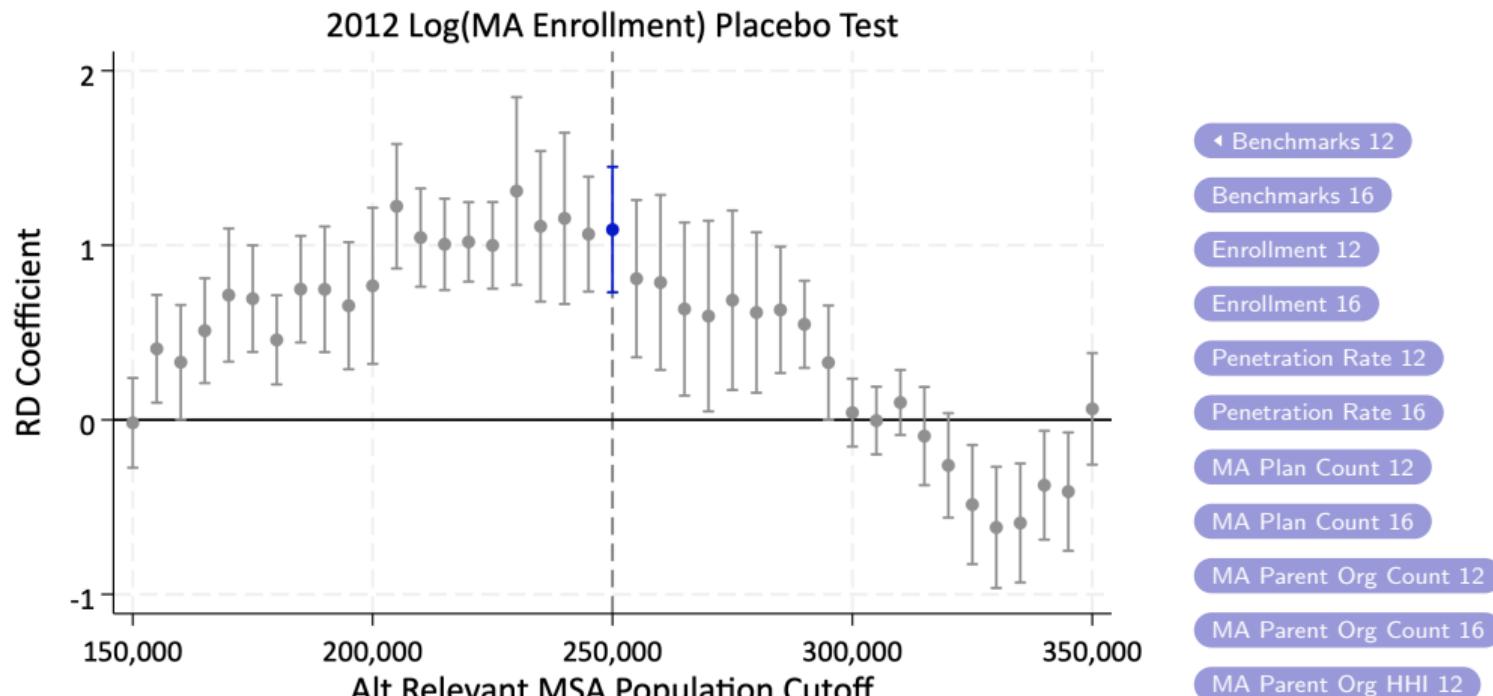
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 Log(MA Enrollment)



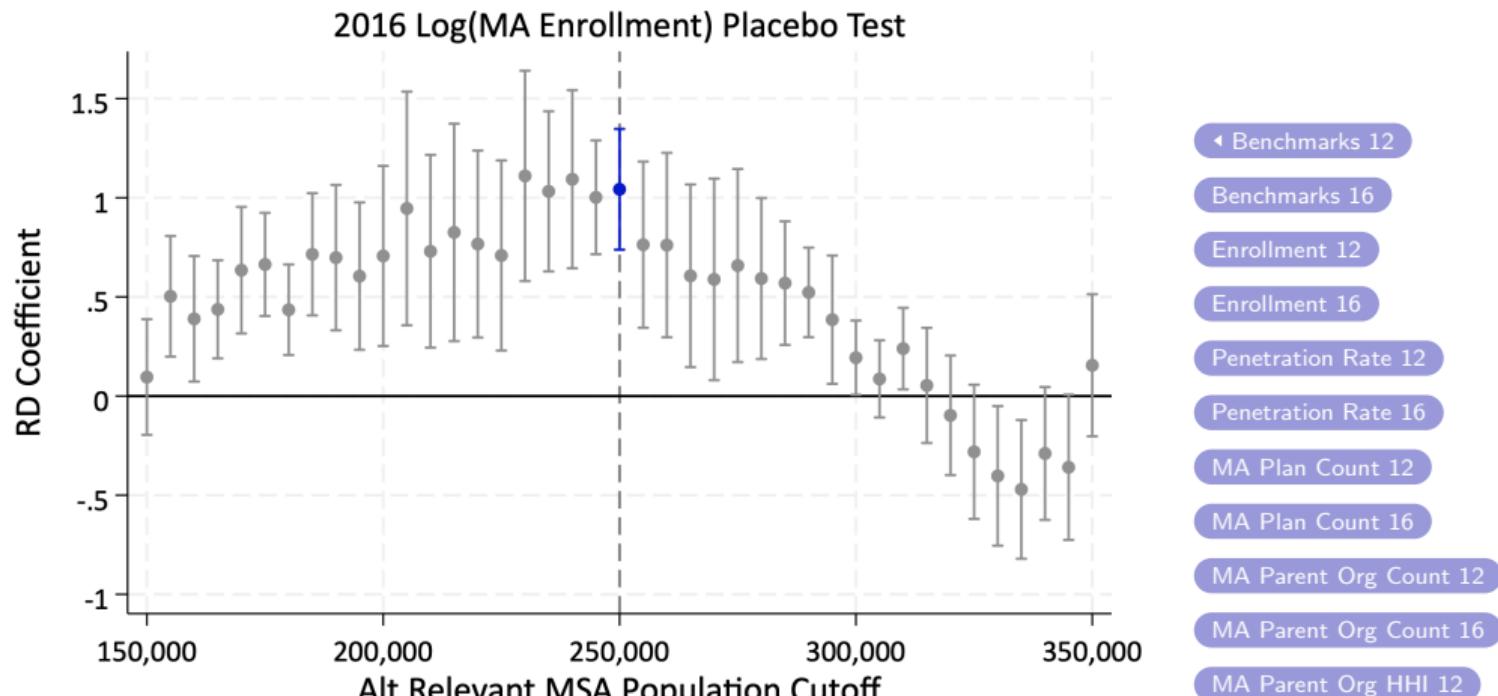
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 Log(MA Enrollment)



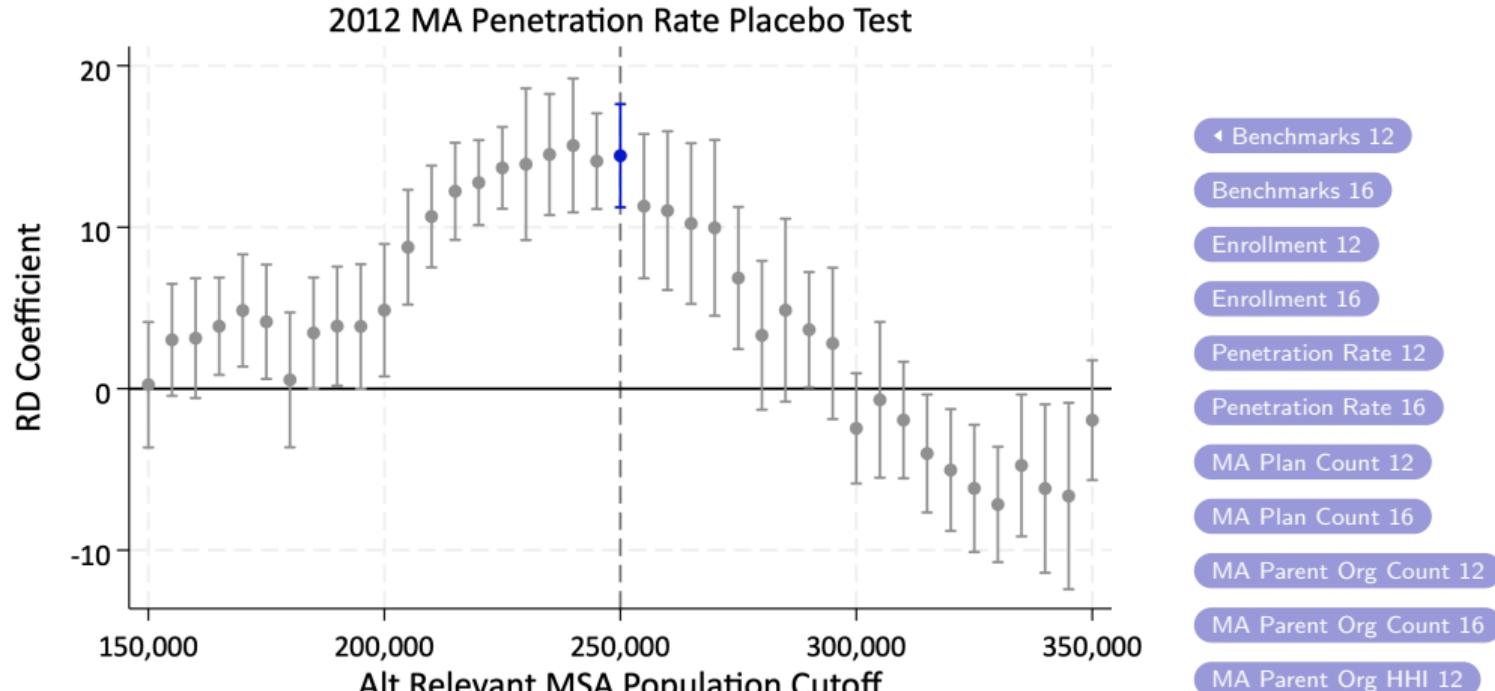
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 MA Penetration Rate



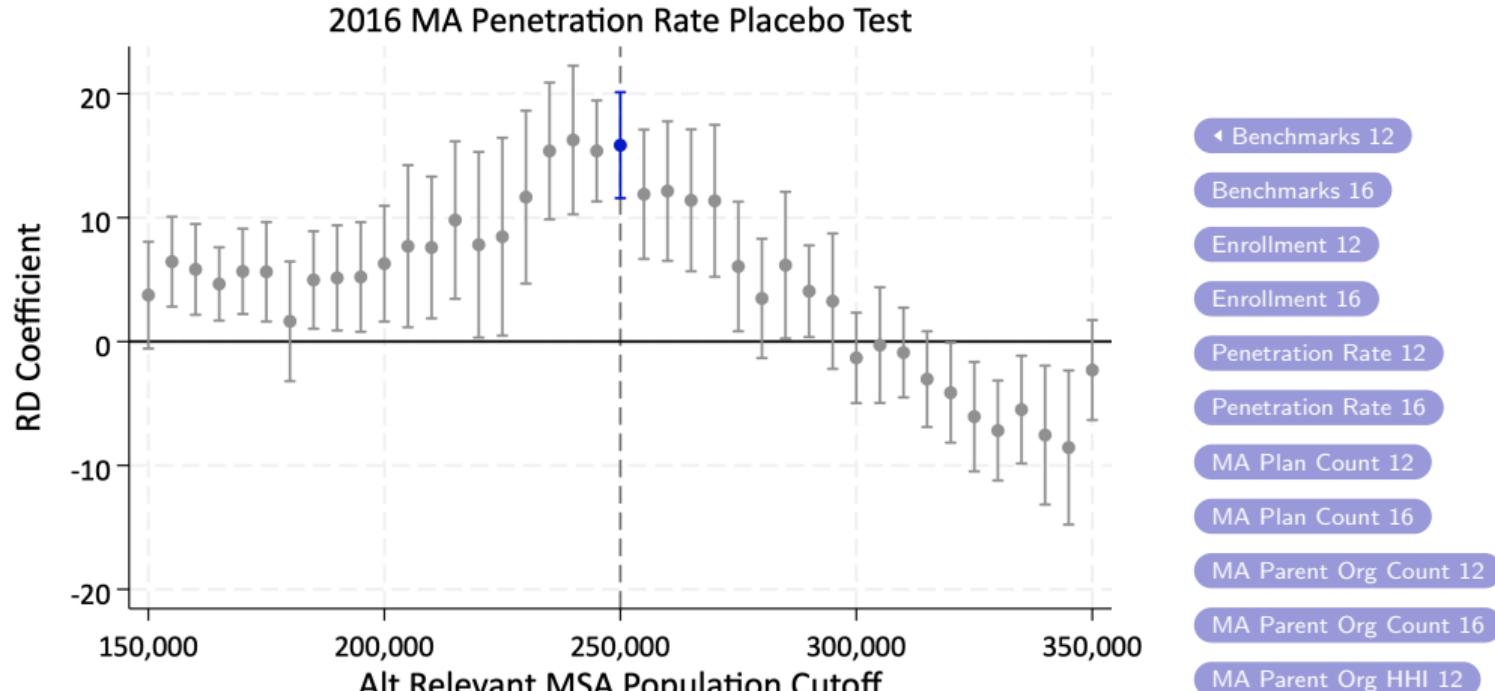
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 MA Penetration Rate



Sources: CMS, US Census Bureau.

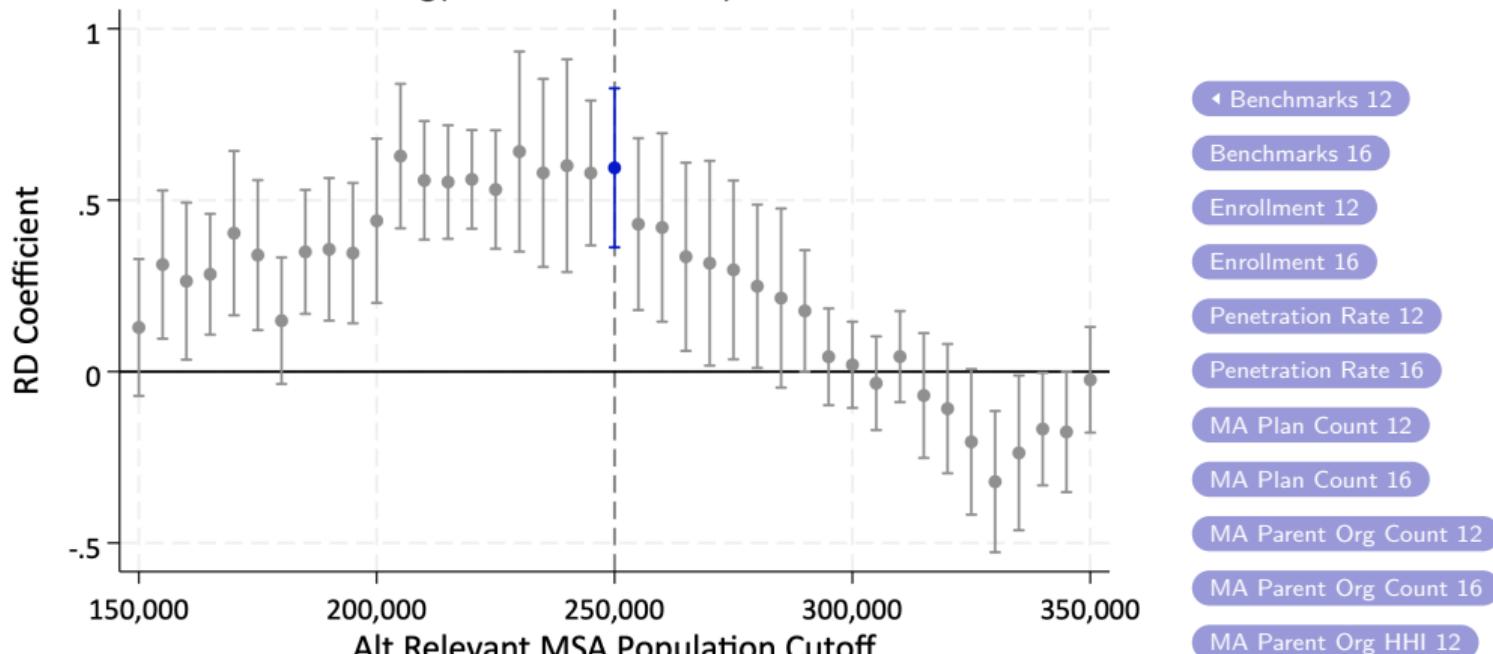
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 Log(Count of MA Plans)

## 2012 Log(Count of MA Plans) Placebo Test



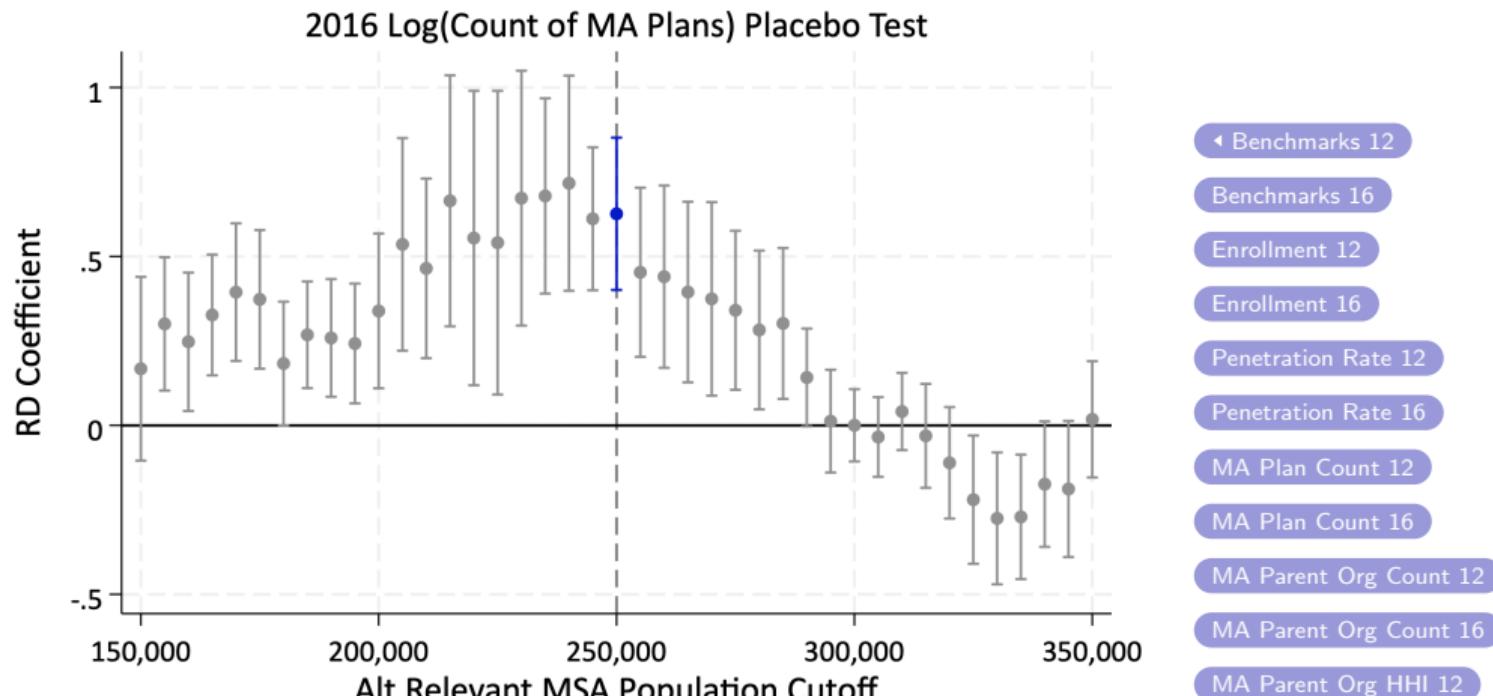
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 Log(Count of MA Plans)



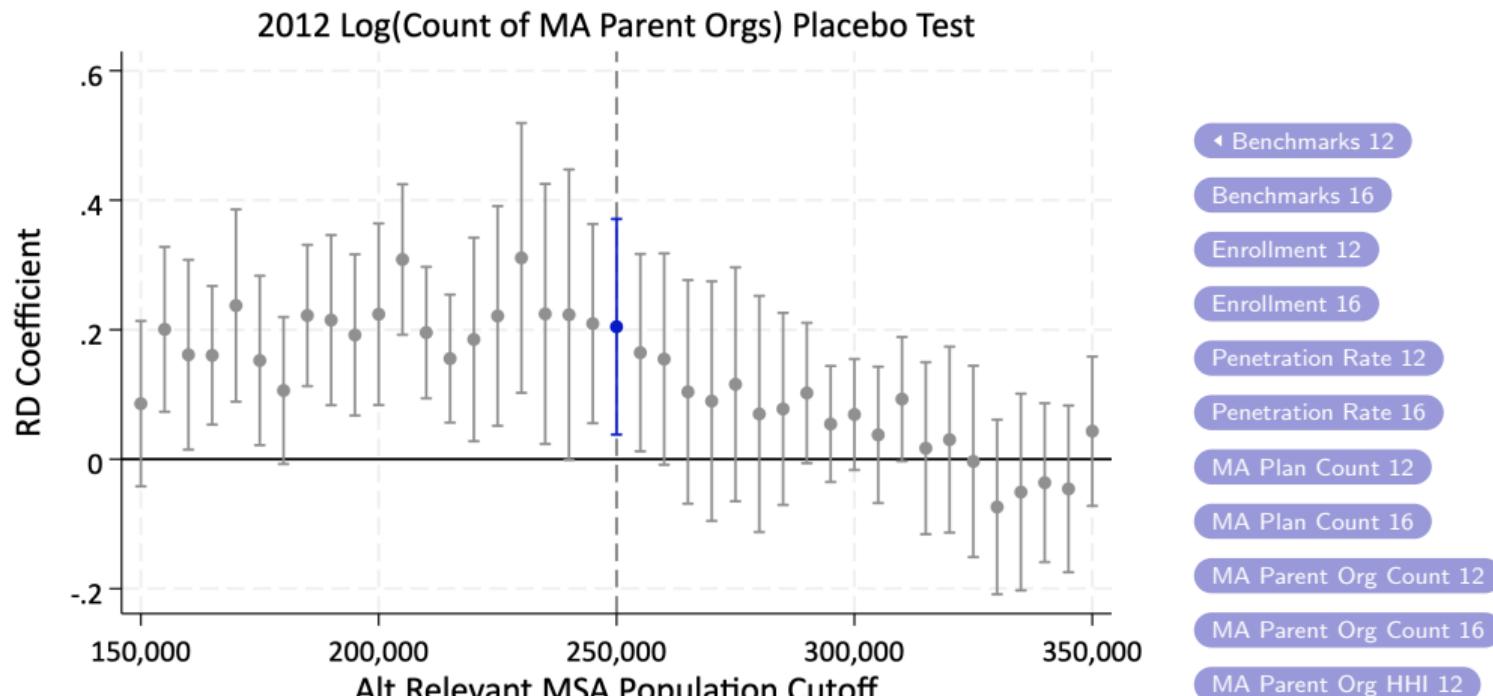
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 Log(Count of MA Parent Orgs)



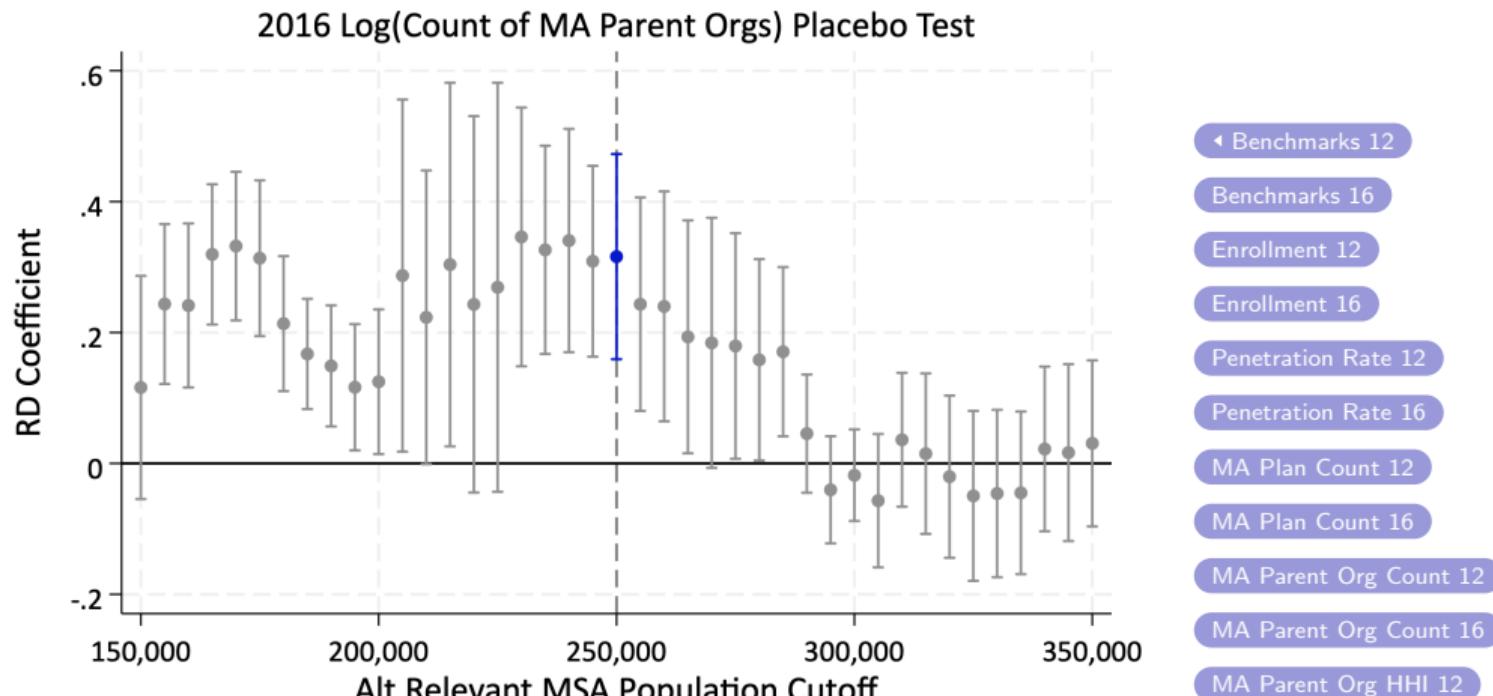
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 Log(Count of MA Parent Orgs)



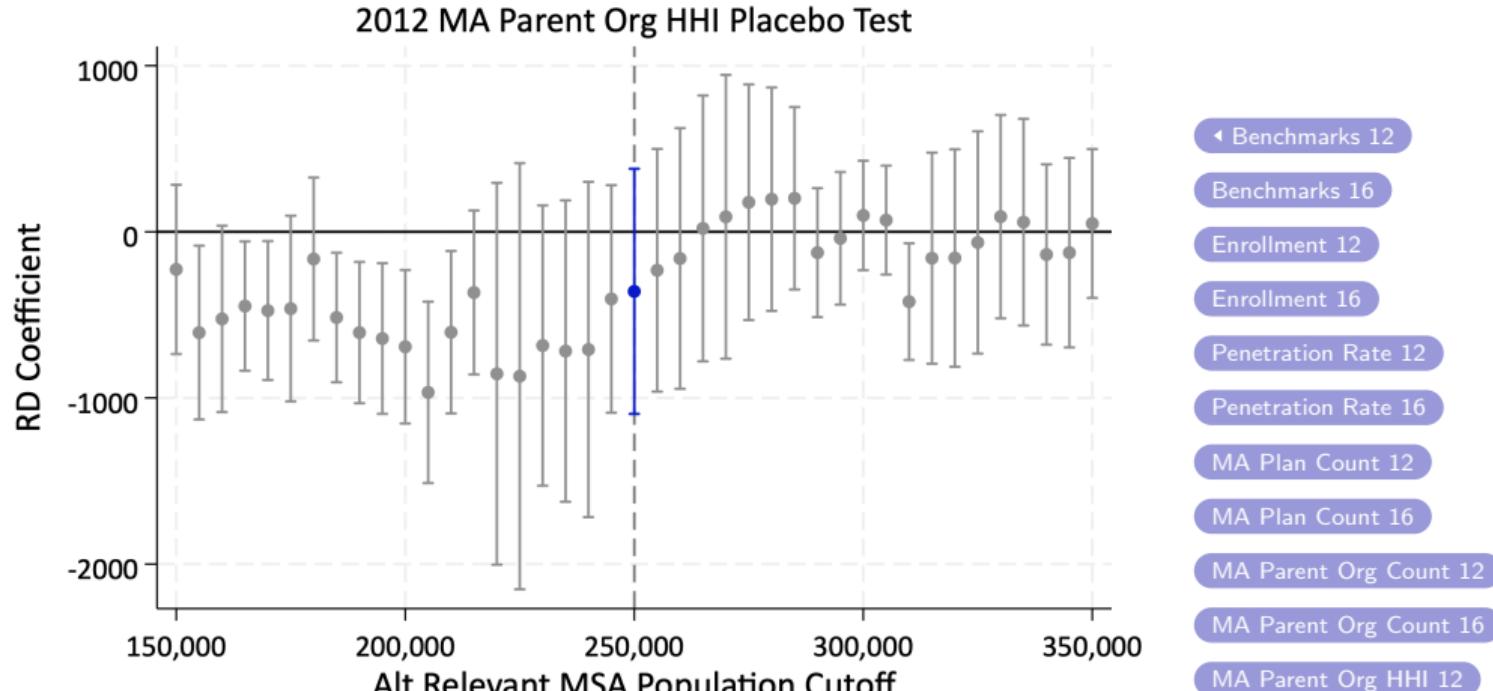
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2012 MA Parent Org HHI



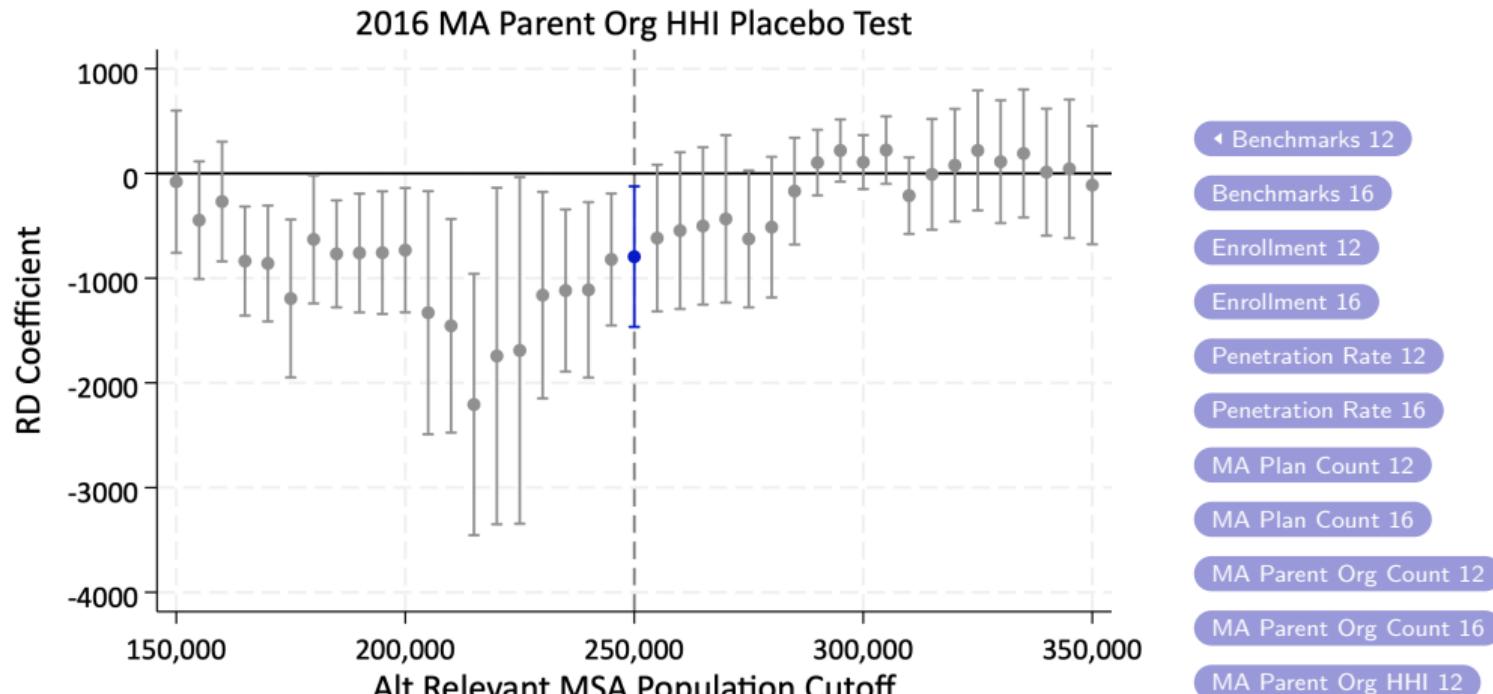
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SES NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 MA Parent Org HHI



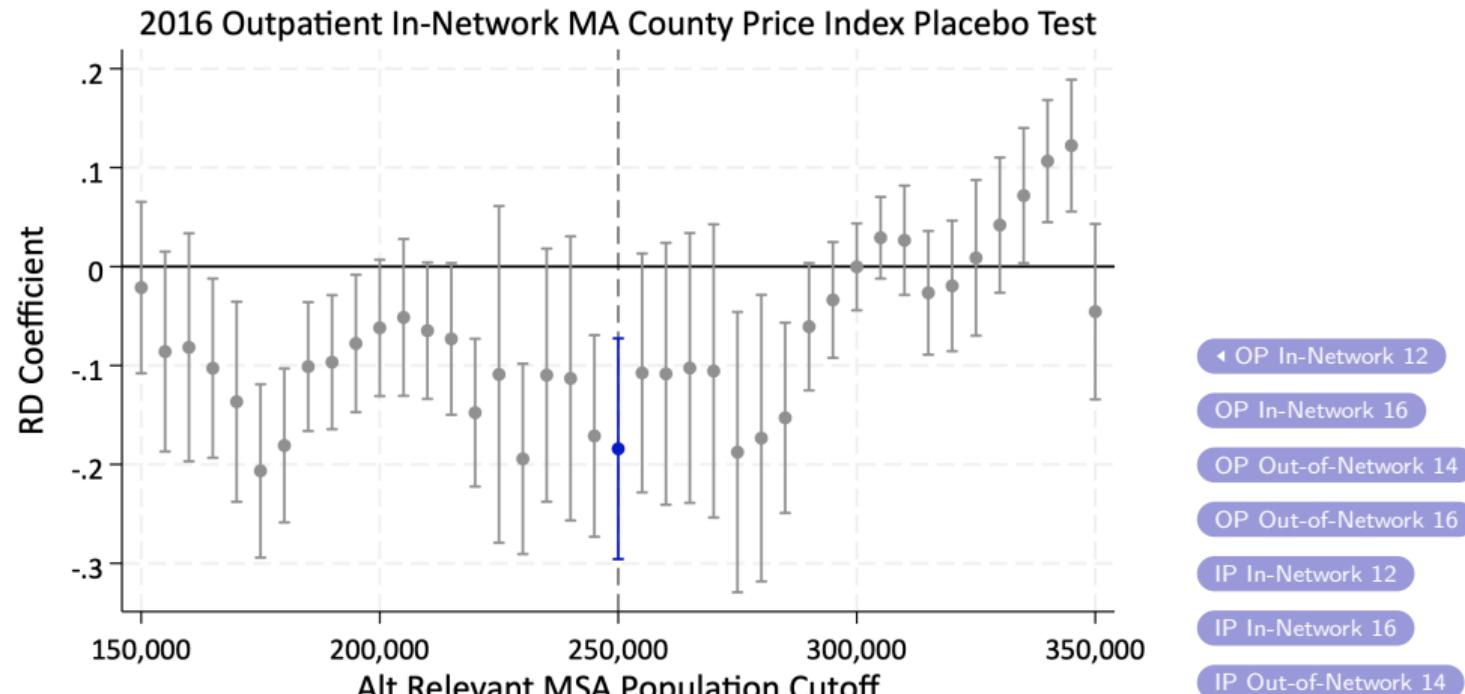
Sources: CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

# Placebo Test: 2016 Outpatient In-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

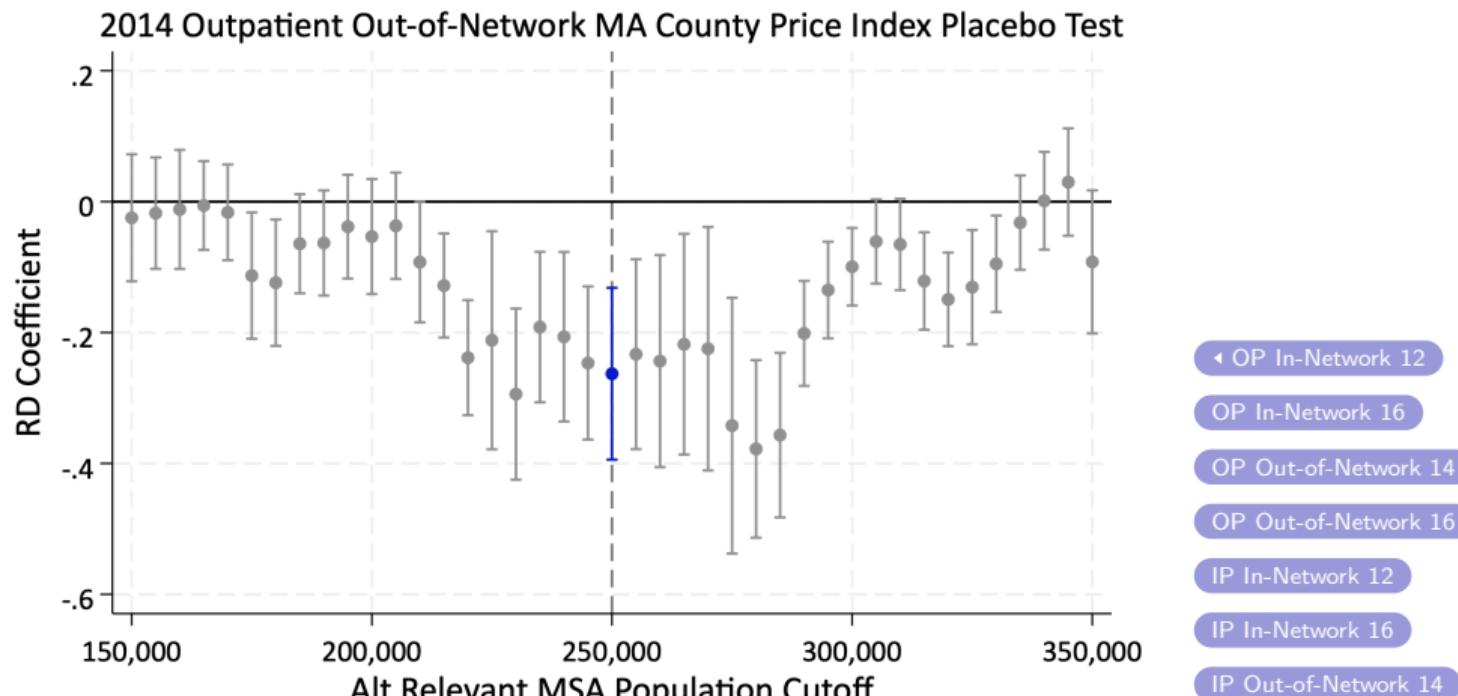
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: Procedure Code, Log(Units), Demographics.

# Placebo Test: 2014 Outpatient Out-of-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

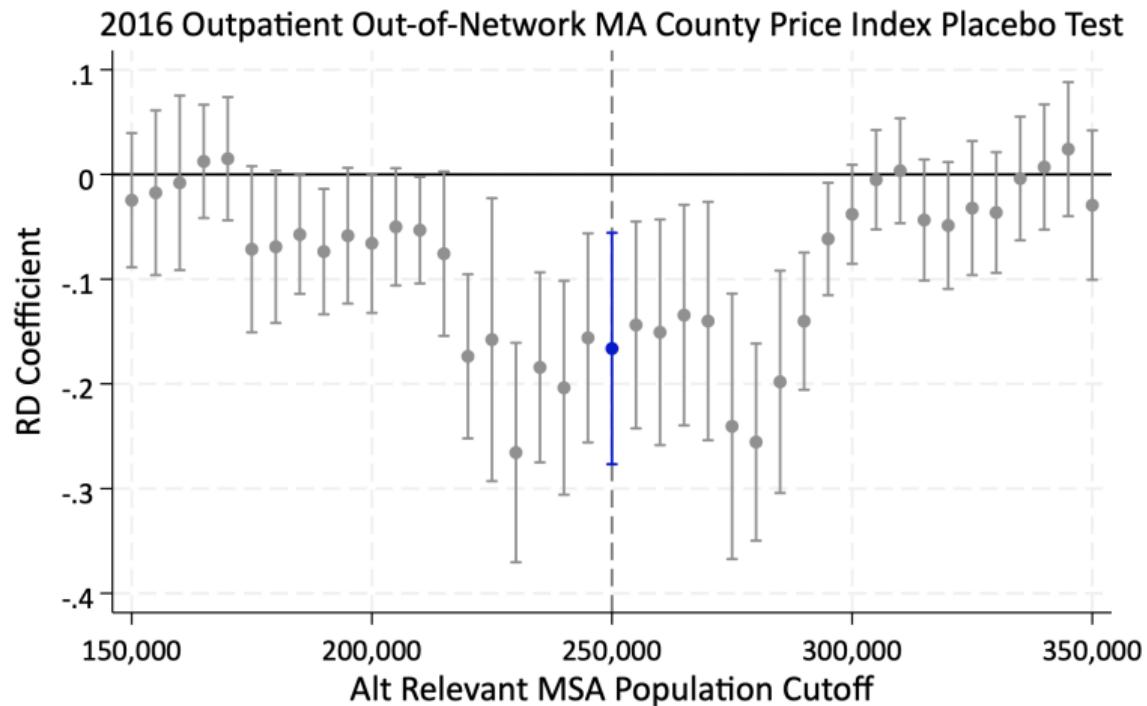
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: Procedure Code, Log(Units), Demographics.

# Placebo Test: 2016 Outpatient Out-of-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

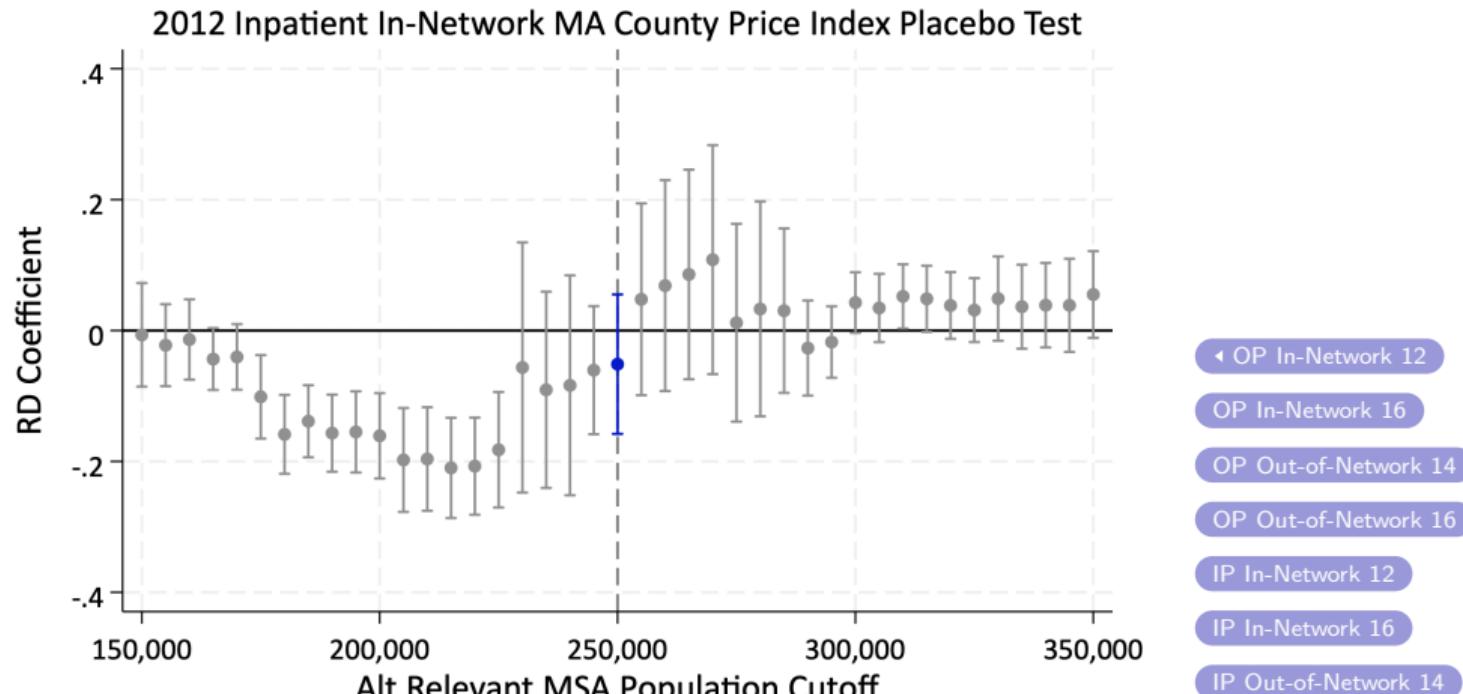
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

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Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

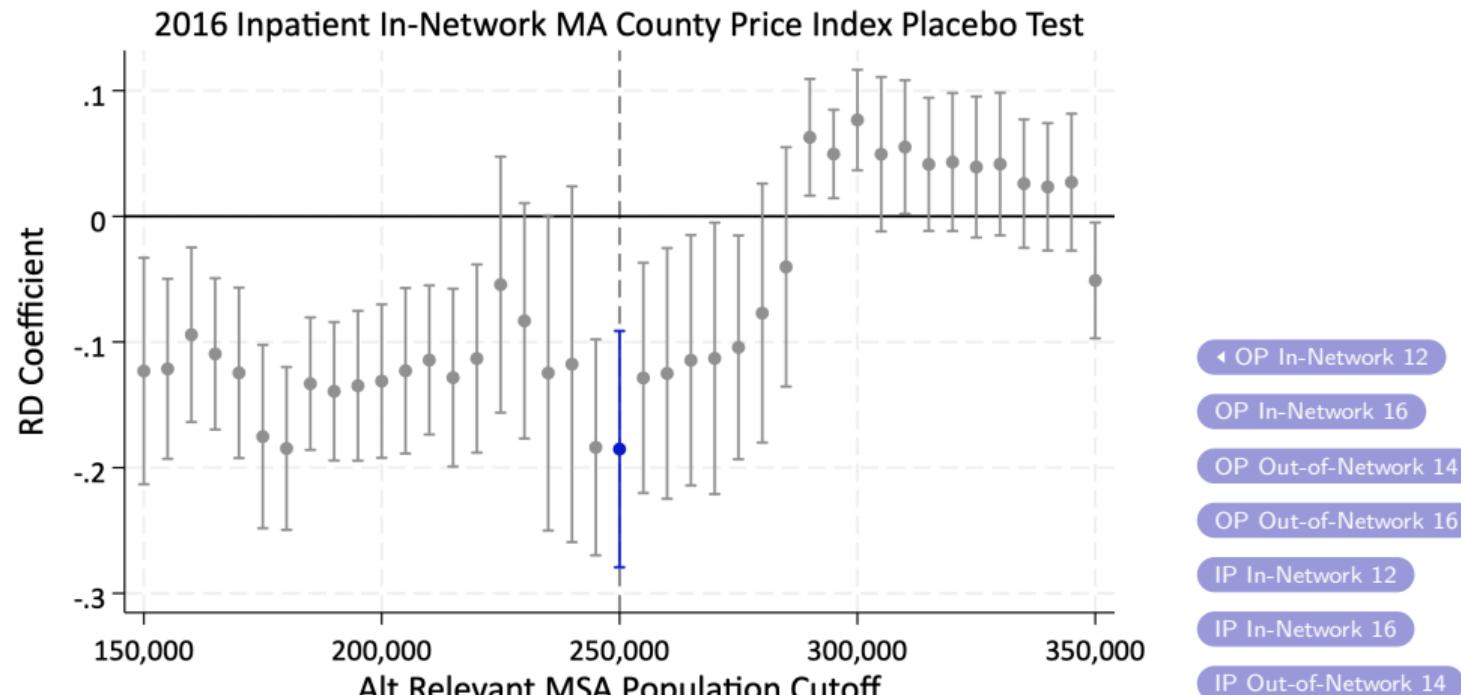
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

# Placebo Test: 2016 Inpatient In-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

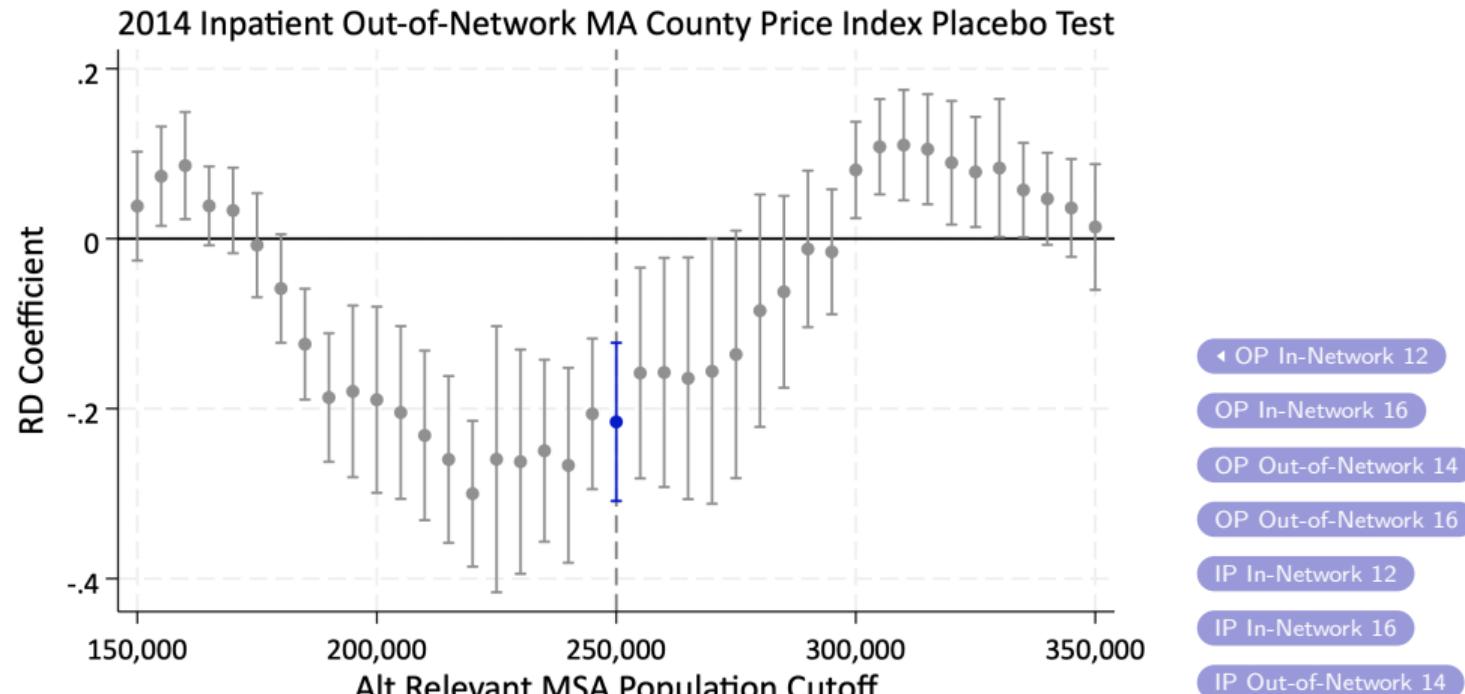
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

# Placebo Test: 2014 Inpatient Out-of-Network County Price Index



Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

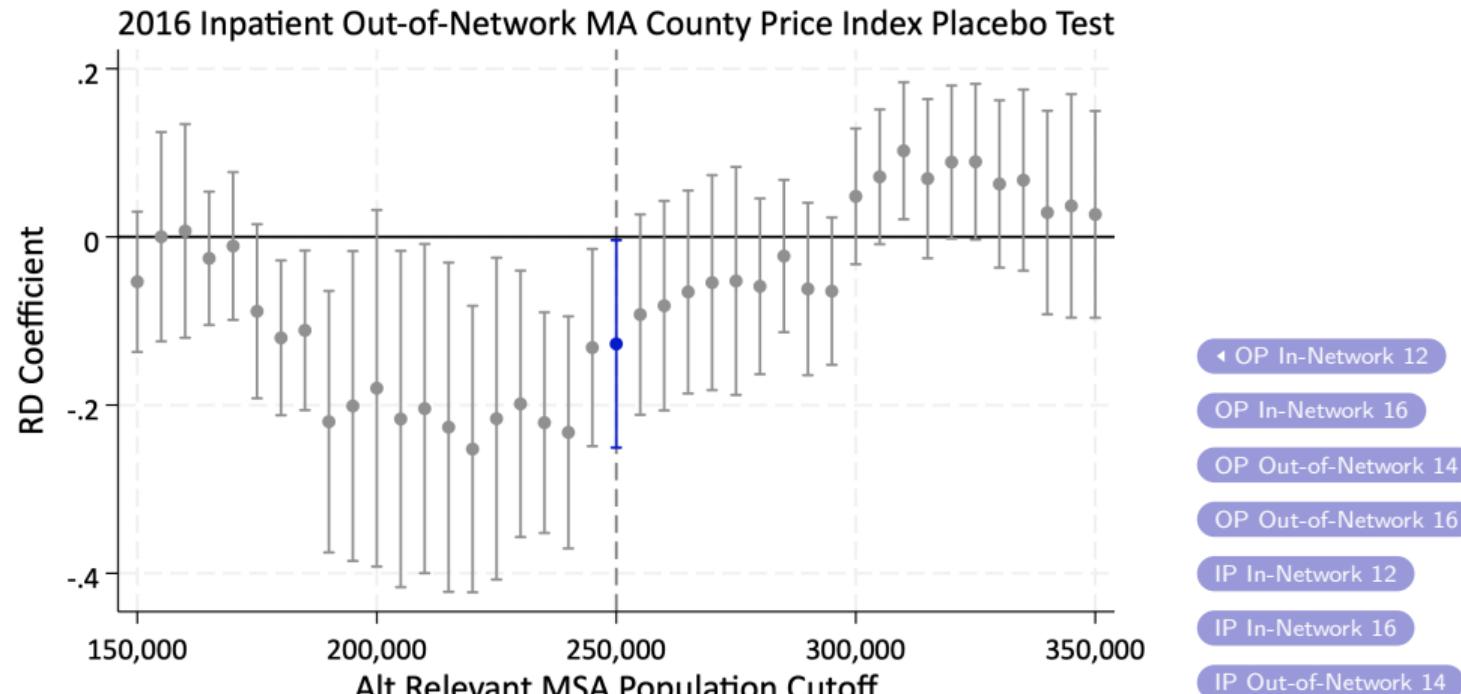
Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: DRG, Log(Length Of Stay), Demographics.

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Sources: Authors' calculations from HCCI, CMS, US Census Bureau.

Notes: RD estimates and SEs result from estimating RD using Group 1 counties and data-driven bandwidths at selected cutoff.

SEs NN clustered at the relevant MSA. Bars represent 95% CIs.

RD Controls: Log(1997 FFS Rate), Log(1997 MA Enrollment)

Price Index Controls: DRG, Log(Length Of Stay), Demographics.