Love It or Leave It: Medicaid Expansion and Physician Location Choice

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August 28, 2024

Motivation - Public Health Insurance Expansion

- Aim to ensure universal access to healthcare
  - **Medicaid** covers 99 million economically disadvantaged populations (50% pregnant women)
  - **States** expand eligibility: e.g. CA, 200% to 322% Federal Poverty Line (FPL)

- Do public health insurance expansions guarantee **access to care**? **Not obvious!**
  - Access also depends on **supply/provider** side
  - Two **competing** incentives due to Medicaid expansions

Positive Incentive: New Demand

+ Medicaid enrollees $\Uparrow$: from $\begin{cases} uninsured \\ private \end{cases}$
+ Care consumed per patient $\Uparrow$

?

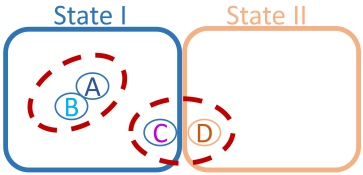
Negative Incentive: Crowding-out

– Private patients $\Downarrow$: switch to Medicaid
– Low Medicaid reimbursement rates
e.g. CA in 2020, 50% of private prices

Motivation - Physician Mobility

- Extensive margin physician supply $\Rightarrow$ **critical in underserved areas** ▸ Map
  - 47% counties with less than 1 OB-GYN (Obstetrics and Gynecology) per 100,000 pop
  - Relocation rate of **incumbent** physicians: 15% to 25% in 5 years (Ricketts and Randolph, 2007; Holmes and Fraher, 2017; McGrail et al., 2017; Molitor, 2018)

- Physicians are mobile than (Medicaid) patients ▸ Interstate Medical Licensure Compact
  - In state reshuffling **A** $\Leftrightarrow$ **B**
  - Across states: multi-state licenses **C** $\Leftrightarrow$ **D**
  - Moving cost increases with distance $\Longrightarrow$ Local search



Research Question

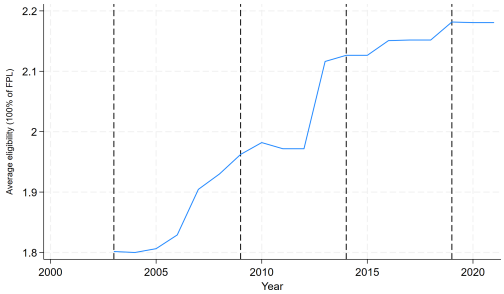
- **How do physicians relocate in response to public health insurance expansions?**
  - conflicting incentives from Medicaid expansions
  - complex patterns of physician mobility

$\Longrightarrow$ **Unintended** consequences of **Medicaid expansions** on **access to care**

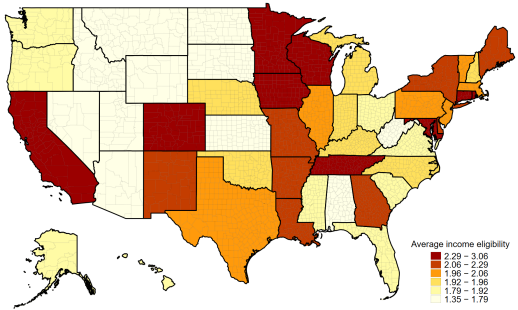
Medicaid/CHIP coverage for pregnant women: time and state variations

- **ALL** pregnant women are covered based on **household incomes** since 1989:
  - **Income eligibility ⇒ only variation:** 2003-2020
  - Not affected by ACA expansion

Expanded over time



Huge state disparity



How do physicians relocate in response to Medicaid expansions?

Policy: **State expands Medicaid income eligibility:**
⇒ 200% to 322% Federal Poverty Line (FPL)

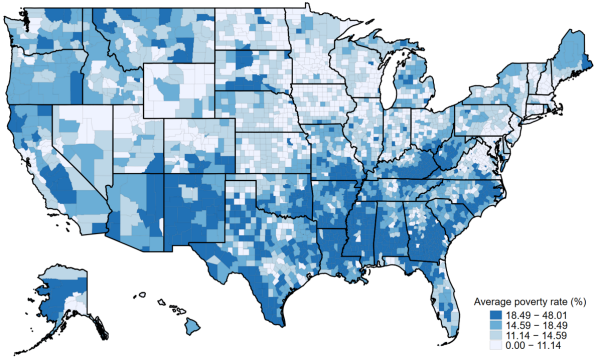
⇓

Demand: **Local population responds based on incomes:**
⇒ mainly middle-low income areas respond

⇓

Supply: **Physicians choose most profitable market:**
⇒ New demand V.S. Crowding-out

County level average poverty rate (2001-2020)



Location Choice Model

A Location Choice Model (McFadden, 1981; Huh, 2021)

- **Formalize how a representative physician relocates to maximize the profit**
  - Minimize relocation cost $\Rightarrow$ the most profitable nearby market
  - Combine revenues come from Medicaid and private markets
- **Show how the local total supply of physicians is related to Medicaid eligibility expansions**
  - Main specification
- **Four predictions of how physicians respond to Medicaid eligibility expansions**
  - Main mechanisms

A Location Choice Model (McFadden, 1981; Huh, 2021)

Profit-maximizing from practicing in county i in period t:

$$U_{it} = \overbrace{Revenue_{it}^{M} + Revenue_{it}^{NM} - Cost_{it}}^{profit} + \overbrace{\epsilon_{it}}^{stochastic}$$

- Revenues come from Medicaid (M) and private (NM) markets

A Location Choice Model (McFadden, 1981; Huh, 2021)

Profit-maximizing from practicing in county i in period t:

$$U_{it} = \overbrace{\frac{q_{it}^{M} d_{it}^{M} r_{it}^{M}}{S_{it}} + \frac{q_{it}^{NM} d_{it}^{NM} r_{it}^{NM}}{S_{it}}}^{profit} - Cost_{it} + \overbrace{\epsilon_{it}}^{stochastic}$$

- Revenues come from Medicaid (M) and private (NM) markets
  - A product of **total number of patients** q_{it}, **demand for care per patient** d_{it}, and **price rate per service** r_{it}
  - Equally shared by all physicians S_{it}

A Location Choice Model (McFadden, 1981; Huh, 2021)

Profit-maximizing from practicing in county i in period t:

$$U_{it} = \overbrace{\frac{q^M(E_{it}, Z_{it})d^M(E_{it}, Z_{it})r^M(Z_{it})}{S_{it}} + \frac{q^{NM}(E_{it}, Z_{it})d^{NM}(Z_{it})r^{NM}(Z_{it})}{S_{it}} - Cost_{it}}^{profit} + \overbrace{\epsilon_{it}}^{stochastic}$$

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- Revenues come from Medicaid (M) and private (NM) markets
  - A product of **total number of patients** q_{it}, **demand for care per patient** d_{it}, and **price rate per service** r_{it}
    - Each is determined by local time-variant characteristics Z_{it} and Medicaid eligibility E_{it}
  - Equally shared by all physicians S_{it}
- Practicing cost is determined by local time-variant characteristics Z_{it} and time-invariant characteristics μ_i

A Location Choice Model (McFadden, 1981; Huh, 2021)

Profit-maximizing from practicing in county i in period t:

$$U_{it} = \overbrace{v(E_{it}, Z_{it}, S_{it}, \mu_i)}^{profit} + \overbrace{\epsilon_{it}}^{stochastic}$$

- County i will be preferred over county k, if $U_{it} > U_{kt}$: e.g. ϵ_{it} is distributed with a Gumbel distribution (Type I extreme value distribution)

$$P_{it} = Prob(U_{it} > U_{kt}, \forall k, k \neq i) = \frac{exp^{v_{it}}}{\sum exp^{v_{kt}}}$$

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- In equilibrium, S_{it} is determined by physicians' choices

$$S^*_{it} = P_{it} N_t = S(E_{it}, Z_{it}, \mu_i)$$

  - N_t is the national number of physicians

$\Longrightarrow$ **Estimate the relationship between Medicaid eligibility E_{it} and county level physician supply S_{it}**

A Location Choice Model (McFadden, 1981; Huh, 2021)

- Physicians move if marginal revenue increase $\gg$ extra moving costs
  - Find the **most profitable nearby county** $\Rightarrow C(\mu_i, Z_{it}) - C(\mu_j, Z_{jt}) \approx 0$
  - Marginal revenue: **Medicaid demand surge** V.S. **Crowding-out from private market**

$$\frac{\partial v_{it}}{\partial E_{it}} = \overbrace{\frac{\partial q^M(E_{it}, Z_{it})}{\partial E_{it}}}^{>0} \frac{d^M(E_{it}, Z_{it})}{S_{it}} r^M + \overbrace{\frac{\partial d^M(E_{it}, Z_{it})}{\partial E_{it}}}^{>0} \frac{q^M(E_{it}, Z_{it})}{S_{it}} r^M + \underbrace{\frac{\partial q^{NM}(E_{it}, Z_{it})}{\partial E_{it}}}_{<0} \frac{d^{NM}(Z_{it})}{S_{it}} r^{NM}$$

$$= \overbrace{\frac{\partial Demand^M(E_{it}, Z_{it})}{\partial E_{it}}}^{>0} r^M + \underbrace{\frac{\partial Demand^{NM}(E_{it}, Z_{it})}{\partial E_{it}}}_{<0} r^{NM}$$

A Location Choice Model (McFadden, 1981; Huh, 2021)

Marginal revenue increases $\Longrightarrow$ If $\frac{\partial v_{it}}{\partial E_{it}} > 0$, $\frac{\frac{\partial Demand^{M}(E_{it}, Z_{it})}{\partial E_{it}}}{-\frac{\partial Demand^{NM}(E_{it}, Z_{it})}{\partial E_{it}}} > \frac{r_{it}^{NM}}{r_{it}^{M}} \gg 0$

A Location Choice Model (McFadden, 1981; Huh, 2021)

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Prediction 1

Marginal revenue increases in counties with a substantial increase in new Medicaid enrollees and in demand for care among Medicaid patients.

- mid-low income, Medically Underserved areas

A Location Choice Model (McFadden, 1981; Huh, 2021)

$$\text{Marginal revenue increases} \Longrightarrow \text{If } \frac{\partial v_{it}}{\partial E_{it}} > 0, \; \frac{\frac{\partial Demand^{M}(E_{it}, Z_{it})}{\partial E_{it}}}{-\frac{\partial Demand^{NM}(E_{it}, Z_{it})}{\partial E_{it}}} > \frac{r_{it}^{NM}}{r_{it}^{M}} \gg 0$$

Prediction 2

More generous Medicaid reimbursement rate further enhances revenue increase.

- Medicaid-to-Medicare Fee index

A Location Choice Model (McFadden, 1981; Huh, 2021)

$$\text{Marginal revenue increases} \Longrightarrow \text{If } \frac{\partial v_{it}}{\partial E_{it}} > 0, \quad \frac{\frac{\partial Demand^{M}(\bar{E}_t, Z_{it})}{\partial \bar{E}_t}}{-\frac{\partial Demand^{NM}(\bar{E}_t, Z_{it})}{\partial \bar{E}_t}} > \frac{r_{it}^{NM}}{r_{it}^{M}} \gg 0$$

Prediction 3

Within the same state ($\bar{E}_t$), physicians choose a county, where local characteristics maximize the marginal revenue change. ($\frac{\partial v_{it}}{\partial E_{it}}$ depends on Z_{it})

- concentrate towards target population

A Location Choice Model (McFadden, 1981; Huh, 2021)

Marginal revenue increases $\Longrightarrow$ If $\frac{\partial v_{it}}{\partial E_{it}} > 0$, $\frac{\frac{\partial Demand^{M}(E_{it}, \bar{Z}_t)}{\partial E_{it}}}{-\frac{\partial Demand^{NM}(E_{it}, \bar{Z}_t)}{\partial E_{it}}} > \frac{r_{it}^{NM}}{r_{it}^{M}} \gg 0$

Prediction 4

Same $\frac{\partial v_{it}}{\partial E_{it}}$ among counties with similar socioeconomic conditions ($\bar{Z}_t$).

- move across state borders
- physicians prefer markets with lower eligibility, if crowding-out dominates ($\frac{\partial v_{it}}{\partial E_{it}} < 0$)

Empirical Analysis

Data Sets

Summary statistics

- Area Health Resource File (2001-2020)
  - County level counts of physicians by specialty and socioeconomic characteristics
- National Plan and Provider Enumeration System (2007-2023)
  - NPIs' **practice location**, specialty code $\Rightarrow$ **yearly moving counts (current to next year)**
    - as good as other physician data (DesRoches et al., 2015)
  - individual yearly moving rate: 3.1%; 6-year rate: 15.7%
- American Community Survey (2001-2020): women (15-44 years old)
  - Actual Medicaid fraction eligible
  - Simulated Medicaid fraction eligible
- American Family Cohort data (2001-2020)
  - Patient level insurance status and use of care

Overall effect of Medicaid/CHIP eligibility on OB-GYN supply

- In state reshuffling
- Across state migration

Empirical Strategy

- **Approach one:** Difference-in-difference (event study) to difference out pre-expansion level
  - State-yearly associations

$$log(MD_{ct}) = \alpha_0 + \sum_{k=-6, k\neq -1}^{11} \beta_k I\{t - T_s^{1stEXP} = k\} EXP_{st} + Z_{ct}\Upsilon + \mu_t + \lambda_s + \epsilon_{ct}$$

- MD_{ct} is the total # of OB-GYN per 100,000 people in county c and year t
- T_s^{1stEXP} is the eligibility (1st) expansion year
- EXP_{st} is the increased line since T_s^{1stEXP} Trend
- Z_{ct} denotes county yearly characteristics
- μ_t is year fixed effect and λ_s is the state fixed effect

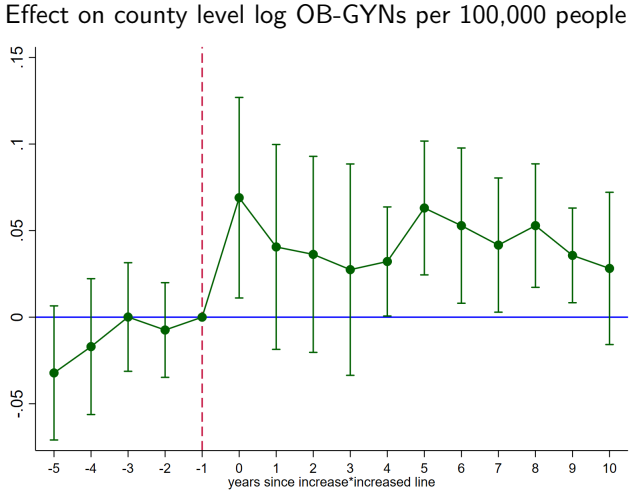
Empirical Strategy

- **Approach two:** state-year level simulated fraction eligible (Currie and Gruber, 1996) as the Instrument Variable (IV) of actual fraction eligible

$$log(MD_{ct}) = \alpha_0 + \beta_1 FRAC_{st} + Z_{ct}\Upsilon + \mu_t + \lambda_s + \epsilon_{ct}$$

  - $FRAC_{st}$ is the state level fraction eligible among women (15-44) in ACS
    - Instrument: the "simulated fraction eligible" using state eligibility lines and 20,000 women randomly drawn from the national sample each year
    - Endogenous local socioeconomic and demographic characteristics
    - Relevance, Independence, and Reduced Form
    - Significant increase post-expansion Evidence

Effect of Medicaid eligibility on county OB-GYN supply: Event study plots



$\Longrightarrow$ **Expanding income eligibility increases county total number of OB-GYNs**

Effect of Medicaid eligibility on county OB-GYN supply: DID and 2SLS

	(1)	(2)	(3)	(4)
	Log OB-GYNs per 100,000 people			
Eligibility line	0.030**			
	(0.009)			
Expanded eligibility (DID)		0.031***		
		(0.007)		
Fraction eligible			0.201***	
			(0.057)	
Fraction eligible (2SLS)				0.163**
				(0.054)
Observations	52,893	52,568	52,893	52,893
R-squared	0.580	0.580	0.580	0.506
First-stage F statistics				525.50

Note: County yearly controls are poverty rate, log median household income, log per capita income, log total employment, log total number of non-OB-GYN MDs per 100,000 people. State and year fixed effects are controlled for. Standard error clustered at census division level.

$\Longrightarrow$ **Expanding eligibility by 10% of FPL increases OB-GYNs/100,000 pop by 0.3%**

- National average expansion: 40% of FPL

Effect of Medicaid eligibility on county OB-GYN supply: DID and 2SLS

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$\Longrightarrow$ **Expanding eligible fraction by 1 pp increases OB-GYNs/100,000 pop by 0.2%**

- National average expansion: 4 pp

Border effect of Medicaid/CHIP eligibility

– **Across state migration**

Effect of Medicaid eligibility on county OB-GYN supply: Border effect

- Counties along the same state border:
  - Similar patient population
  - Different Medicaid eligibility

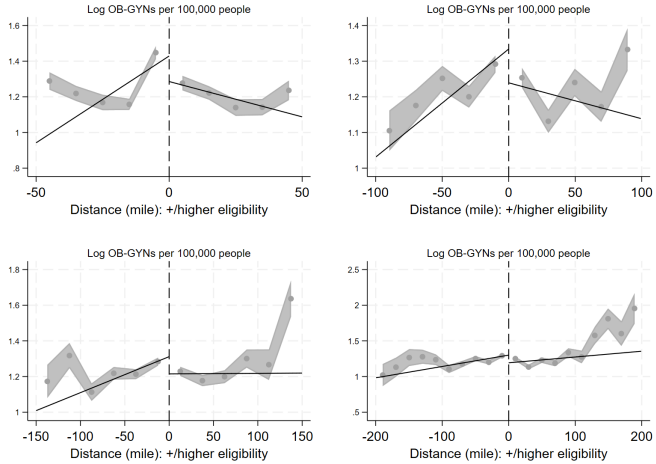
- Border RD with a multidimensional discontinuity in latitude and longitude (Dell, 2010; Imbens and Zajonc, 2011; Kumar, 2018).

$$log(MD_{ct}) = \alpha_0 + \beta_1 HIGH_{st} + \sum_{0}^{P}\sum_{0}^{Q} \lambda_{pq} X_c^p Y_c^q + \mu_t + \lambda_s + \epsilon_{ct}$$

  - $HIGH_{st}$ is an indicator of state with higher eligibility line
  - X_c and Y_c are longitude and latitude of county c

Border RD plots of county OB-GYN supply

▸ Covariates



$\Longrightarrow$ **Log OB-GYNs per 100,000 people is lower on the side with higher eligibility**

Effect of Medicaid eligibility on county OB-GYN supply: Border RD

Donut | Border Pair

	(1)	(2)	(3)	(4)
	Log OB-GYNs per 100,000 people			
Bandwidth	<=50 miles	<=100 miles	<=150 miles	<=200 miles
Higher line	-0.071	-0.078*	-0.081*	-0.080*
	(0.039)	(0.038)	(0.041)	(0.041)
Observations	34,237	47,259	50,115	51,271
R-squared	0.166	0.153	0.155	0.157

Note: Quadratic polynomial in latitude and longitude, state and year fixed effects are controlled for. Standard error clustered at census division level.

$\Longrightarrow$ **Log OB-GYNs per 100,000 people is lower on the side with higher eligibility**

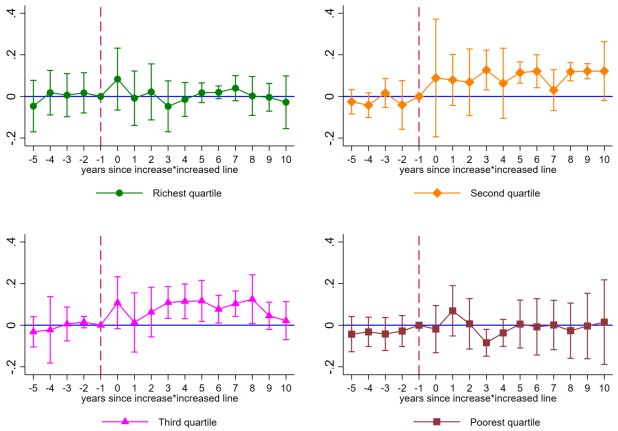
- Within-border pair DID: Expanding eligibility by 10% of FPL $\uparrow \Rightarrow$ 0.7% fewer OB-GYNs/100,000 pop

Mechanisms

– **Four theoretical predictions**

Prediction 1: Physician supply increase $\Leftarrow$ large demand surge

Effect on county level log OB-GYNs per 100,000 people



$\Longrightarrow$ **Primarily driven by mid-low income counties (3rd quartile by poverty rate)**

Prediction 1: Physician supply increase $\Leftarrow$ large demand surge

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log OB-GYNs per 100,000 people							
	MUA	Non-MUA	MUA	Non-MUA	MUA	Non-MUA	MUA	Non-MUA
Eligibility line	0.033**	0.034						
	(0.010)	(0.032)						
Expanded eligibility (DID)			0.035***	0.030				
			(0.010)	(0.035)				
Fraction eligible					0.228***	0.106		
					(0.044)	(0.225)		
Fraction eligible (2SLS)							0.186**	0.171
							(0.062)	(0.182)
Observations	42,821	10,072	42,563	10,005	42,821	10,072	42,821	10,072
R-squared	0.589	0.575	0.590	0.575	0.589	0.575	0.510	0.482
First-stage F statistics							453.01	971.30

Note: County yearly controls are poverty rate, log median household income, log per capita income, log total employment, log total number of non-OB-GYN MDs per 100,000 people. Standard error clustered at census division level.

$\Longrightarrow$ **Primarily driven by Medically Underserved counties with unmet health care demand**

Prediction 2: Physician supply increase ⇐ generous reimbursement rates

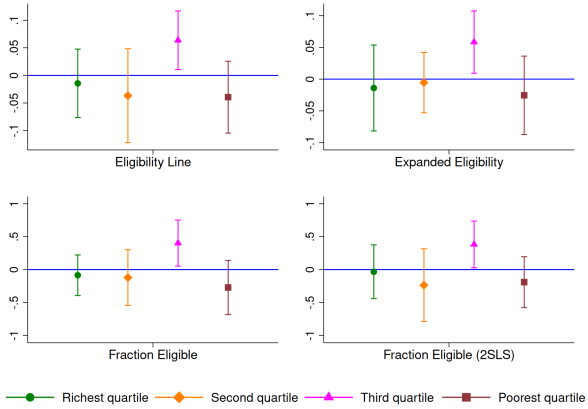
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log OB-GYNs per 100,000 people							
	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower
Eligibility line	0.073**	-0.028						
	(0.023)	(0.036)						
Expanded eligibility (DID)			0.081***	-0.028				
			(0.019)	(0.036)				
Fraction eligible					0.433**	-0.084		
					(0.164)	(0.176)		
Fraction eligible (2SLS)							0.436**	-0.166
							(0.162)	(0.211)
Observations	25,751	25,527	25,426	25,527	25,751	25,527	25,751	25,527
R-squared	0.564	0.598	0.564	0.598	0.564	0.598	0.494	0.521
First-stage F statistics							121.87	2449.32

Note: Higher VS lower reimbursement rate is defined based on the Medicaid-to-Medicare Fee Index (Zuckerman et al., 2021). County yearly controls are poverty rate, log median household income, log per capita income, log total employment, log total number of non-OB-GYN MDs per 100,000 people. Standard error clustered at census division level.

⟹ **Primarily driven by states with more generous Medicaid reimbursement rates**

Prediction 3: same policy expansion, physicians choose target population

Effect on county level log OB-GYN NPIs moving in from other in-state counties per 100,000 people



$\Longrightarrow$ **Non-border counties: more physicians move closer to mid-low income counties (3rd quartile by poverty rate)**

Prediction 4: across borderlines, physicians can move away from expansion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Log OB-GYN NPIs moving-out across state borders per 100,000 people									
	All		IMLC states since 2015		Non-IMLC states and years		Lower poverty rate		Higher poverty rate	
Higher line	0.009**		0.023*		-0.001		0.015***		-0.002	
	(0.003)		(0.012)		(0.007)		(0.006)		(0.009)	
Gap of line		-0.001		0.031***		-0.016**		0.010		-0.004
		(0.006)		(0.004)		(0.007)		(0.007)		(0.009)
Observations	18,556	18,556	6,145	6,145	12,406	12,406	10,368	10,368	8,112	8,112
R-squared	0.293	0.293	0.395	0.395	0.354	0.354	0.402	0.402	0.484	0.484

Note: IMLC: Interstate Medical Licensure Compact. Counties bordering multiple counties are duplicated to the number of pairs. County yearly controls are poverty rate, log median household income, log per capita income, log total employment, log total number of non-OB-GYN MDs per 100,000 people. County and border pair-year fixed effects are controlled for. Standard error clustered at state level.

$\Longrightarrow$ **Border counties: on average, more physicians move away from higher eligibility**

Prediction 4: across borderlines, physicians can move away from expansion

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$\Longrightarrow$ **Border counties: on average, more physicians move away from higher eligibility**

- enhanced among ▸ Interstate Medical Licensure Compact states since 2015 $\leftarrow$ low moving cost

Prediction 4: across borderlines, physicians can move away from expansion

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Gap of line		-0.001		0.031***		-0.016**		0.010		-0.004
		(0.006)		(0.004)		(0.007)		(0.007)		(0.009)
Observations	18,556	18,556	6,145	6,145	12,406	12,406	10,368	10,368	8,112	8,112
R-squared	0.293	0.293	0.395	0.395	0.354	0.354	0.402	0.402	0.484	0.484

Note: IMLC: Interstate Medical Licensure Compact. Counties bordering multiple counties are duplicated to the number of pairs. County yearly controls are poverty rate, log median household income, log per capita income, log total employment, log total number of non-OB-GYN MDs per 100,000 people. County and border pair-year fixed effects are controlled for. Standard error clustered at state level.

$\Longrightarrow$ **Border counties: on average, more physicians move away from higher eligibility**

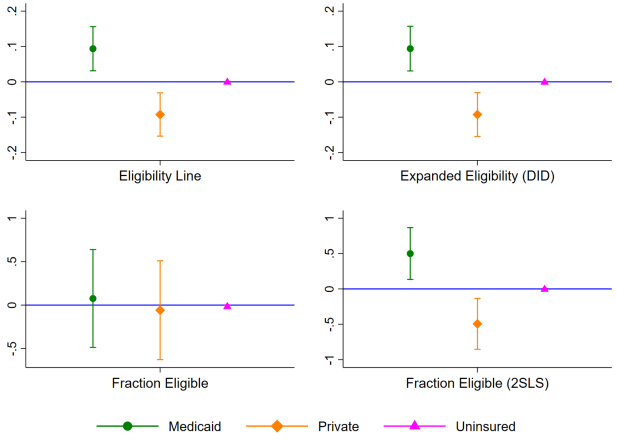
- enhanced among ▸ Interstate Medical Licensure Compact states since 2015 $\leftarrow$ low moving cost
- enhanced among higher-income counties within borderline $\leftarrow$ small new demand

More Evidence on Heterogeneity

- By market competition ▸ Results
  - More substantial in low physician supply counties
- By population size ▸ Results
  - Mainly in mid-populated counties
- By racial composition ▸ Results
  - Mainly in counties with higher shares of minority
- By urban-rural ▸ Results
  - Mainly in mid-urbanized counties

Effect of Medicaid eligibility on pregnant women's Medicaid coverage

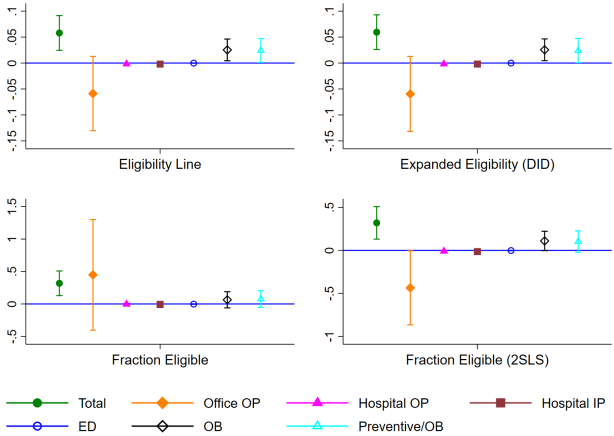
Effect on the monthly probability of using each insurance program



$\Longrightarrow$ **Increased Medicaid enrollment, except** ▸ border counties**; Evidence of crowding-out**

Effect of Medicaid eligibility on pregnant women's healthcare utilization

Effect on monthly log total number of each type of visits



$\Longrightarrow$ **Use more care, especially OB visits, except** ▸ border counties

Robustness Checks

- Different types of physicians ▸ Results
- Placebo test ▸ Results
- Influence of county population ▸ Results
- Confounding policies
  - Other Medicaid reforms ▸ Results
  - Other physician incentive programs ▸ Results
  - Additional controls ▸ Results
- Staggered DID (before 2013) ▸ Results
- Various version of DID ▸ Results
- Overall effect from NPI data ▸ Results
- Border effect
  - RD by Interstate Medical Licensure Compact ▸ Results
  - Traditional one-dimensional RD ▸ Results
  - Excluding 3rd quartile ▸ Results

Conclusions and Discussions

- Medicaid/CHIP income eligibility expansions affect physician supply at the extensive margin
  - induce relocation positively when demand for care increases substantially
  - potentially undermined by low reimbursement rate (crowding-out)
- Physicians make location choices in response to Medicaid expansion both in-state and across state borders
- Policy implications:
  - State level policies in the fragmented healthcare market
  - More measures to attract physicians where physicians are more mobile

Thank you very much!

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