The Value of Quiet Neighborhoods: Traffic Noise and Housing Demand

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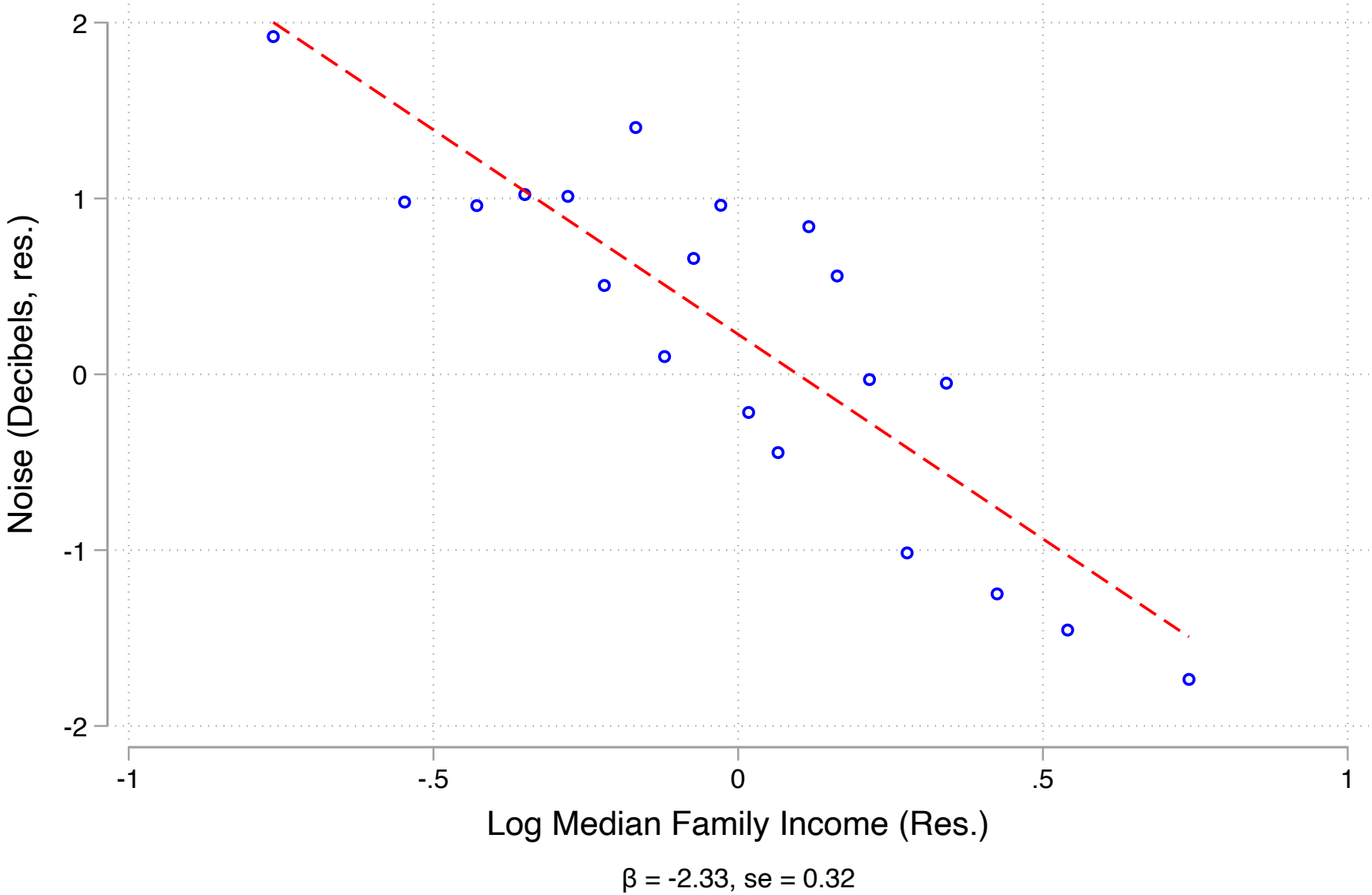
Introduction

- Traffic noise is an important negative local externality
  - 23 million American live close to high levels of traffic noise
  - Linked to a wealth of health problems (WHO, 2017)
- It is likely to be a "regressive" externality
  - Low-income individuals more likely to live near high traffic roads
- Largely ignored in economics
  - Limited causal evidence on the effects on economic outcomes

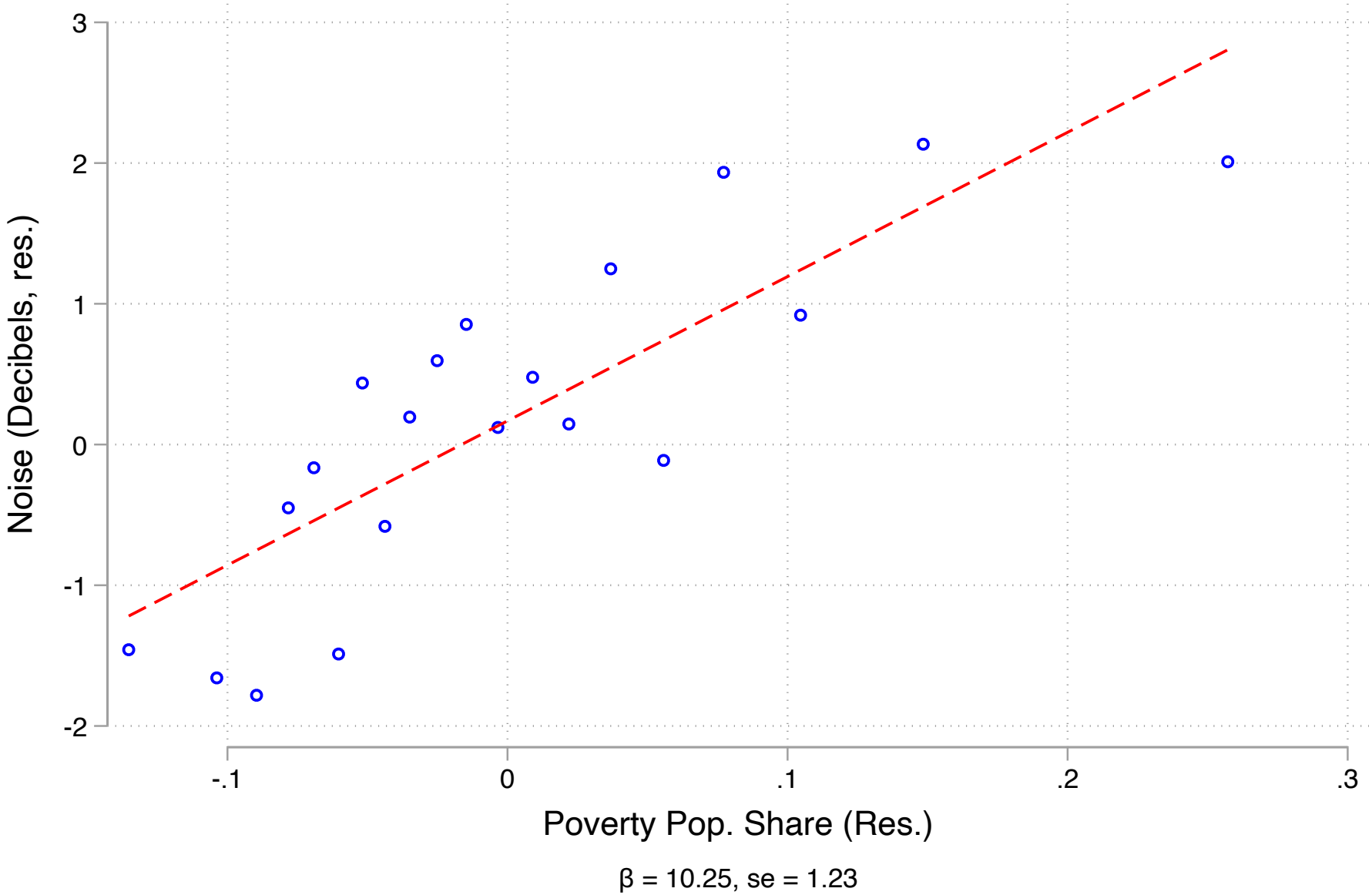
This paper

1. What is the effect of noise on housing demand?
   - We estimate the reduction in property values: are prices in neighborhoods with more noise lower?
2. How large is the negative externality in the aggregate? Who bears it?
3. What are the policy implications for the adoption of Electric Vehicles?

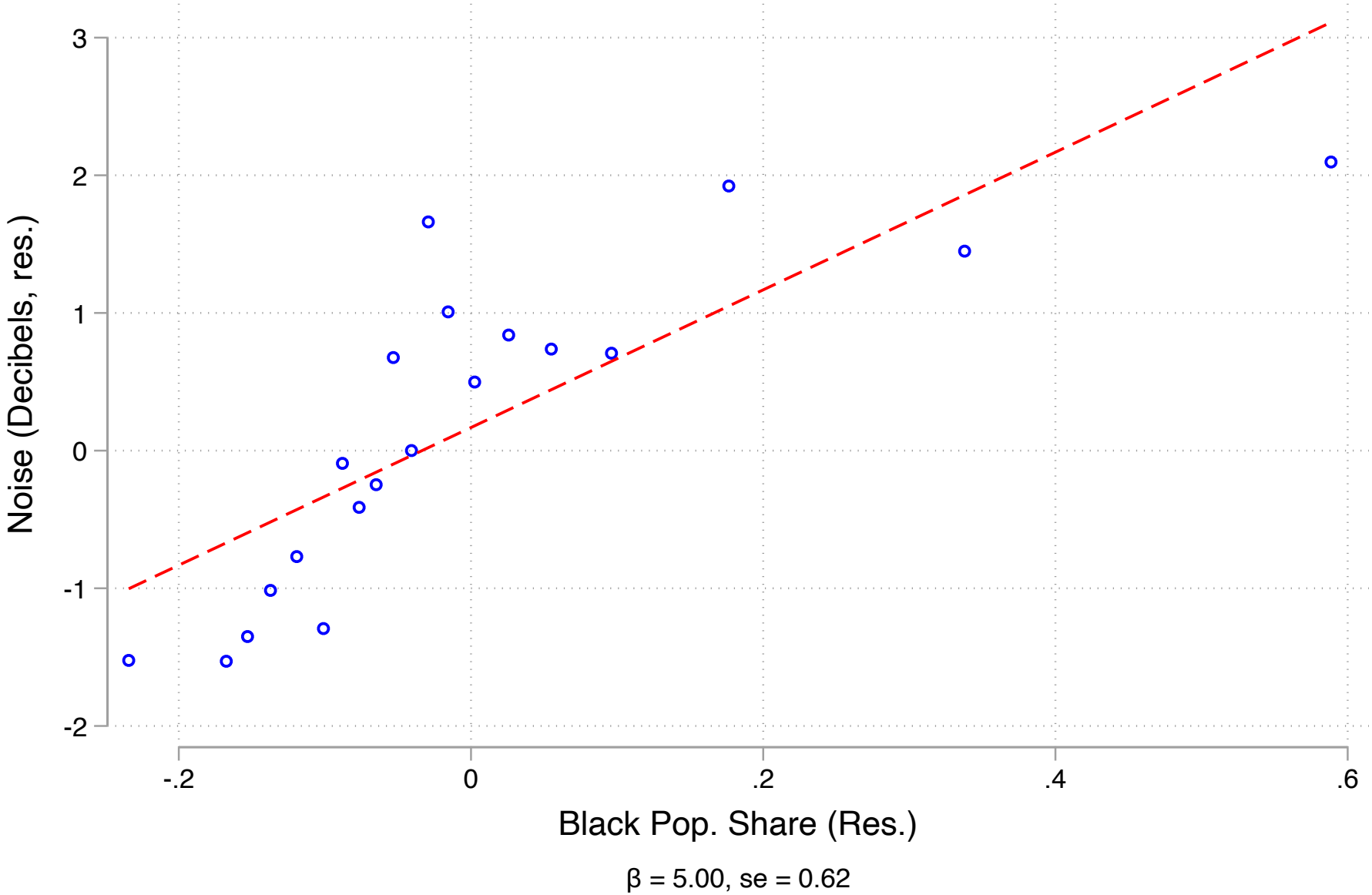
Noise and local income



Noise and poverty



Noise and share of neighborhood that is black



This paper

- We provide broad descriptive facts on traffic noise
  - 6% of US households are exposed to high levels of noise
  - Share significantly higher for low income and minority households
  - Regressive externality
- We estimate the effect of traffic noise on property values
  - Strong negative correlation
  - Difficult to interpret: units and residents near major roads likely to have worse unobservables
- We use variation based on the construction of sound barriers
- We compare the change in prices after construction of properties close to road with the change in properties further from the road
  - $0 - 100$m : 6.7% increase
  - $100 - 200$m: 4.2% increase
  - $200 - 300$m: 3.0% increase
  - > 300m: no effect
  - No pre-trends, effects decay to zero with distance
  - Effect increases in the amount of noise reduction

This paper

- We use this estimate to quantify the aggregate cost of the externality
  - The aggregate cost: $127.4 billion
- Who bears the cost?
  - As a proportion of property values: cost is larger for low-income families
  - In absolute terms: the cost is larger for high income families

This paper

- We focus on the expected benefits of Electric Vehicles (EV) adoption on housing demand
  - We use our estimate of the causal effect of noise to estimate the economic benefit of EVs adoption on each property currently exposed to traffic noise
  - We compare it to Biden's administration subsidies for EV
  - Lower bound of total benefits (pollution)
  - We estimate benefits on different income groups.
- We conclude that the local benefits of EV for neighborhoods are significantly larger than current subsidies
- Subsidies for EVs are typically motivated as a way to reduce CO2 (global externality)
- EV can reduce noise (local externality)

Related literature

- Lit on noise and property values largely focus on correlations
  - Huges and Sirmans 1992; Verhoef 1994; Epsey and Lopez 2000; Sebastian and Maennig 2011; Franck et al 2015; Hofstetter and Muller-Wenk 2005; Kim et al 2007; Li et al 2009; Narvud 2002; Nelson 2004; Rich and Nilesen 2004; Theebe 2004; Wilhelmsson 2000; Blanco and Flindell 2011; Cohen et al 2021
- Limited causal evidence
  - Lindgren (2021) studies noise mitigation
  - Wang et al. (2023) studies rental demand near roads during COVID
- 100% adoption of EVs would reduce traffic noise by 7.1 dB – 7.3 dB relative to 100% internal combustion engines
  - Lan et al 2018, Pallas 2014, 2015; Walker 2016; King 2017; Cesbron 2021
- Expected noise reduction is larger at low speeds than high speeds
  - Pallas et al 2016; Iversen et al, 2015; Marbjerb, 2013

Noise barriers along roads

- Structures built beside roads to reduce noise diffusion
- Since 1963, Federal-aid Highway Program helps fund state DOT noise barriers
- Can be built on existing highways or in response to a change in the highway
- A sound barrier that reduces noise by 10 db would have the following effects
  - $2\times$ distance $\Rightarrow$ sound level -6 db
  - 50m: 74 db $\Rightarrow$ 64 db
    - what it sounds like: vaccum cleaner $\Rightarrow$ air conditioner
  - 100m: 68 db $\Rightarrow$ 58 db
    - what it sounds like: passenger car driving by $\Rightarrow$ television
  - 200m: 62 db $\Rightarrow$ 52 db
    - what it sounds like: dishwasher $\Rightarrow$ moderate rainfall
  - 400m: 56 db $\Rightarrow$ 46 db
    - what it sounds like: electric toothbrush $\Rightarrow$ urban ambient noise

Barrier constructed in Jacksonville, FL in 2016

View from the neighborhood before the barrier

October 2015

View from the neighborhood after

February 2019

Home sale from the neighborhood

- House is 70m from barrier built in 2016
- Sold in 2015: $202k (2022 USD)
- Sold in 2017: $211k (2022 USD)

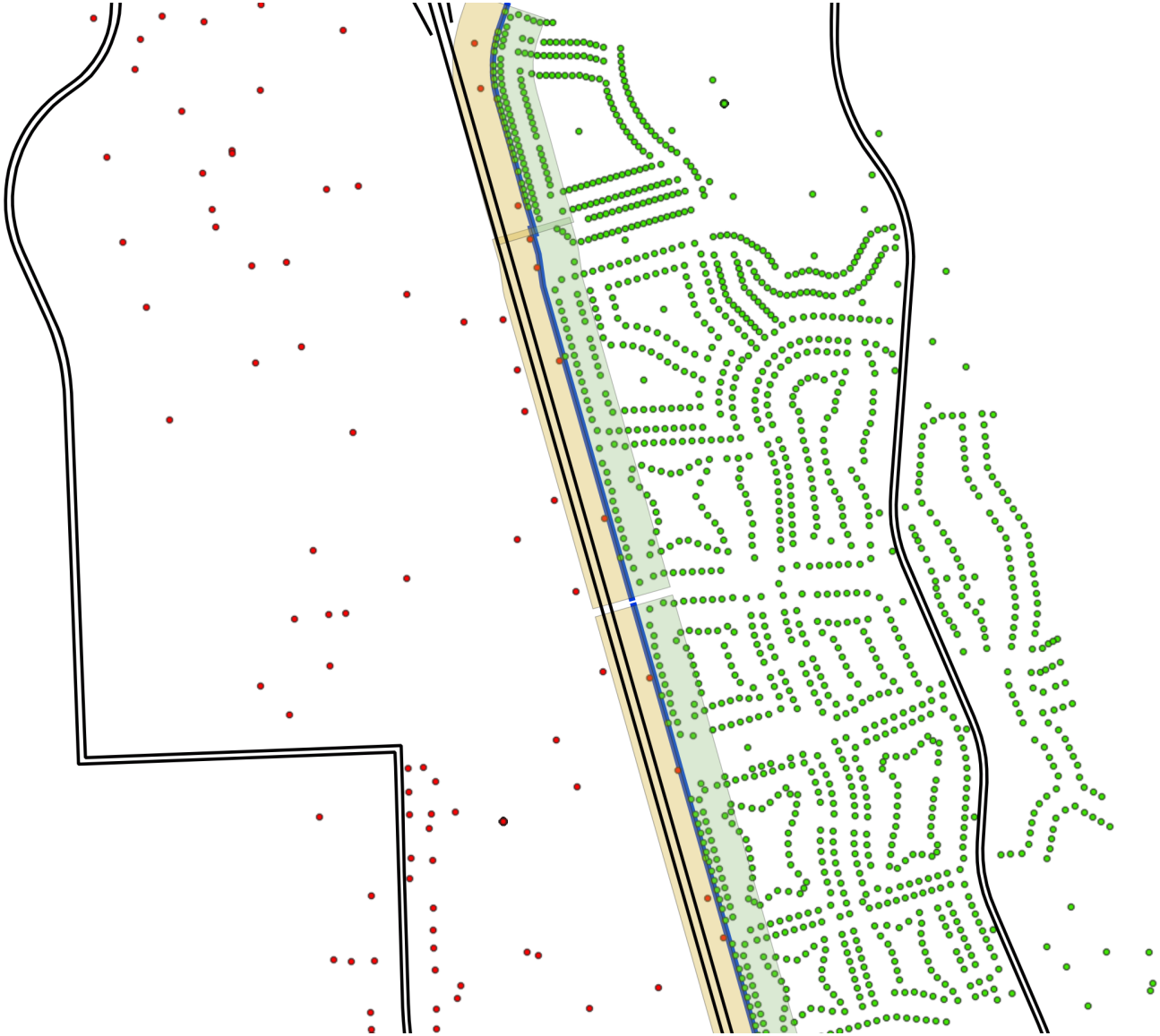
Data

- **Corelogic transactions** (1990-2022)
  - Transaction characteristics, sale date, sale price, buyer / seller info
- **Corelogic assessor data** (2006, 2022)
  - Building characteristics, year built, location
- **FDOT barriers inventory** (1988-2023)
  - Barrier, built year, cost, materials, noise reduction, shapefile
  - Information on constructed barriers and proposed ones
- **DOT national transporation map** (2020)
  - Model-based estimate of local noise from aviation, rail, and roads
- **5-year ACS** (2015-2019)
  - Neighborhood demographics like income, poverty rates, share of pop that is black, home values

Sample

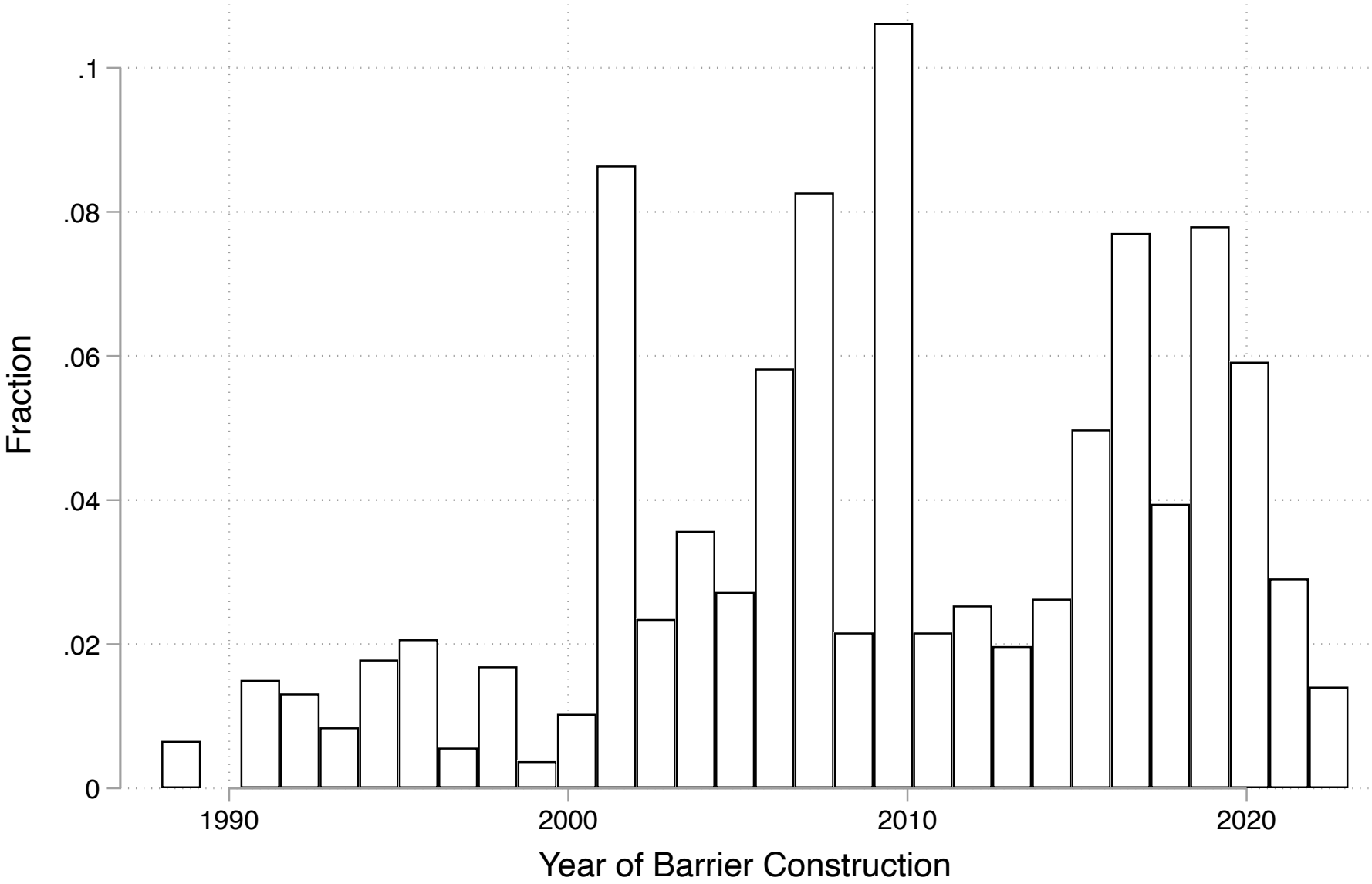
- Florida
  - Large, diverse state (w/ complete geocoded barrier data)
  - We use data on the universe of FL sound barriers
    - ★ Since 1988, $N = 1064$
- Transaction restrictions
  - Small buildings: ≤ 4 stories, ≤ 2 units
  - SFR, condo, apartment, or duplex; no mobile homes
  - Arm's length transactions
  - Greater than \$1k, less than \$7.5m
- Time period
  - Transactions from 1990 to 2022
  - Five years prior to/since barrier construction
- Spatial area
  - Buffer of length 1500m drawn from barrier
  - Use barrier-parcel pairs that are closest

Spatial sampling of transactions

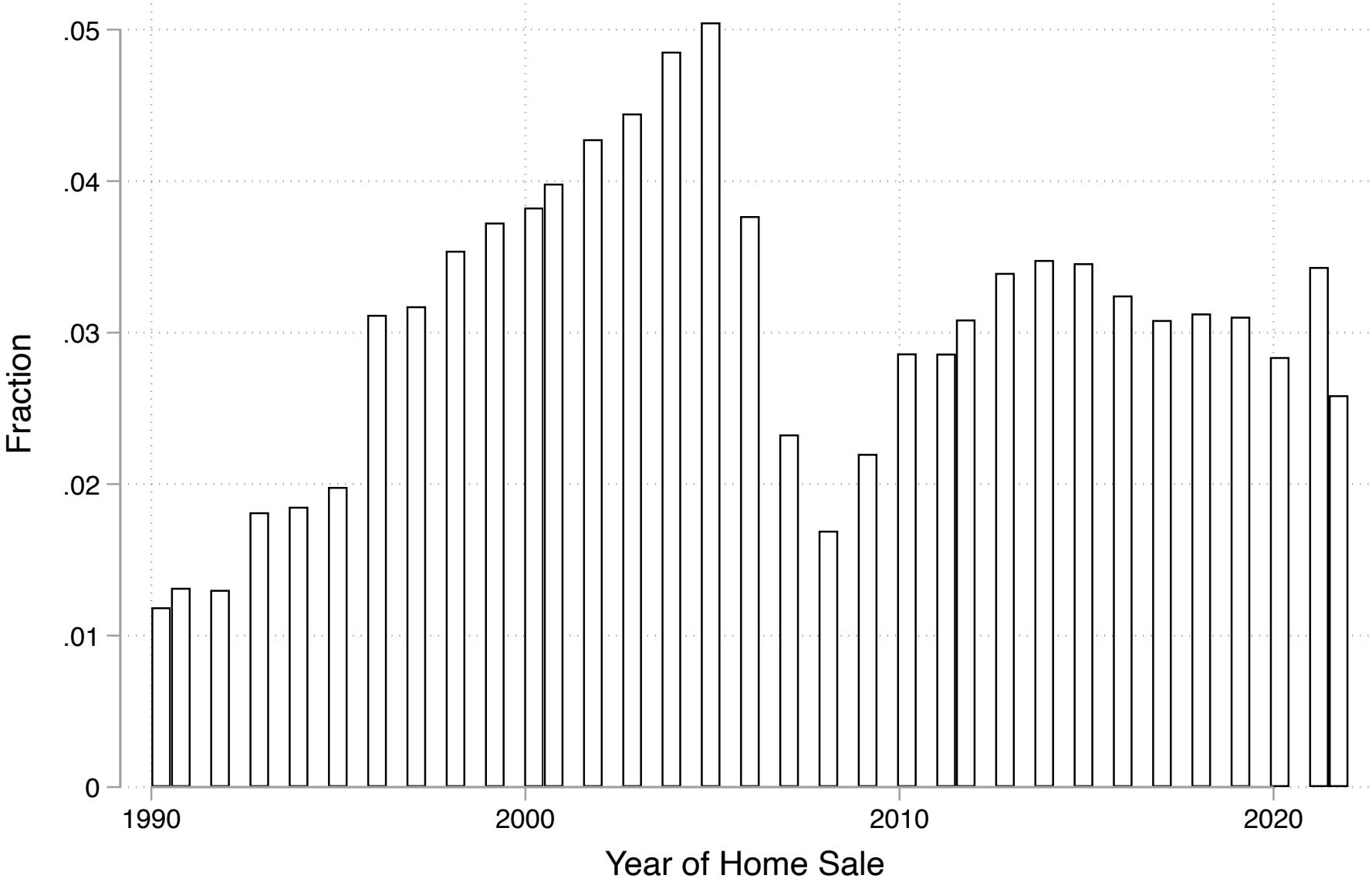


▸ algorithm here

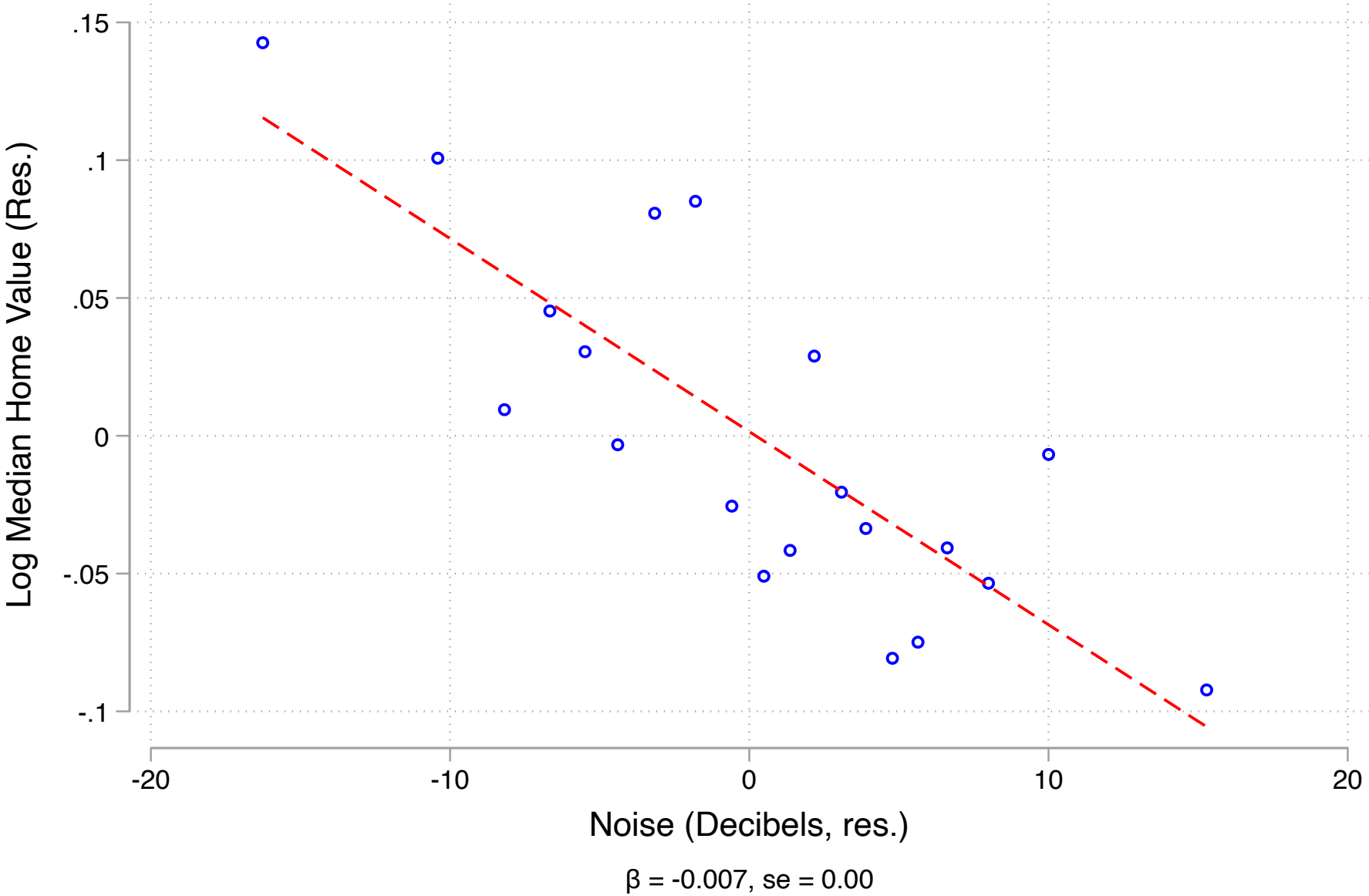
Distribution of barrier construction years



Distribution of transaction years



Home values and noise



Design

- ρ_{it} is the sale price of parcel i at time t
- τ is years since / to barrier construction; d is distance from barrier b
- Difference-in-differences across space

$$\log \rho_{it} = \sum_{j \leq 1200\text{m}} \mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau \geq 0\} \cdot \beta_j$$

$$+ \sum_{j} \left(\mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau < -5\} \cdot \beta_j^0 + \mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau > 5\} \cdot \beta_j^1 \right)$$

$$+ \gamma_{b(i)d(i)} + \eta_{b(i)\tau} + x_{it}'\zeta + \varepsilon_{it}$$

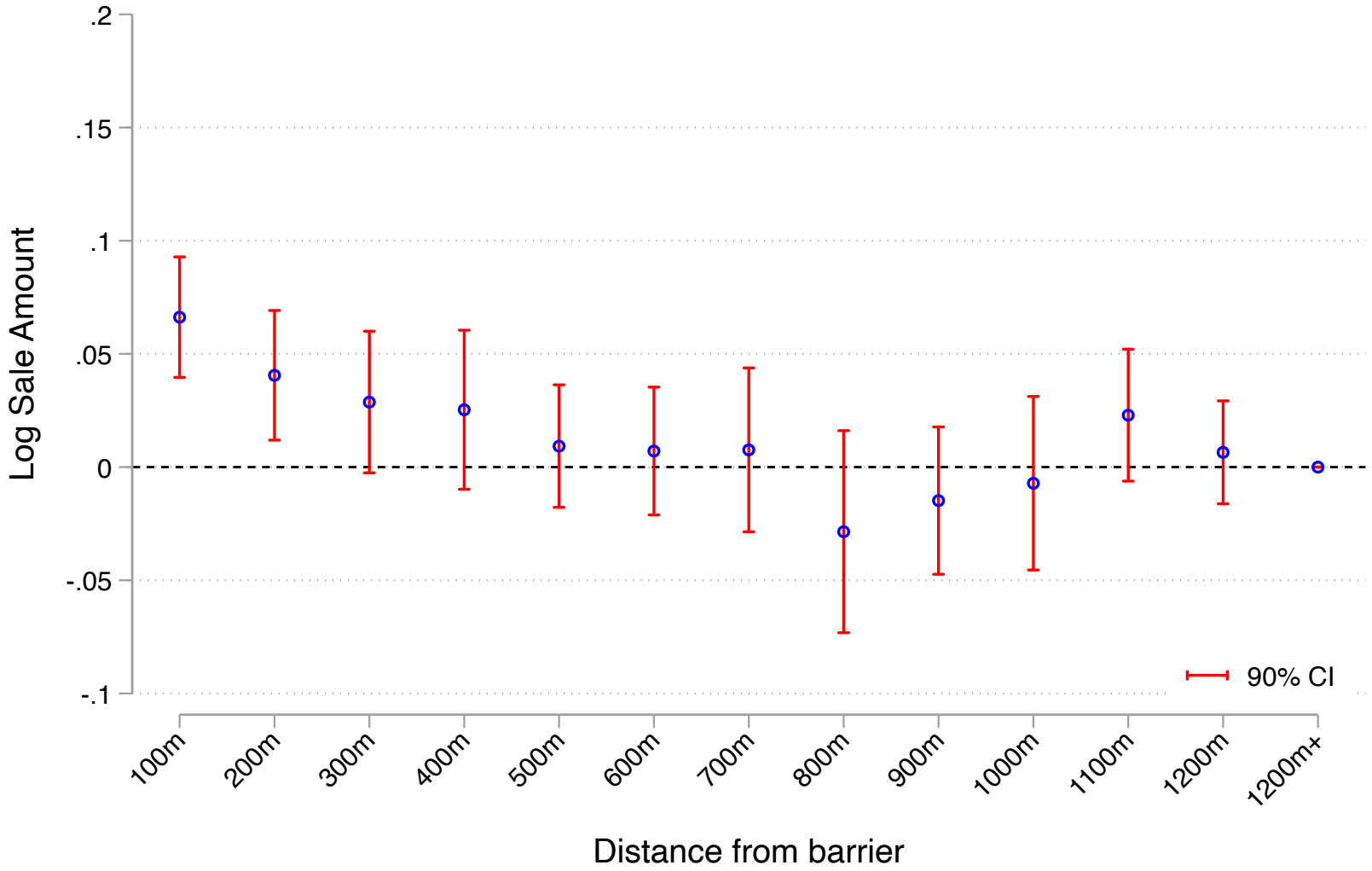
- Event study for a single distance group d^*

$$\log \rho_{it} = \sum_{k \neq -1} \mathbb{1}\{\text{dist} = d^*\} \cdot \mathbb{1}\{\tau = k\} \cdot \alpha_k$$

$$+ \sum_{j \neq d^*,\ j \leq 500\text{m}} \mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau \geq 0\} \cdot \tilde{\beta}_j + \sum_{j} \Bigg(\mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau < -5\} \cdot \beta_j^0$$

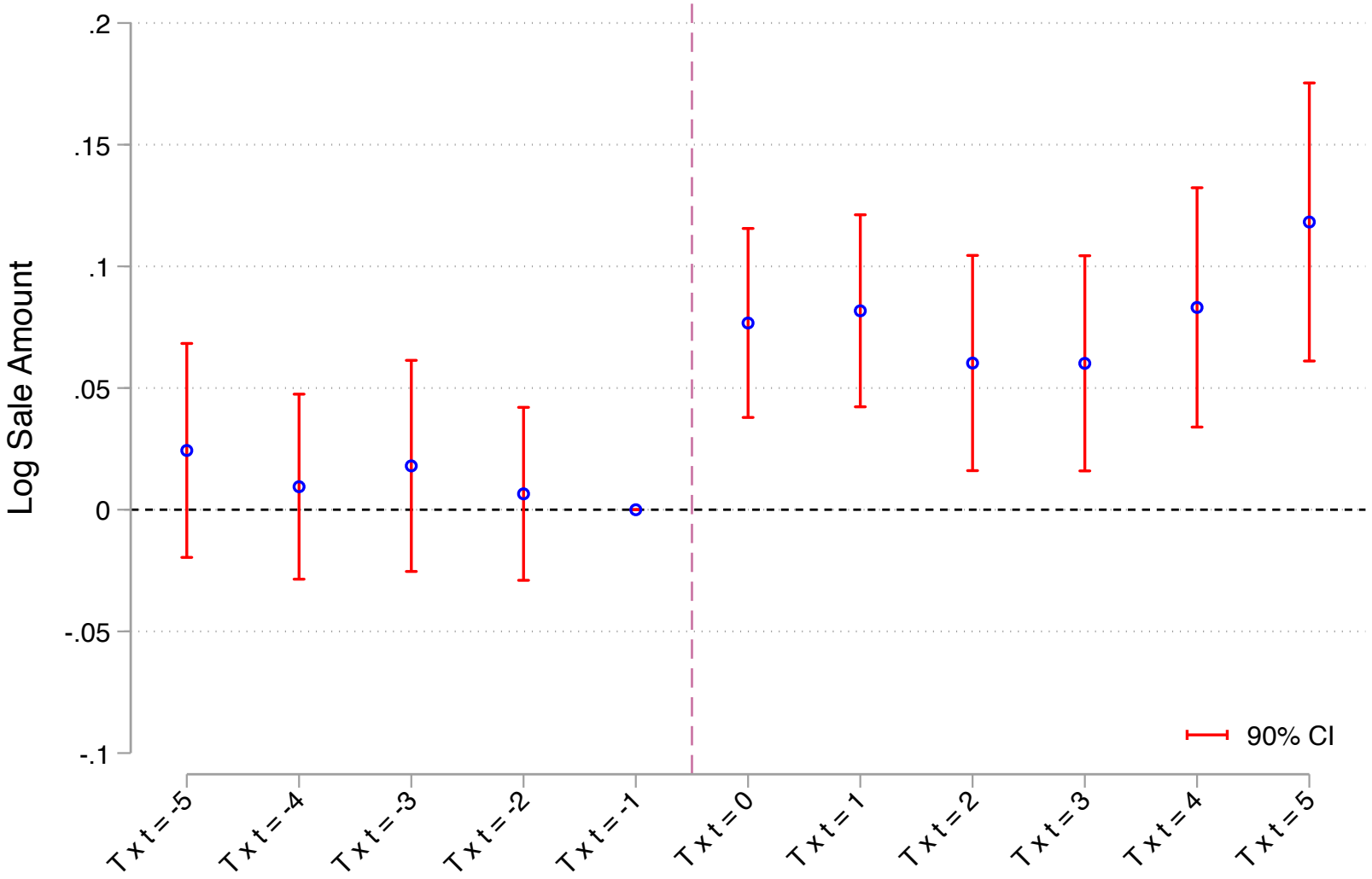
$$+ \mathbb{1}\{\text{dist} = j\} \cdot \mathbb{1}\{\tau > 5\} \cdot \beta_j^1 \Bigg) + \tilde{\gamma}_{b(i)d(i)} + \tilde{\eta}_{b(i)\tau} + x_{it}'\tilde{\zeta} + \tilde{\varepsilon}_{it}$$

Difference-in-differences estimates by distance



- Control group: 1200-1500 m

Effects for 0-100m by event time



▸ other distances here

- Control group: 500-1500 m

Alternative specifications

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value	(5) Log. Value	(6) Log. Value
100 meters x post	0.0672***	0.0846***	0.0660***	0.0876***	0.0761***	0.101***
	(0.0131)	(0.0220)	(0.0157)	(0.0260)	(0.0166)	(0.0260)
200 meters x post	0.0418***	0.0615***	0.0423***	0.0650***	0.0581***	0.0814***
	(0.0135)	(0.0189)	(0.0156)	(0.0227)	(0.0162)	(0.0231)
300 meters x post	0.0296**	0.0443**	0.0298**	0.0439*	0.0415***	0.0524**
	(0.0123)	(0.0196)	(0.0141)	(0.0226)	(0.0147)	(0.0221)
400 meters x post	0.0264	0.0411*	0.0270	0.0422*	0.0291	0.0458**
	(0.0180)	(0.0214)	(0.0202)	(0.0229)	(0.0207)	(0.0234)
500 meters x post	0.0103	0.0151	0.0108	0.0181	0.0200	0.0294*
	(0.0103)	(0.0155)	(0.0113)	(0.0163)	(0.0122)	(0.0173)
Observations	594,936	474,033	1,093,205	933,301	1,093,205	933,301
R^2	0.699	0.820	0.681	0.800	0.682	0.801
Main FE	✓	✓	✓	✓	✓	✓
Parcel FE		✓		✓		✓
Not Built BIDs			✓	✓	✓	✓
Dist x Yr FE					✓	✓

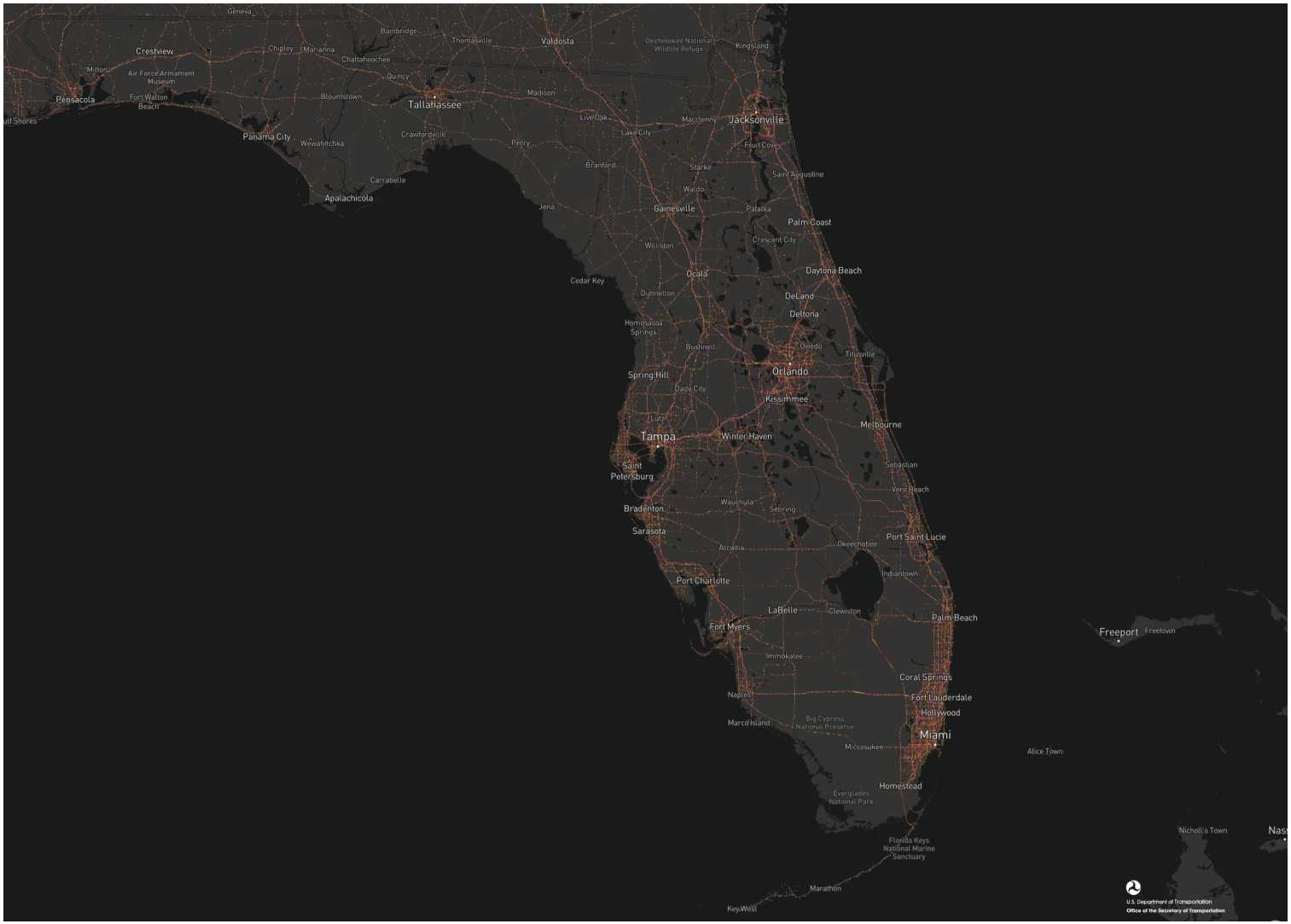
Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Discussion

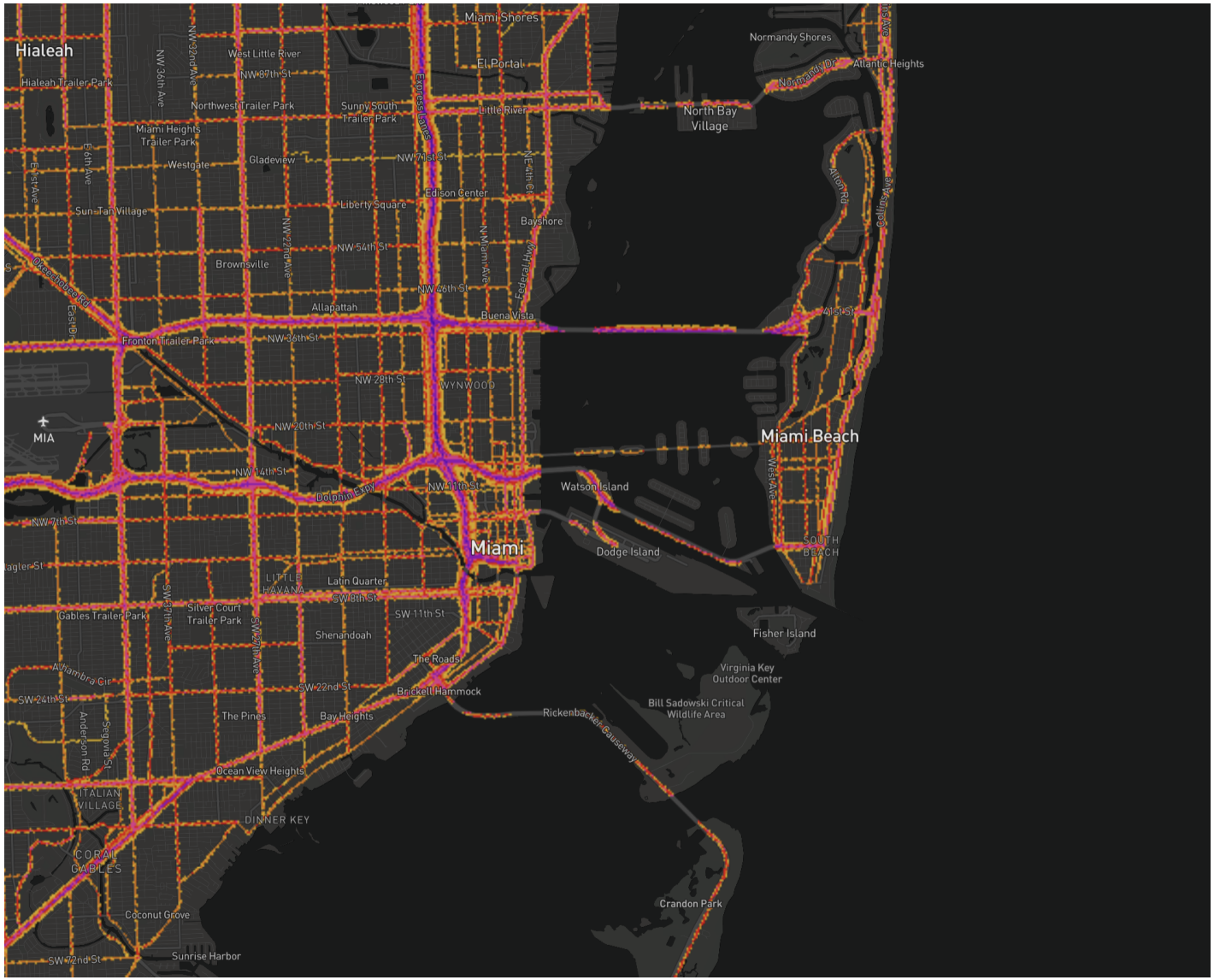
- Main estimate of 6.7% effect within 100m of barrier
  - Price depreciation of 0.9% with every decibel of noise
  - Property value appreciation over costs (MVPF): 1.7
  - MVPF for proposed barriers: 1.3
- Effects are driven by noise reduction
  - Effects decline with distance
  - Effects are larger for longer barriers ▸ here
  - Effects are larger for more effective barriers ▸ here
- Results are robust
  - Little to no composition change in transactions, home types, and building characteristics across distance bins ▸ tables here
  - Dropping outliers ▸ here or new construction ▸ here
  - Placebos: opposite side of highway ▸ here, permute year constructed ▸ here, proposed but unconstructed barriers ▸ here
  - PPML ▸ here, repeat sales and distance by year FE specifications

Extrapolating these effects to all locations



Source: 2020 National Transportation Noise Map

Noise is uneven and concentrated within cities



Source: 2020 National Transportation Noise Map

Price effects vary by barrier effectiveness

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0659***	0.0538***	0.0568***	0.0567***
	(0.0197)	(0.0191)	(0.0199)	(0.0206)
T*post $\times$ (**DBs** $-$ 7)		0.0159*	0.0280**	0.0280**
		(0.00942)	(0.0128)	(0.0126)
T*post $\times$ (**DBs** $-$ 7)^2			-0.00476	-0.00462
			(0.00316)	(0.00467)
T*post $\times$ (**DBs** $-$ 7)^3				-2.90e-05
				(0.000657)
Observations	232,680	222,295	222,295	222,295
R^2	0.687	0.687	0.687	0.687
Main Controls	✓	✓	✓	✓
DBA effects	Const.	Linear	Quad.	Cubic
Partial F	11	5.4	3.6	2.9
p-val	.00084	.0049	.012	.021

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Price effects do not vary with noise

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0672***	0.0717***	0.0687***	0.0637***
	(0.0131)	(0.0156)	(0.0178)	(0.0197)
T*post $\times$ (**Noise** $-$ 45**db**)		-0.000903	0.000750	0.00515
		(0.00139)	(0.00353)	(0.00681)
T*post $\times$ (**Noise** $-$ 45**db**)^2			-9.60e-05	-0.000550
			(0.000131)	(0.000572)
T*post $\times$ (**Noise** $-$ 45**db**)^3				1.02e-05
				(1.26e-05)
Observations	594,936	594,936	594,936	594,936
R^2	0.699	0.699	0.699	0.699
Main Controls	✓	✓	✓	✓
Noise effects	Const.	Linear	Quad.	Cubic
Partial F	26	13	8.8	6.8
p-val	3.8e-07	2.7e-06	8.8e-06	.000021

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Extrapolation procedure

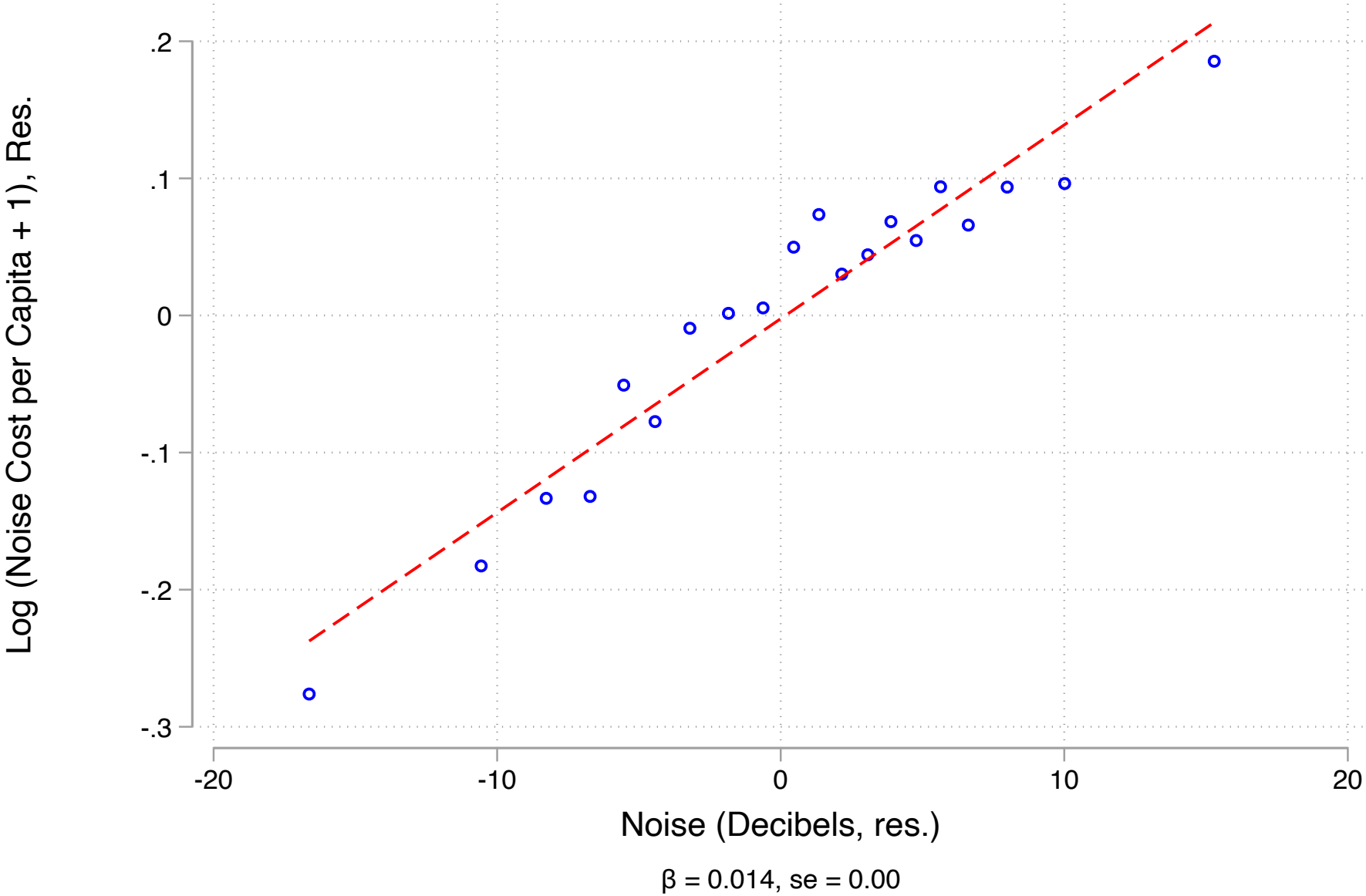
- Quadratic fits effects well
- No effect at 5.5dB reduction (5th percentile for barriers), achieves maximum at 10dB reduction (95th percentile for barriers)

$$Q^*(\mathbf{dB}) = .057 + .028 \cdot (\mathbf{dB} - 7) - .005 \cdot (\mathbf{dB} - 7)^2$$

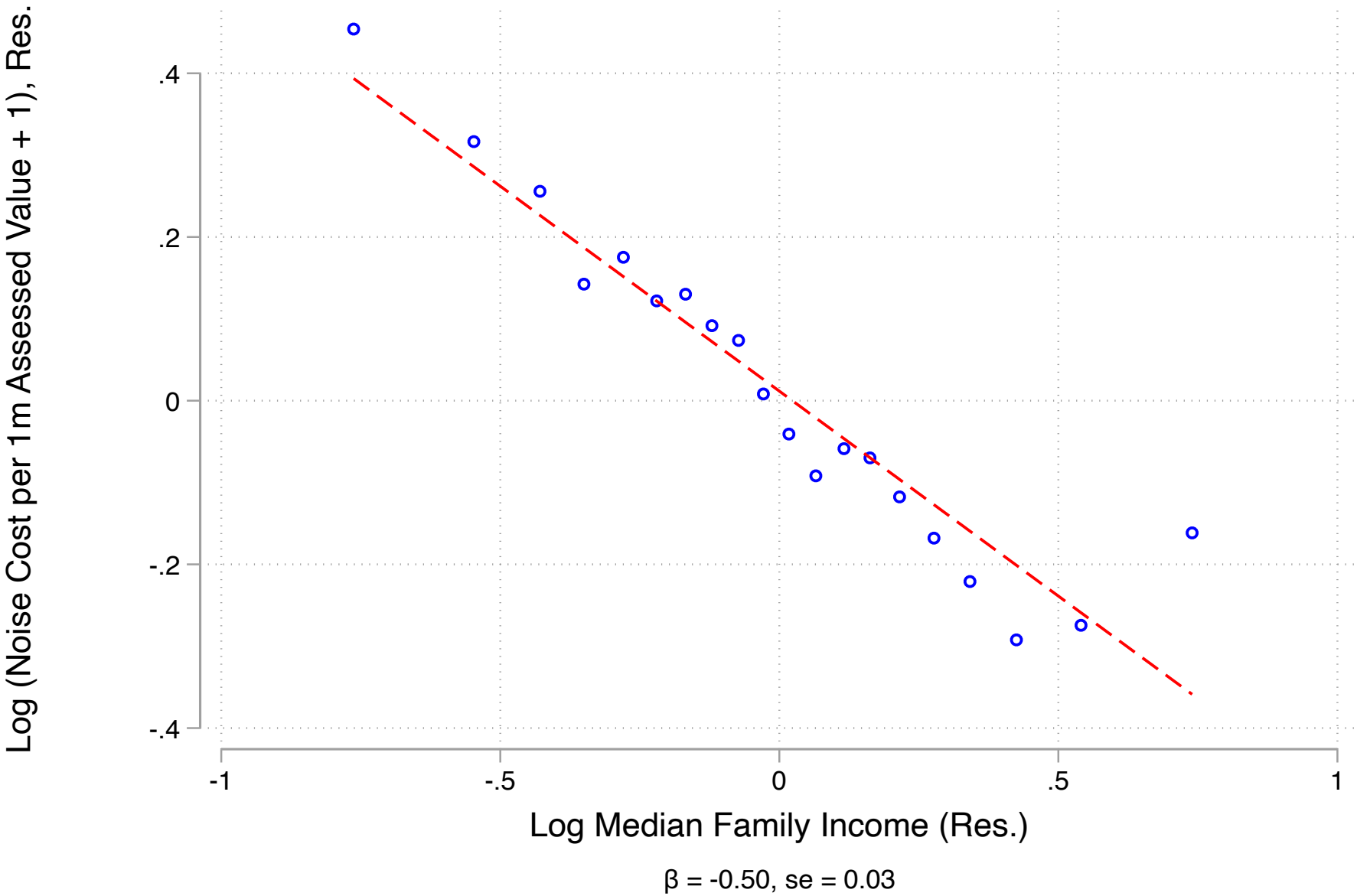
$$Q(\mathbf{dB}) = \begin{cases} 0 & \text{if } Q^* < 0 \\ Q^*(10) & \text{if } \mathbf{dB} > 10 \end{cases}$$

- Ambient urban noise is 45dB
- Capacity for noise reduction at a location: $\text{noise}_i - 45\text{dB}$
- Cost of noise externality at parcel: $\text{Property Value}_i \times Q(\text{noise}_i - 45)$
- Aggregate to neighborhoods (2010 census tracts)

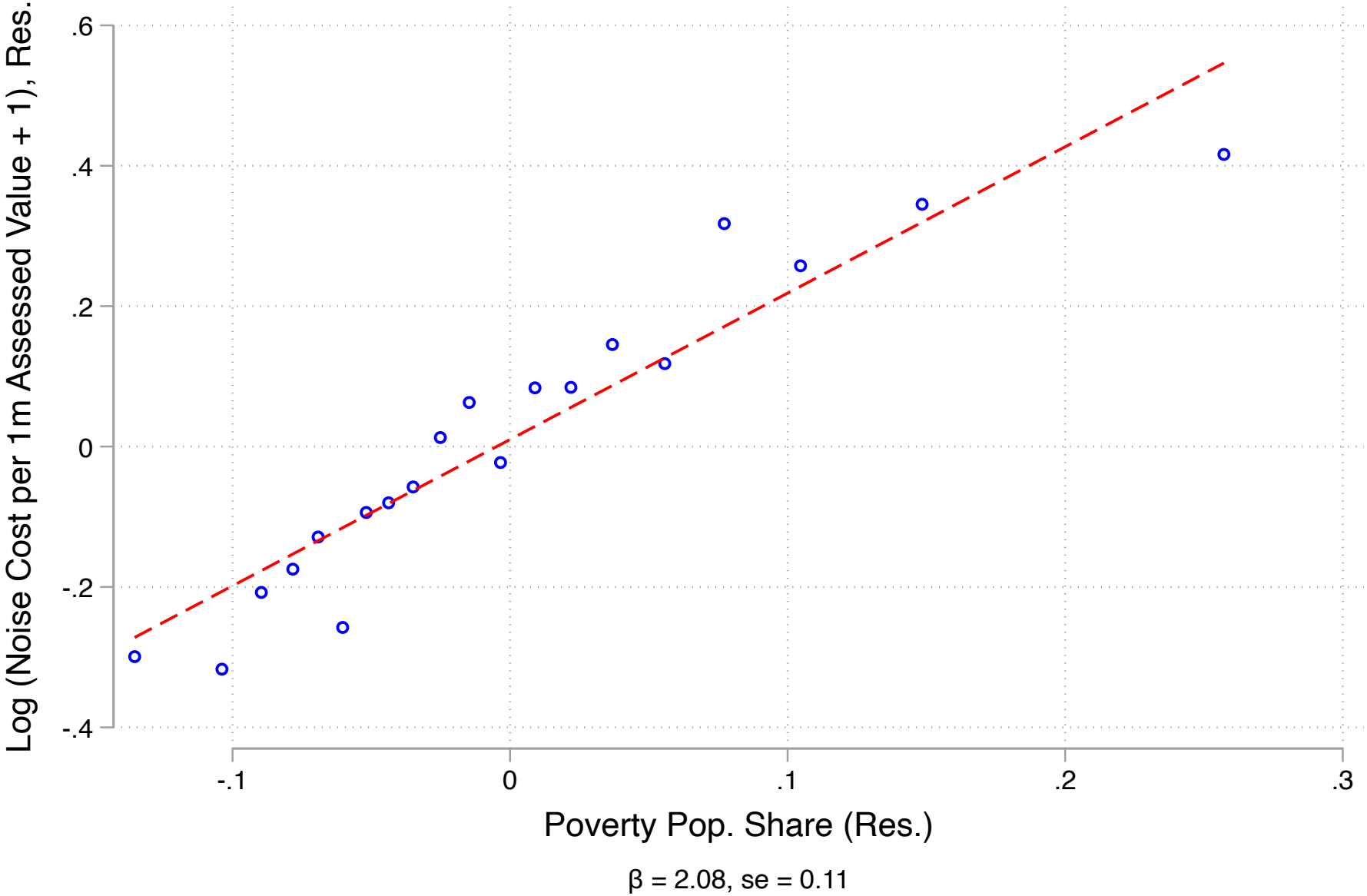
Noise externality costs and local noise across nbhds



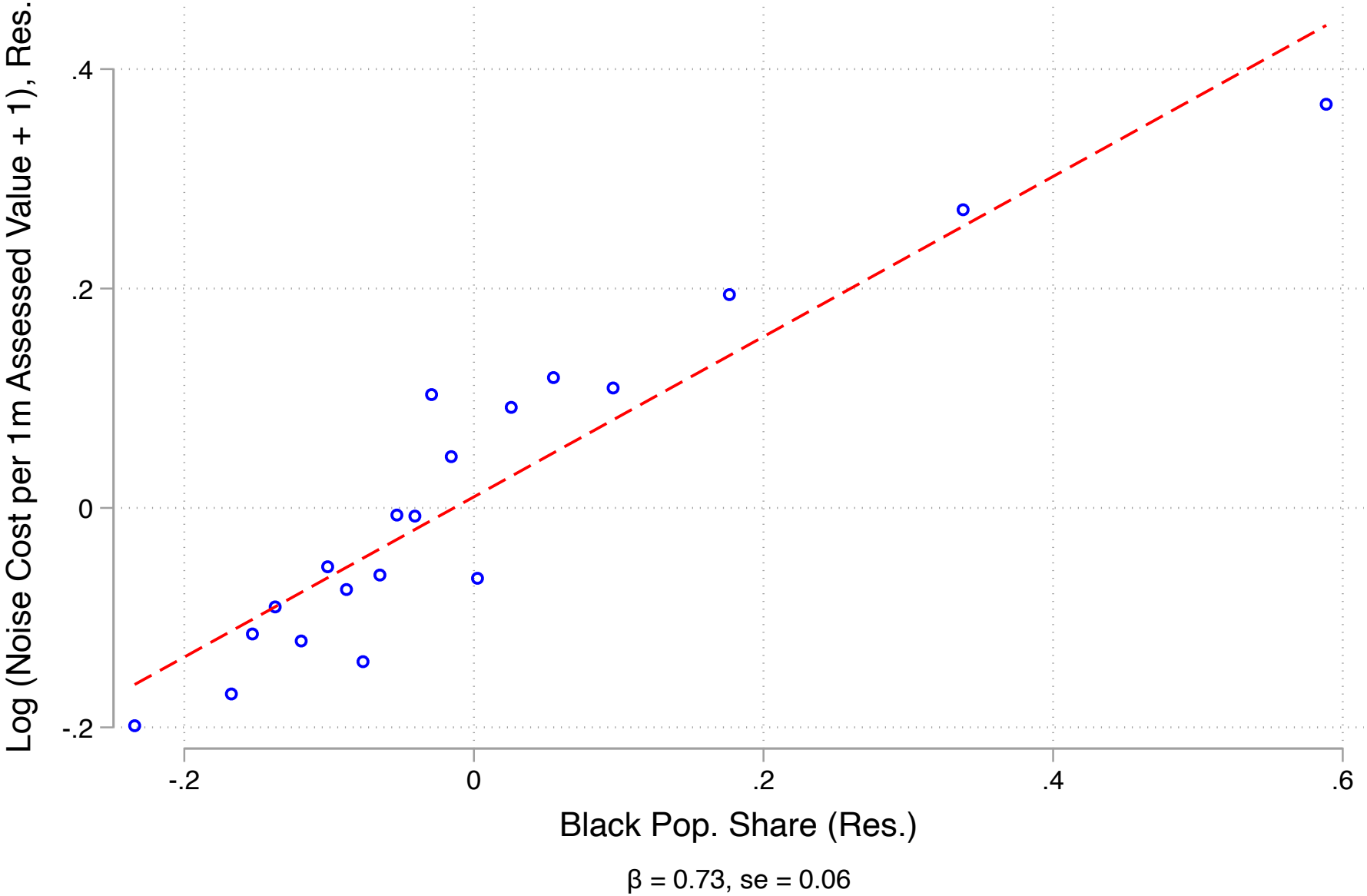
Noise externality costs and income across nbhds



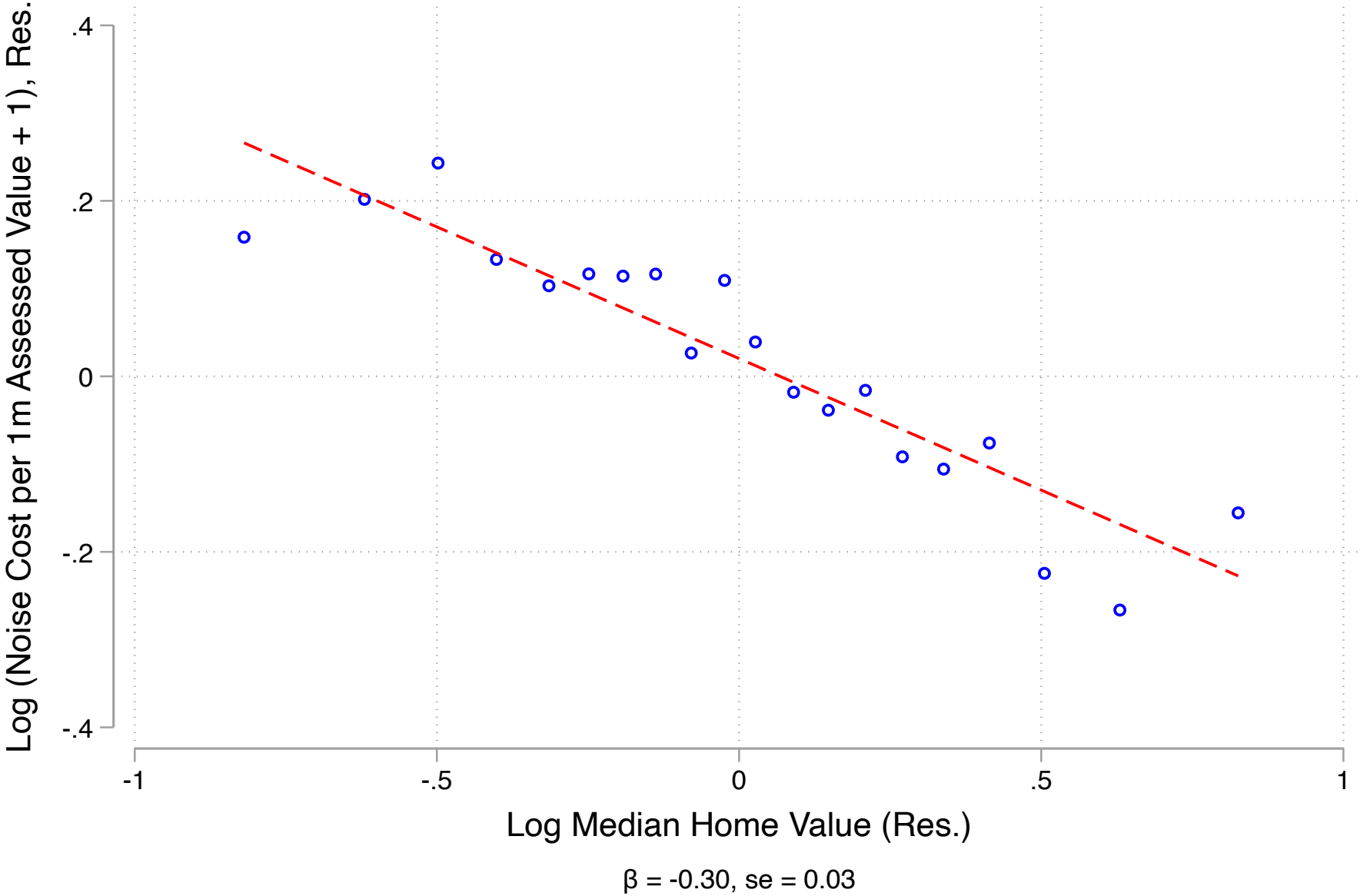
Noise externality costs and poverty across nbhds



Noise externality costs and share of the nbhd that is black



Noise externality costs and home values across nbhds



Externality is progressive in per capita terms

Recent policies for EV adoption

- Biden administration passed several policies to support EV adoption
- Infrastructure Investment and Jobs Act (2021)
  - $5B for charging ports along highways
  - $2.5B in competitive grants for charging infrastructure, with 50% of funding for low-income and rural neighborhoods
  - $2.5B for purchase or lease of electric school buses
- Inflation Reduction Act (2021)
  - $7500 tax credit for EV buyers
    - Also a used EV vehicle tax credit
  - $3B to electrify USPS federal fleet
- Manufacturing incentives
  - IIJA: $6.1B for battery processing & recycling grants
  - IRA: $10B investment tax credit for manufacturers in EV projects
  - IRA: $3B incentives for battery and minerals production
  - IRA: $2B to retrofit existing factories for EVs

Noise costs and EV benefits

- For EV calculation: 100% EVs would reduce noise by 7.1dB
- Assume (for now) that this applies to all roads equally

Sample	Noise Costs			100% EV Benefits		
	Total ($1b)	Cost ($1k) per Capita	Cost per 1m Prop. Val. (%)	Total ($1b)	Value ($1k) per Capita	Value per 1m Prop. Val. (%)
Florida	8.36	0.40	3.09	5.63	0.27	2.08
Lower Quartile (MFI)	2.02	0.41	5.26	1.35	0.28	3.52
Upper Quartile (MFI)	3.04	0.59	2.56	2.07	0.40	1.74
Lower Quartile (% Black)	2.35	0.56	2.72	1.60	0.38	1.85
Upper Quartile (% Black)	1.87	0.35	4.20	1.25	0.23	2.81
United States	127.41			85.83		

Conclusion

- Traffic noise is a pervasive problem affecting millions of Americans
- Causal evidence: noise $\uparrow$ 1dB $\Rightarrow$ property values $\downarrow -0.9\%$
- We find that the aggregate costs of this externality are regressive
  - Caveat: the price for noise is set by distaste among the marginal buyer. Many residents may be inframarginal
- The local benefits of EVs are both progressive and significantly larger than current subsidies

Sample algorithm

- Data
  - Roads, barriers, parcel locations
- Determine side that is affected by noise barrier
  - Calculate sum total of roads within 100m, 200m of barrier on either side
  - Side for analysis will be side with "less" road on it
- Determine parcels affected by barrier
  - Take line segment from begin and end point of the noise barriers, take straight one-sided buffer extending 1500m out, take all parcels in that barriers
  - Union with parcels within 100m buffer of barrier

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Transaction types

	(1) Investor (0/1)	(2) Resale (0/1)	(3) New Bldg (0/1)	(4) Cash (0/1)	(5) Mortgage (0/1)	(6) Foreclosure (0/1)
100 meters x post	-0.000284	-0.00462	0.00457	-0.0164*	0.00726	-0.000309
	(0.00283)	(0.00799)	(0.00799)	(0.00974)	(0.00989)	(0.00870)
200 meters x post	-0.000285	0.00250	-0.00251	-0.00818	0.000276	0.00622
	(0.00273)	(0.00722)	(0.00722)	(0.00948)	(0.00977)	(0.00826)
300 meters x post	-0.00472	-0.00344	0.00364	-0.0118	0.00685	7.94e-05
	(0.00296)	(0.00583)	(0.00583)	(0.01000)	(0.0101)	(0.00836)
400 meters x post	-0.00184	-0.00196	0.00202	-0.00627	0.00187	-0.00301
	(0.00290)	(0.00621)	(0.00621)	(0.0111)	(0.0112)	(0.00858)
500 meters x post	-0.00119	-0.00113	0.00108	-0.0288***	0.0237**	0.00167
	(0.00268)	(0.00617)	(0.00617)	(0.0103)	(0.0104)	(0.00788)
600 meters x post	-0.00137	0.00654	-0.00658	-0.0206**	0.0133	0.00137
	(0.00314)	(0.00863)	(0.00863)	(0.0104)	(0.0106)	(0.00808)
700 meters x post	0.00238	0.0107	-0.0107	-0.0184	0.0175	0.00446
	(0.00275)	(0.00944)	(0.00943)	(0.0117)	(0.0119)	(0.00935)
800 meters x post	0.000124	0.0130	-0.0129	-0.0291**	0.0248**	-0.00690
	(0.00283)	(0.00926)	(0.00927)	(0.0117)	(0.0123)	(0.00788)
900 meters x post	0.00391	0.0108	-0.0111	-0.00114	-0.00334	0.00462
	(0.00284)	(0.00787)	(0.00787)	(0.00988)	(0.0102)	(0.00685)
1000 meters x post	-0.00298	0.00732	-0.00729	-0.0182*	0.0157	-0.00532
	(0.00296)	(0.00760)	(0.00760)	(0.0103)	(0.0105)	(0.00730)
1100 meters x post	-0.00327	0.00339	-0.00337	-0.00392	0.00497	0.00799
	(0.00289)	(0.00651)	(0.00651)	(0.0106)	(0.0110)	(0.00819)
1200 meters x post	-0.000519	0.00703	-0.00705	-0.0123	0.0101	0.0140**
	(0.00265)	(0.00625)	(0.00625)	(0.00918)	(0.00941)	(0.00700)
Observations	594,936	594,936	594,936	594,936	594,936	594,936
R^2	0.103	0.669	0.669	0.372	0.328	0.315
Outcome Mean	.02128	.9147	.08524	.3487	.6164	.1446
Barrier x Dist FE	✓	✓	✓	✓	✓	✓
Barrier x E. Time FE	✓	✓	✓	✓	✓	✓
Built Yr x Yr FE	✓	✓	✓	✓	✓	✓
Noise x Yr FE	✓	✓	✓	✓	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Residential types

	(1) SFR (0/1)	(2) Condo (0/1)	(3) Duplex (0/1)	(4) Apt. (0/1)
100 meters x post	0.0192*	-0.0143	-0.00207	-0.00284
	(0.0109)	(0.0103)	(0.00269)	(0.00252)
200 meters x post	0.00493	-0.00450	-0.000325	-0.000110
	(0.0105)	(0.00980)	(0.00212)	(0.00227)
300 meters x post	0.00966	-0.00718	-0.00166	-0.000819
	(0.0102)	(0.00973)	(0.00213)	(0.00225)
400 meters x post	0.00810	-0.00891	0.00296	-0.00214
	(0.0124)	(0.0116)	(0.00222)	(0.00233)
500 meters x post	0.0125	-0.0139	0.00341	-0.00201
	(0.0111)	(0.0103)	(0.00235)	(0.00237)
600 meters x post	0.0167	-0.0148	-0.000472	-0.00136
	(0.0107)	(0.0104)	(0.00215)	(0.00232)
700 meters x post	0.0219*	-0.0150	-0.00201	-0.00486*
	(0.0118)	(0.0109)	(0.00219)	(0.00290)
800 meters x post	0.0142	-0.0123	-6.17e-06	-0.00198
	(0.0148)	(0.0139)	(0.00239)	(0.00222)
900 meters x post	0.0193	-0.0199	0.000347	0.000182
	(0.0168)	(0.0157)	(0.00293)	(0.00262)
1000 meters x post	0.0168	-0.0137	-0.00296	-9.88e-05
	(0.0128)	(0.0120)	(0.00286)	(0.00263)
1100 meters x post	0.0156	-0.0119	-0.000844	-0.00289
	(0.00959)	(0.00915)	(0.00281)	(0.00287)
1200 meters x post	0.0100	-0.00305	-0.00688*	-7.77e-05
	(0.00740)	(0.00575)	(0.00373)	(0.00281)
Observations	594,936	594,936	594,936	594,936
R^2	0.796	0.841	0.490	0.297
Outcome Mean	.7152	.2556	.01427	.01493
Barrier x Dist FE	✓	✓	✓	✓
Barrier x E. Time FE	✓	✓	✓	✓
Built Yr x Yr FE	✓	✓	✓	✓
Noise x Yr FE	✓	✓	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Unit characteristics

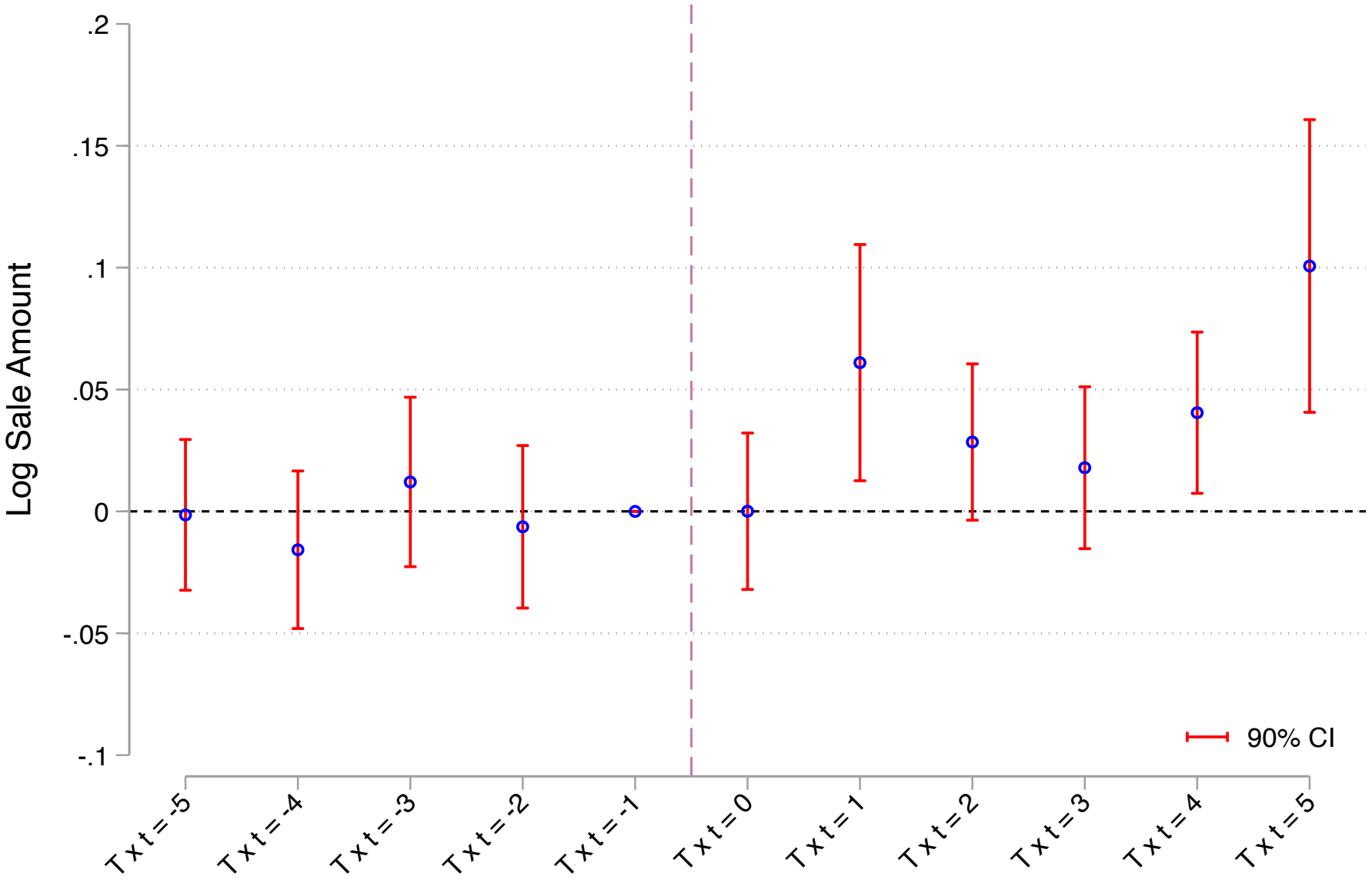
	(1) Bedrooms	(2) Stories	(3) Pool (0/1)	(4) Central AC (0/1)	(5) Finished Garage (0/1)
100 meters x post	-0.00145	0.0145	0.00544	-0.00175	0.00328
	(0.0241)	(0.0154)	(0.00615)	(0.00459)	(0.00555)
200 meters x post	-0.0142	0.00535	0.00348	0.00121	0.00721
	(0.0204)	(0.0145)	(0.00540)	(0.00435)	(0.00498)
300 meters x post	-0.00113	0.0267*	0.0122**	0.00257	0.00469
	(0.0206)	(0.0147)	(0.00610)	(0.00433)	(0.00529)
400 meters x post	-0.0189	0.0236	0.000502	-0.00437	0.00340
	(0.0241)	(0.0175)	(0.00613)	(0.00612)	(0.00605)
500 meters x post	0.0149	0.0237	0.00893	-0.000179	0.00172
	(0.0194)	(0.0151)	(0.00651)	(0.00504)	(0.00518)
600 meters x post	0.0226	0.0380**	0.00484	0.00418	0.00570
	(0.0200)	(0.0160)	(0.00618)	(0.00496)	(0.00543)
700 meters x post	0.0141	0.0374**	0.00294	0.00600	-0.00285
	(0.0185)	(0.0178)	(0.00686)	(0.00489)	(0.00568)
800 meters x post	0.00845	0.0314	0.000528	0.00214	0.000953
	(0.0173)	(0.0206)	(0.00655)	(0.00446)	(0.00557)
900 meters x post	0.0292	0.0470*	-0.00151	0.00148	0.00776
	(0.0211)	(0.0264)	(0.00718)	(0.00471)	(0.00611)
1000 meters x post	0.0208	0.0319	0.00309	-0.00205	0.0100*
	(0.0219)	(0.0203)	(0.00676)	(0.00443)	(0.00521)
1100 meters x post	0.00920	0.0171	-0.00602	0.00123	-0.00338
	(0.0208)	(0.0131)	(0.00724)	(0.00467)	(0.00531)
1200 meters x post	-0.0205	0.0159	-0.00447	0.00594	0.000457
	(0.0186)	(0.00992)	(0.00645)	(0.00499)	(0.00507)
Observations	594,936	594,936	594,936	594,936	594,936
R^2	0.550	0.718	0.467	0.907	0.792
Outcome Mean	2.839	1.234	.1794	.3035	.2168
Barrier x Dist FE	✓	✓	✓	✓	✓
Barrier x E. Time FE	✓	✓	✓	✓	✓
Built Yr x Yr FE	✓	✓	✓	✓	✓
Noise x Yr FE	✓	✓	✓	✓	✓

Robust standard errors in parentheses

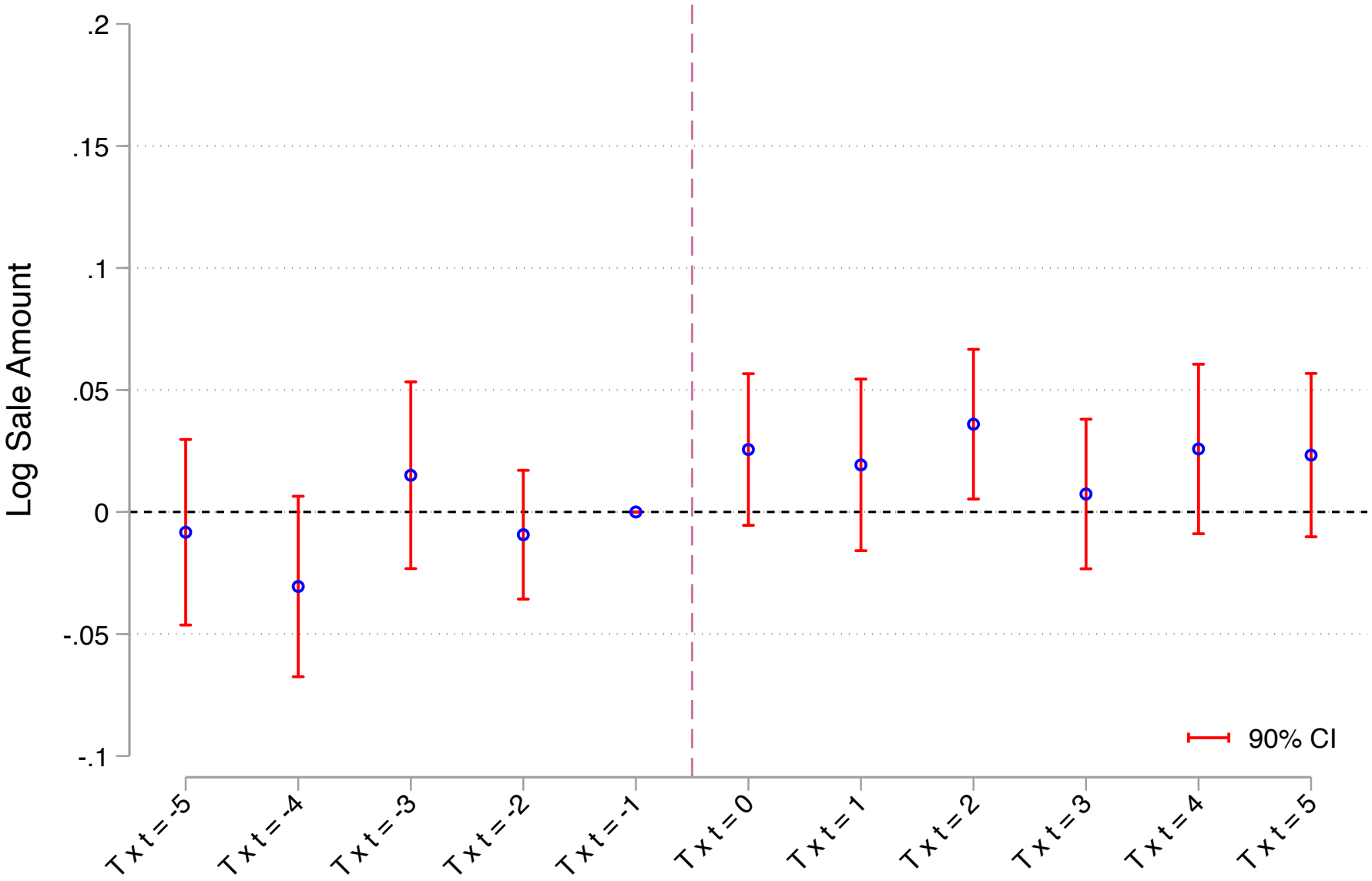
*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

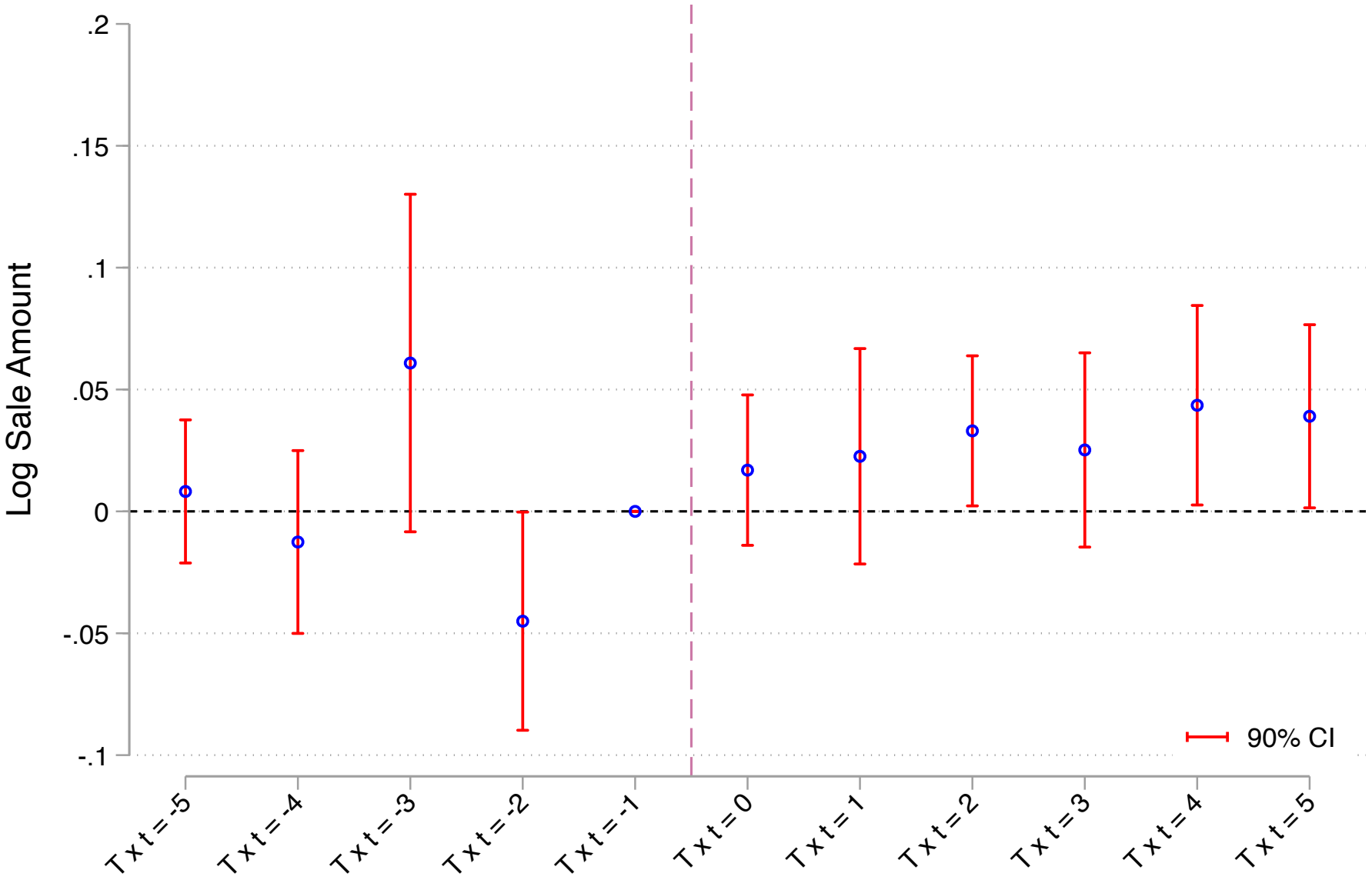
Event study for 100-200m



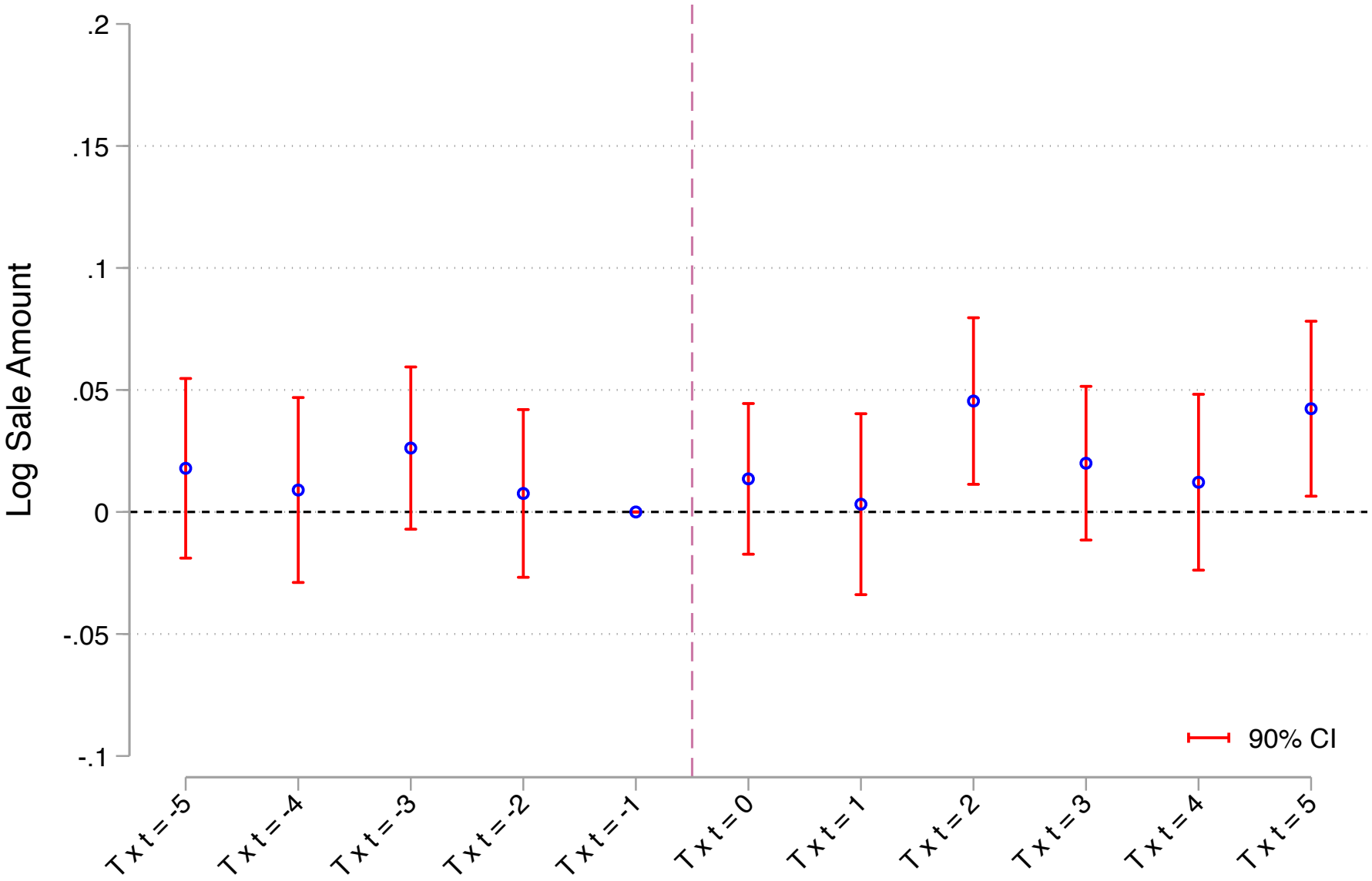
Event study for 200-300m



Event study for 300-400m



Event study for 400-500m



Effects by barrier length

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0672***	0.0688***	0.0679***	0.0492***
	(0.0131)	(0.0136)	(0.0151)	(0.0171)
200 meters x post	0.0418***	0.0447***	0.0410**	0.00957
	(0.0135)	(0.0141)	(0.0163)	(0.0182)
300 meters x post	0.0296**	0.0314**	0.0313**	0.00940
	(0.0123)	(0.0128)	(0.0144)	(0.0151)
400 meters x post	0.0264	0.0275	0.0385***	0.0239
	(0.0180)	(0.0193)	(0.0147)	(0.0157)
500 meters x post	0.0103	0.00717	0.00868	-0.000335
	(0.0103)	(0.0108)	(0.0124)	(0.0144)
Observations	594,936	542,199	398,886	292,376
R^2	0.699	0.697	0.692	0.695
Main Controls	✓	✓	✓	✓
Barrier Length	> 0 m	> 250 m	> 500 m	> 750 m

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Effects by barrier noise reduction

	(1) Log Sale Amt.	(2) Log Sale Amt.	(3) Log Sale Amt.	(4) Log Sale Amt.
100 meters x post	0.0659***	0.0746***	0.0934***	0.0947**
	(0.0197)	(0.0207)	(0.0343)	(0.0372)
200 meters x post	0.0389**	0.0490***	0.0535	0.0703*
	(0.0165)	(0.0175)	(0.0339)	(0.0388)
300 meters x post	0.0280**	0.0356***	0.0519**	0.0577***
	(0.0125)	(0.0134)	(0.0209)	(0.0198)
400 meters x post	0.0218	0.0210	0.0530**	0.0578**
	(0.0204)	(0.0220)	(0.0245)	(0.0276)
500 meters x post	0.00765	0.00876	0.0113	0.00160
	(0.0118)	(0.0125)	(0.0209)	(0.0244)
Observations	232,680	208,495	105,573	68,930
R^2	0.713	0.712	0.700	0.711
Main Controls	✓	✓	✓	✓
Noise Reduction	$>$ 0 dba	$>$ 6 dba	$>$ 7 dba	$>$ 8 dba

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Small outliers sensitivity

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0672***	0.0615***	0.0593***	0.0579***
	(0.0131)	(0.0121)	(0.0117)	(0.0113)
200 meters x post	0.0418***	0.0394***	0.0380***	0.0390***
	(0.0135)	(0.0125)	(0.0124)	(0.0123)
300 meters x post	0.0296**	0.0285**	0.0241**	0.0271**
	(0.0123)	(0.0118)	(0.0114)	(0.0105)
400 meters x post	0.0264	0.0249	0.0254	0.0282*
	(0.0180)	(0.0174)	(0.0172)	(0.0168)
500 meters x post	0.0103	0.00340	0.00542	0.00443
	(0.0103)	(0.00949)	(0.00922)	(0.00878)
Observations	594,936	591,606	589,302	583,305
R^2	0.699	0.753	0.768	0.784
Main Controls	✓	✓	✓	✓
Value > Cutoff	$1k	$5k	$10k	$20k

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Large outliers sensitivity

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0672***	0.0598***	0.0410***	0.0375***
	(0.0131)	(0.0125)	(0.0105)	(0.0101)
200 meters x post	0.0418***	0.0319**	0.0163	0.0175*
	(0.0135)	(0.0125)	(0.0101)	(0.00971)
300 meters x post	0.0296**	0.0237**	0.0123	0.0138
	(0.0123)	(0.0117)	(0.00991)	(0.00908)
400 meters x post	0.0264	0.0142	0.00934	2.03e-05
	(0.0180)	(0.0159)	(0.0108)	(0.00945)
500 meters x post	0.0103	0.00660	-0.00201	-0.00137
	(0.0103)	(0.00994)	(0.00951)	(0.00975)
Observations	594,936	592,541	589,921	581,004
R^2	0.699	0.701	0.708	0.711
Main Controls	✓	✓	✓	✓
Value $<$ Cutoff	$7.5m	$5m	$2.5m	$1m

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

New developments sensitivity

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0658***	0.0665***	0.0624***	0.0462***
	(0.0130)	(0.0129)	(0.0125)	(0.0115)
200 meters x post	0.0402***	0.0384***	0.0361***	0.0227*
	(0.0133)	(0.0130)	(0.0129)	(0.0120)
300 meters x post	0.0279**	0.0303***	0.0283**	0.0110
	(0.0120)	(0.0114)	(0.0113)	(0.00967)
400 meters x post	0.0235	0.0251	0.0239	-0.000721
	(0.0178)	(0.0176)	(0.0176)	(0.0158)
500 meters x post	0.00778	0.0110	0.0106	-0.00353
	(0.0102)	(0.00986)	(0.00983)	(0.00953)
Observations	588,717	577,045	573,234	541,897
R^2	0.700	0.701	0.703	0.703
Main Controls	✓	✓	✓	✓
Built on/before event time?	t=5	t=0	t=-1	t=-6

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Opposite side of highway placebo

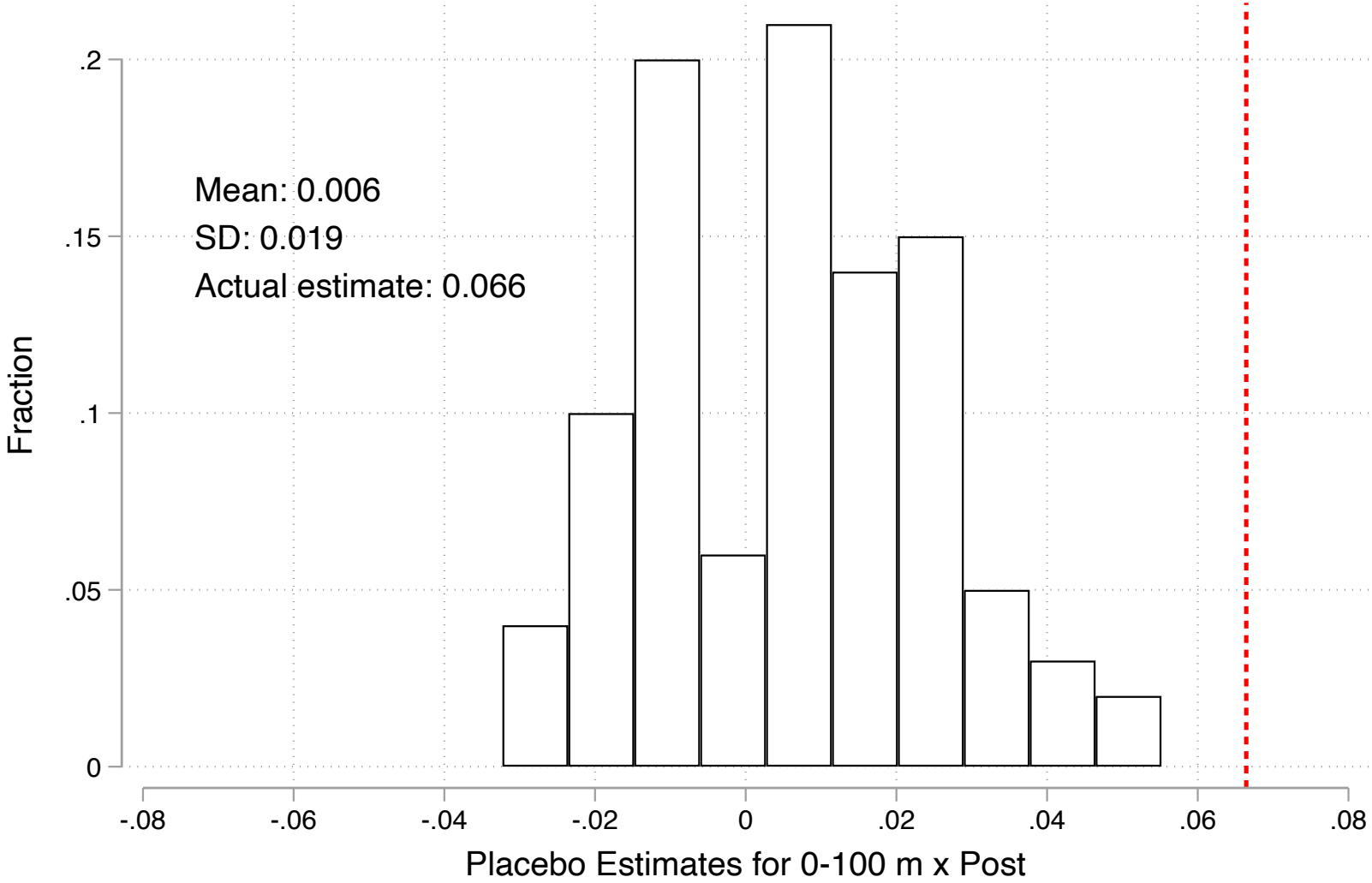
	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
0-200 meters x post	0.0409	-0.00656	0.0188	0.0136
	(0.0626)	(0.0615)	(0.0398)	(0.0391)
300 meters x post	-0.0256	-0.0260	0.00464	-0.00197
	(0.0692)	(0.0351)	(0.0281)	(0.0271)
400 meters x post	0.0764*	-0.0336	-0.00510	-0.00789
	(0.0396)	(0.0257)	(0.0207)	(0.0206)
500 meters x post	0.0896**	-0.00965	0.0146	0.0107
	(0.0446)	(0.0261)	(0.0210)	(0.0209)
Observations	176,475	174,394	174,104	174,104
R^2	0.521	0.685	0.741	0.760
Base FE	✓	✓	✓	✓
BID x Dist FE		✓	✓	✓
BID x E. Time FE		✓	✓	✓
Bldg Cov x Yr FE			✓	✓
Sale Type x Yr FE				✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

Placebo test: permute the year each barrier was built



back to slides

Placebo test: recommended barriers

	(1) Log. Value	(2) Log. Value	(3) Log. Value	(4) Log. Value
100 meters x post	0.0605*	0.0296	0.0277	0.0258
	(0.0352)	(0.0202)	(0.0226)	(0.0241)
200 meters x post	0.0247	0.00732	0.00157	0.00245
	(0.0363)	(0.0178)	(0.0157)	(0.0154)
300 meters x post	-0.00294	-0.00448	-0.0212	-0.0184
	(0.0278)	(0.0163)	(0.0160)	(0.0149)
400 meters x post	0.0395*	0.0178	0.0155	0.0119
	(0.0231)	(0.0147)	(0.0136)	(0.0135)
500 meters x post	0.0190	0.00626	0.00618	0.000689
	(0.0267)	(0.0174)	(0.0145)	(0.0137)
Observations	264,287	263,601	263,375	263,374
R^2	0.549	0.681	0.742	0.760
Base FE	✓	✓	✓	✓
BID x Dist FE		✓	✓	✓
BID x E. Time FE		✓	✓	✓
Bldg Cov x Yr FE			✓	✓
Sale Type x Yr FE				✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides

- Year built is calculated as the year built of the nearest constructed barrier

Repeat sales and PPML

	(1) Value	(2) Value	(3) Value	(4) Value	(5) Value	(6) Value
100 meters x post	0.0919***	0.0914***	0.101***	0.0909***	0.120***	0.110***
	(0.0165)	(0.0183)	(0.0207)	(0.0237)	(0.0243)	(0.0260)
200 meters x post	0.0683***	0.0778***	0.0798***	0.0827***	0.113***	0.110***
	(0.0157)	(0.0191)	(0.0202)	(0.0236)	(0.0230)	(0.0254)
300 meters x post	0.0501***	0.0451***	0.0521**	0.0478**	0.0700***	0.0574***
	(0.0149)	(0.0169)	(0.0203)	(0.0223)	(0.0208)	(0.0220)
400 meters x post	0.0700***	0.0386**	0.0746**	0.0420**	0.0748***	0.0501**
	(0.0246)	(0.0165)	(0.0297)	(0.0201)	(0.0285)	(0.0209)
500 meters x post	0.0365***	0.0427***	0.0429***	0.0446***	0.0518***	0.0546***
	(0.0130)	(0.0156)	(0.0153)	(0.0169)	(0.0159)	(0.0178)
Observations	594,936	474,033	1,093,205	933,301	1,093,205	933,301
Main FE	✓	✓	✓	✓	✓	✓
Parcel FE		✓		✓		✓
Not Built BIDs			✓	✓	✓	✓
Dist x Yr FE					✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

▸ back to slides