Property Tax Pass-Through to Renters: A Quasi-Experimental Approach

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Research Questions

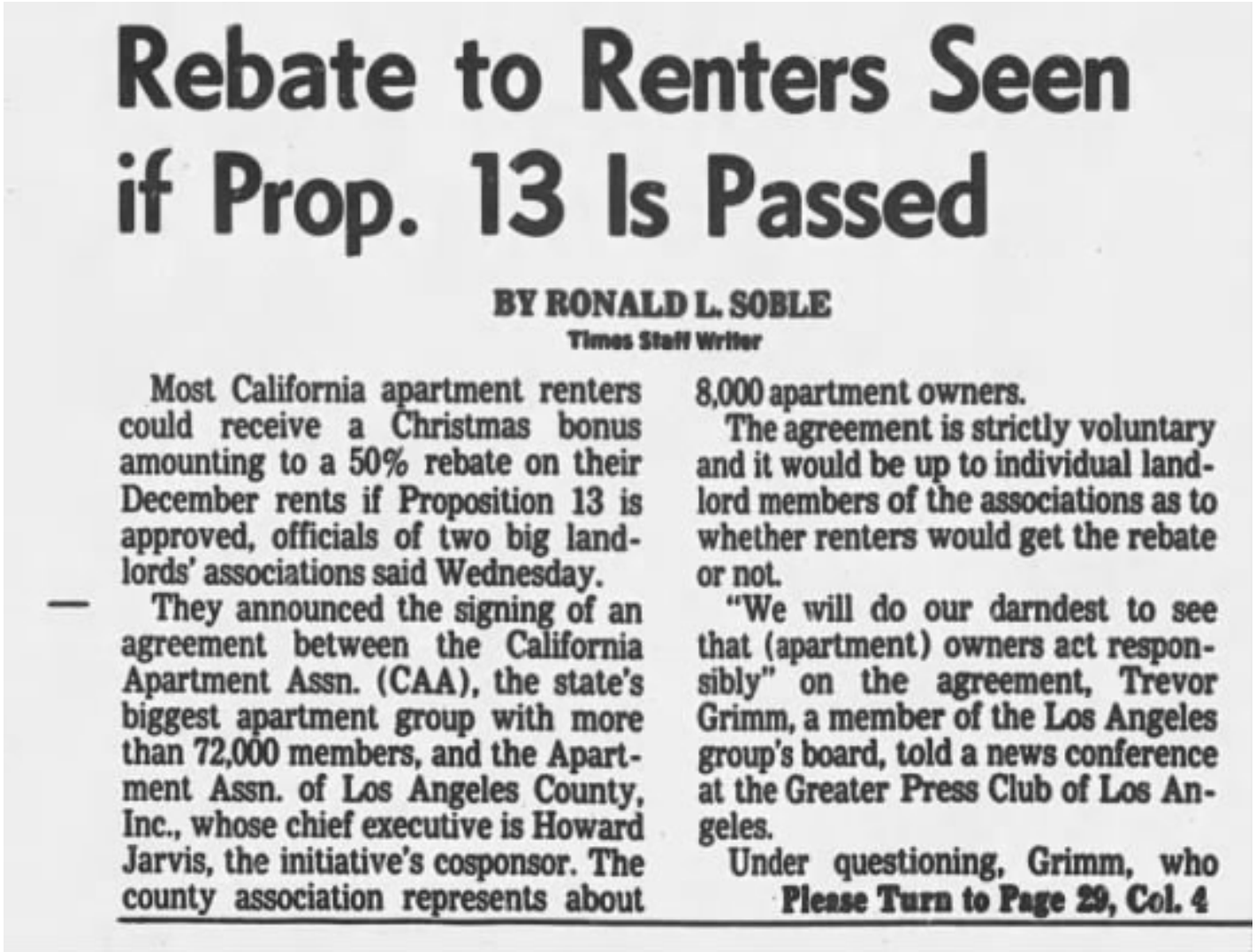
- **Do renters bear the incidence of property taxation?**
  - Yes?: Proponents of property tax caps (Prop. 13) argue that savings should pass through to renters
  - No?: Neoclassical economics tells us the law of one price should prevail over heterogeneous property tax costs
  - **Setting:** Does a landlord's property tax bill affect a new tenant's rent?
- **How do landlords price?**
  - Can landlords charge different rents for similar units?
  - Are landlords pricing 'correctly'?

Outline

Setting

- Prop. 13 in California: Property is taxed on its purchase value plus 2% per year
  - If sold, property is reassessed to new purchase value
  - $\rightarrow$ Semi-random, large increase in property taxes
  - Many other states have laws like Prop. 13 (FL, MI, OR, AZ, MA)
  - Good for long-time homeowners, good for renters?

Los Angeles Times, May 1978



Rebate to Renters Seen if Prop. 13 Is Passed

BY RONALD L. SOBLE
Times Staff Writer

Most California apartment renters could receive a Christmas bonus amounting to a 50% rebate on their December rents if Proposition 13 is approved, officials of two big landlords' associations said Wednesday.

They announced the signing of an agreement between the California Apartment Assn. (CAA), the state's biggest apartment group with more than 72,000 members, and the Apartment Assn. of Los Angeles County, Inc., whose chief executive is Howard Jarvis, the initiative's cosponsor. The county association represents about 8,000 apartment owners.

The agreement is strictly voluntary and it would be up to individual landlord members of the associations as to whether renters would get the rebate or not.

"We will do our darndest to see that (apartment) owners act responsibly" on the agreement, Trevor Grimm, a member of the Los Angeles group's board, told a news conference at the Greater Press Club of Los Angeles.

Under questioning, Grimm, who

Please Turn to Page 29, Col. 4

Setting

- Prop. 13 in California: Property is taxed on its purchase value plus 2% per year
  - If sold, property is reassessed to new purchase value
  - $\rightarrow$ Semi-random, large increase in property taxes
  - Many other states have laws like Prop. 13 (FL, MI, OR, AZ, MA)
  - Good for long-time homeowners, good for renters?
- Rent data from Berkeley, California
  - Rent data is not systematically collected: Rely on surveys, incomplete samples
  - Novel data set of unit-level leases from the Berkeley Rent Board, near-universal city coverage
  - Vacancy decontrol (1999): Landlords can set rent freely upon vacancy. **No rent control for new tenants.**

Unique Quasi-Experimental Setting

Neighboring multi-unit buildings:

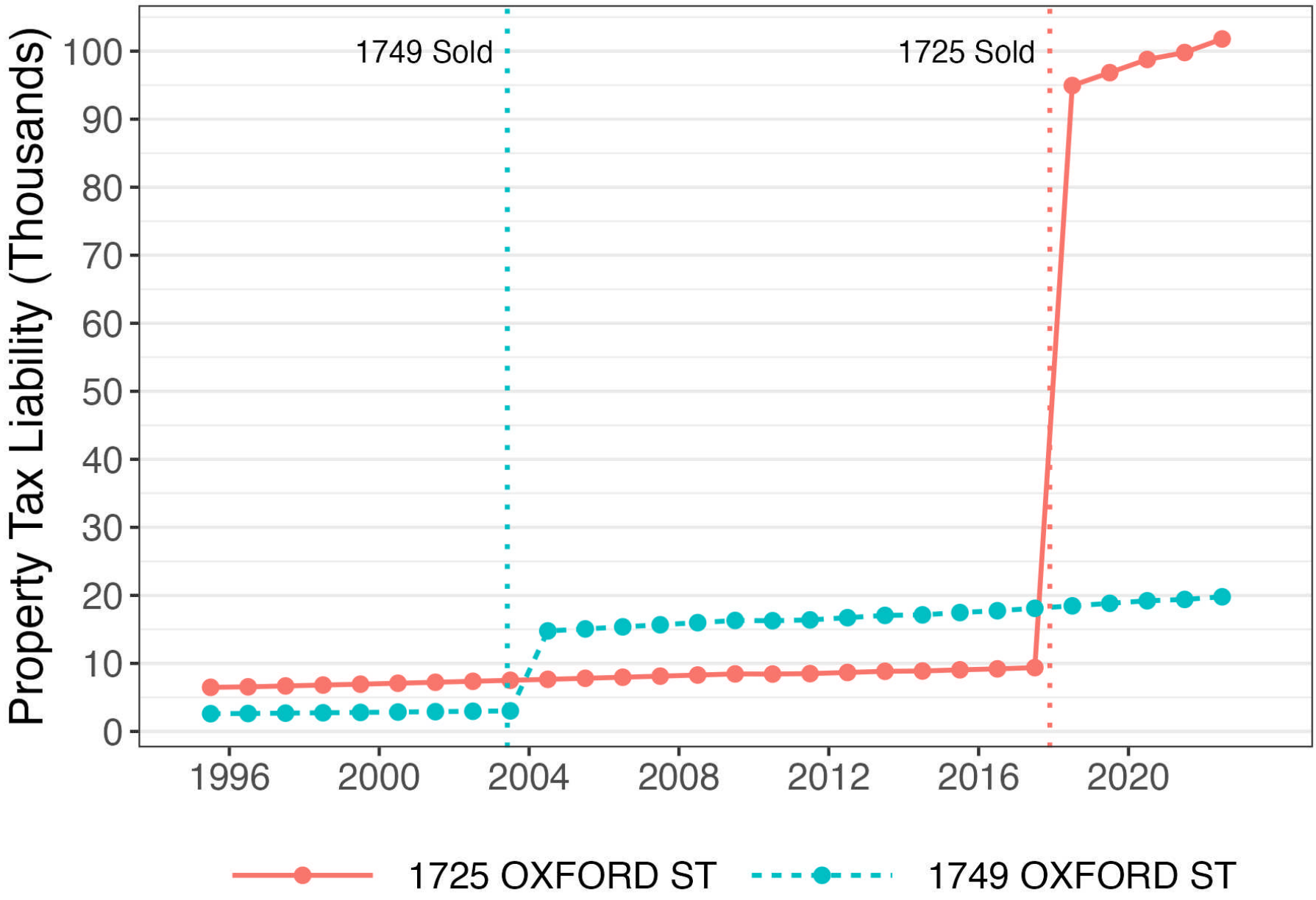
(a) 1725 Oxford St

(b) 1749 Oxford St

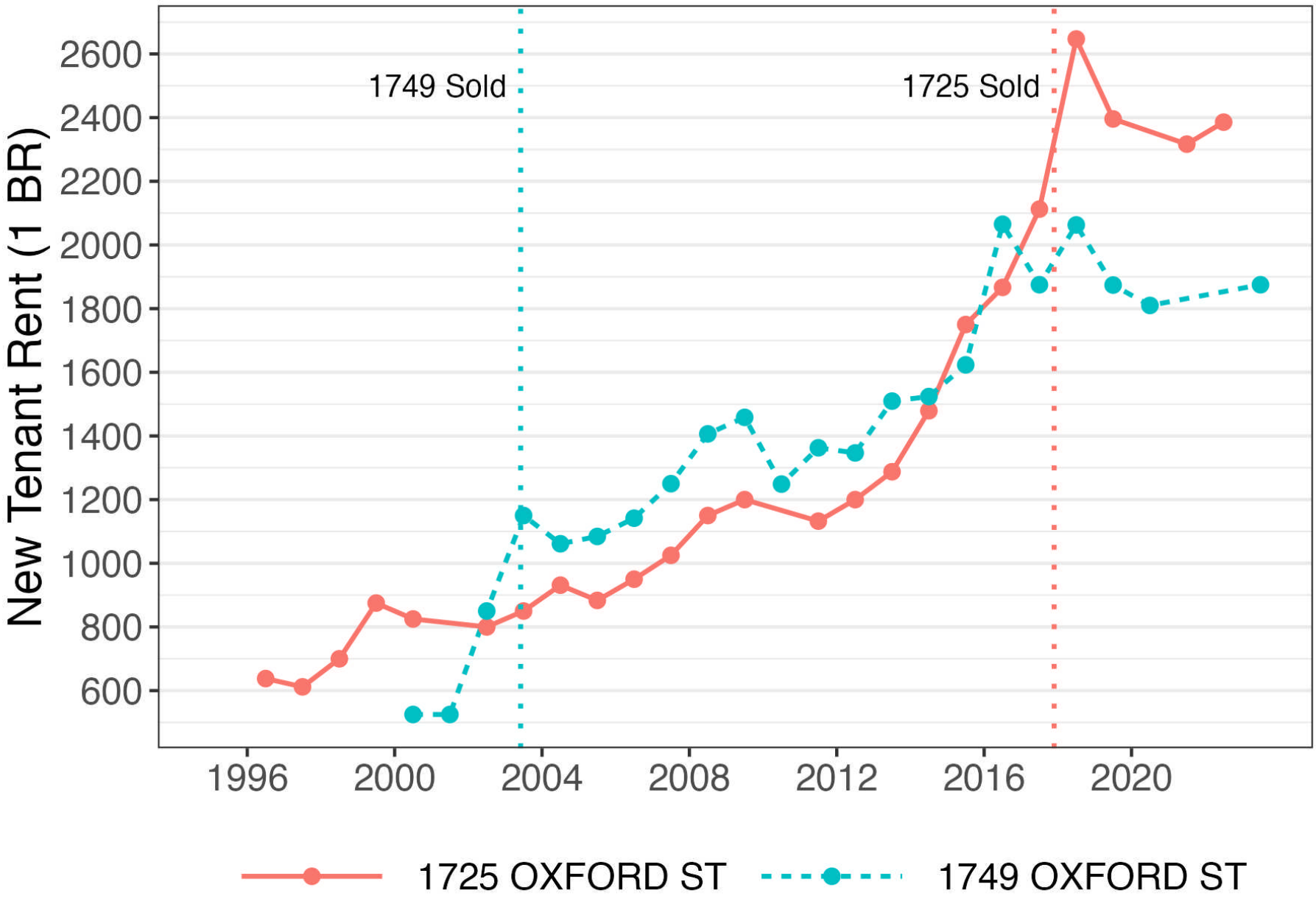
- Last sold in 2018 (for $9.5m)
- Current tax burden: $100,000

- Last sold in 2003 (for $1.45m)
- Current tax burden: $20,000

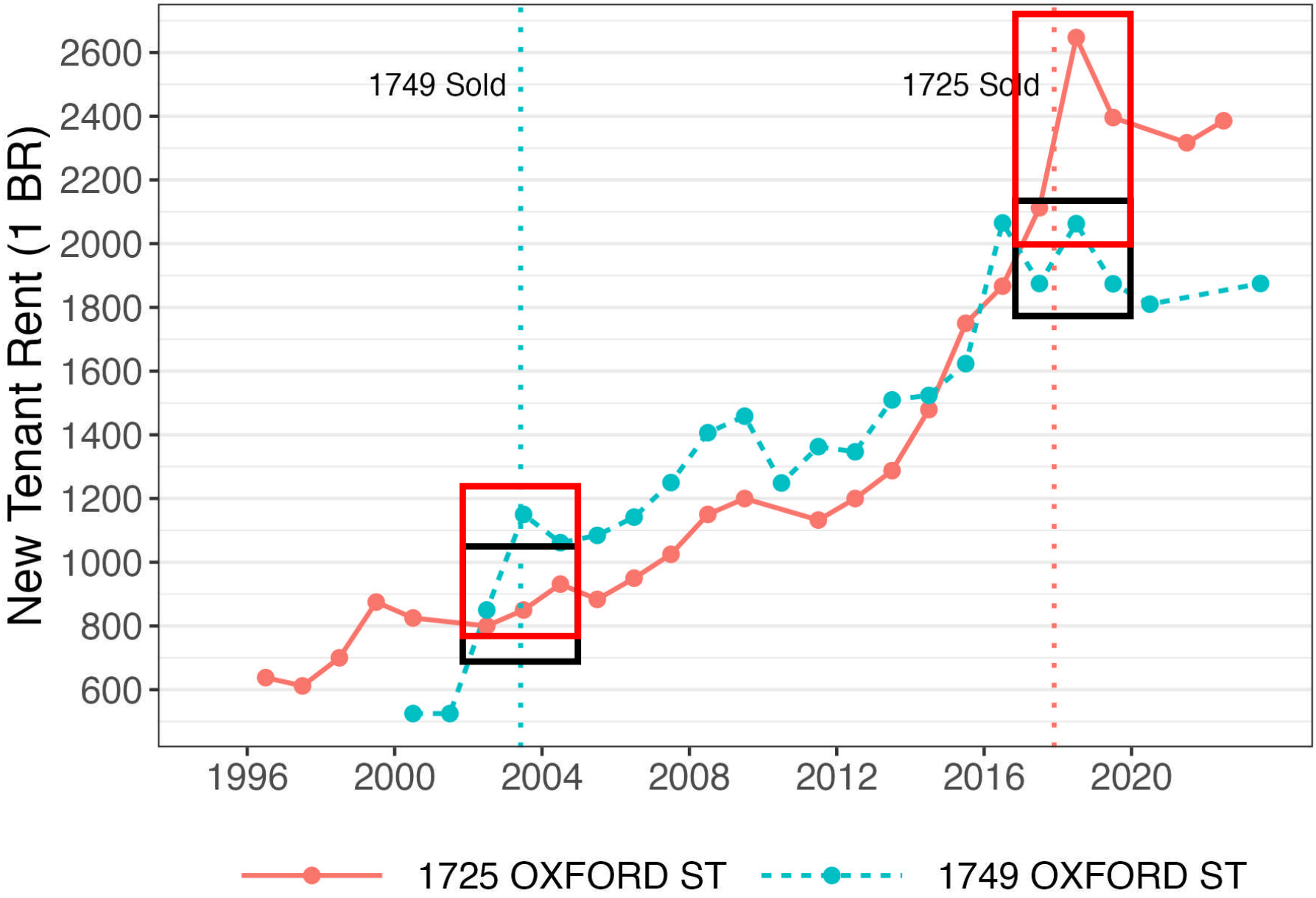
Property Taxes on Oxford St



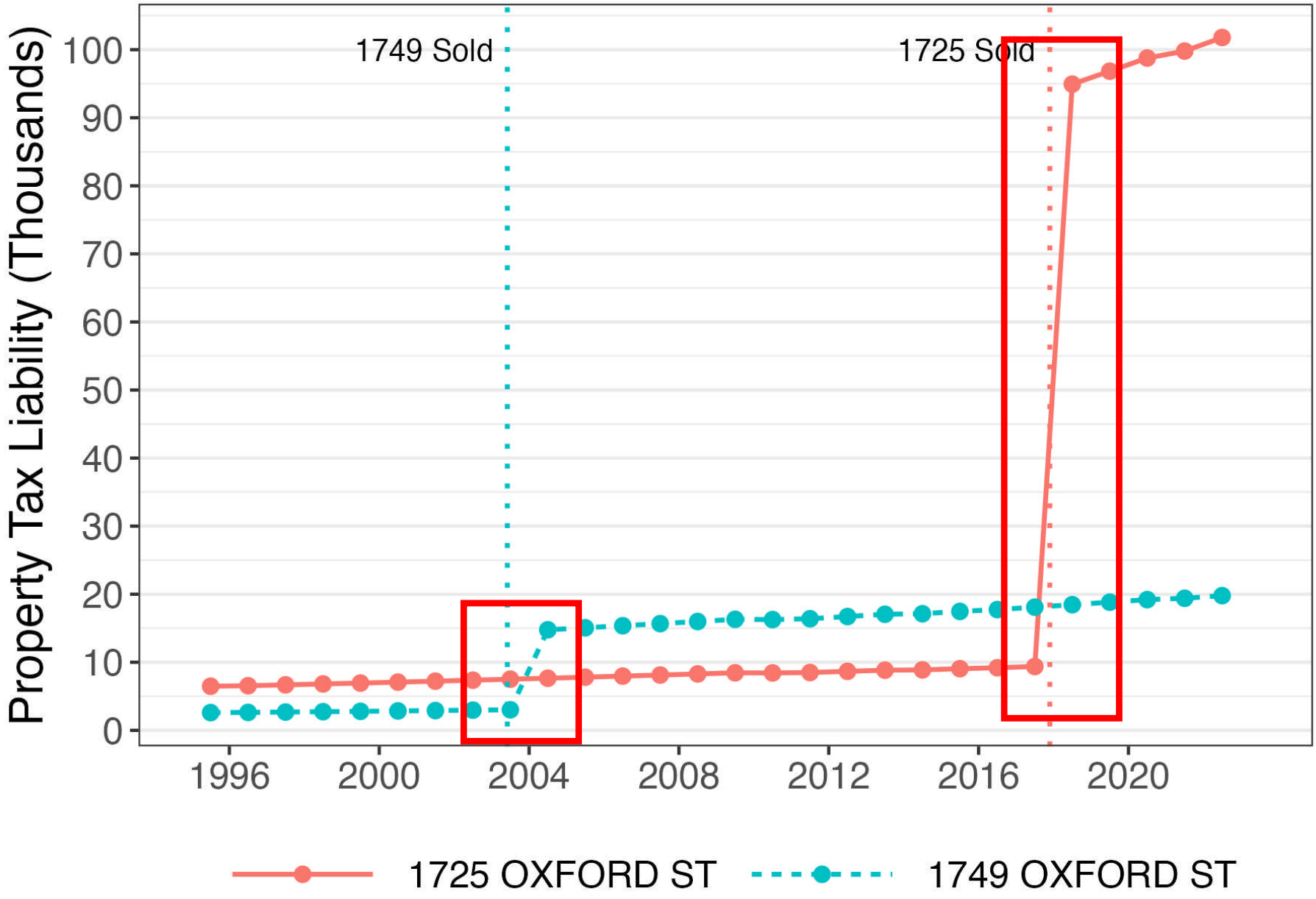
Rent on Oxford St



1. Variation in Sale Status



2. Variation in Dosage



Preview of Findings

- Findings
  - High rate of tax pass-through to renters: **$0.50-$0.89 per $1**
  - Robust to the inclusion of landlord size, permitted renovations
  - Low-tax landlords appear inattentive to market-rate rent
- Interpretation
  - Landlords do have pricing power
  - Taxes are passed through to renters, some renters benefit
  - Pass-through violates the law of one price, but can be justified by landlord inattention and churn
- Contributions
  - Unique quasi-experimental setting
  - Novel, near-universal, unit-level rent data
  - Evidence of tax incidence on renters
  - Evidence of non-standard landlord pricing behavior

Outline

Contribution to the Literature

1. **Property tax incidence**
   - Inconclusive GE estimates of \$0-\$1.40 per \$1: Oates and Fischel (2016), England (2016), Carroll and Yinger (1994)
   - Distributional effects: Avenancio-León and Howard (2022)
   - **Contribution: PE estimate of high pass-through**
2. **Behavioral pricing: Firms**
   - Stevens (2020), Dube et al. (2018), Reis (2006), Matějka (2016)
3. **Behavioral pricing: Housing**
   - Sale price: Genesove and Mayer (2001), Bracke and Tenreyro (2021), Andersen et al. (2022), Badarinza et al. (2024), Guren (2018)
   - Rent stickiness: Genesove (2003), Gallin and Verbrugge (2019), Baker and Wroblewski (2024)
   - Rental pricing: Giacoletti and Parsons (2022), Hirota et al. (2020), Hughes (2022), Watson and Ziv (2024)
   - **Contribution: Behavioral framework to rental housing, novel setting and data, within-property variation**

Outline

Property Taxes 101

California:

- Pay 1% of property's assessed value annually
- Assessed value = purchase price + 2% per year
- Strictest property tax cap in the country (2%)
- **Market value diverges from assessed value** very quickly, because market value is increasing rapidly ($> 2\%$ per year)

Other States:

- Many have assessed value caps ($> 2\%$) or limit property tax growth in different ways
  - E.g. Cap on per-municipality property tax revenue increase, owner-occupier exemptions
- Otherwise: Reassess frequently, and **assessed value attempts to estimate market value**

Berkeley Rental Market 101

- Vacancy decontrol (1999): Rent is set freely upon vacancy
- I.e. for **new tenants**, landlord faces no rent restrictions
- This paper only uses **new tenant rent observations**
- Average turnover: 2–3 years
  - Strong eviction protections
  - Not pressured out after sale Table

Data

Obtained by a combination of public records requests, data purchases, and scraping, I build my 1999–2022 sample, matching on parcel number and/or address:

1. **Property Taxes:** Address, parcel number, taxable value, owner name and address for all county properties
2. **Rent:** unit-level lease start date, initial rent for 25,000 units
3. **Building Permits:** address, permit date, summary of work for all city properties

Sources: Alameda County Assessor's office, Berkeley Rent Board, Alameda County and City of Berkeley public records

Avg. Δ Tax | Active Leases | Rent Over Time | Lease Seasonality | What Requires a Permit | Sale/Permit Freq.

Outline

Roadmap of Empirical Results

1. Neoclassical Benchmark
2. Event Study
3. Pass-Through Specification
4. IV Specification
5. Robustness Checks
   - Landlord Size
   - Renovations

Neoclassical Benchmark: What Should We Expect?

Landlord faces a trade-off between rent and probability of finding a tenant. The landlord maximizes profit (rent minus costs):

$$\max_R \quad \underbrace{\alpha(R)}_{P(\text{Rented})} (R - C) + \underbrace{(1 - \alpha(R))}_{P(\text{Vacant})}(0 - C)$$

$$\implies R^* = \frac{-\alpha(R)}{\alpha'(R)}$$

Result

For a fixed cost C, R^* does not depend on C.

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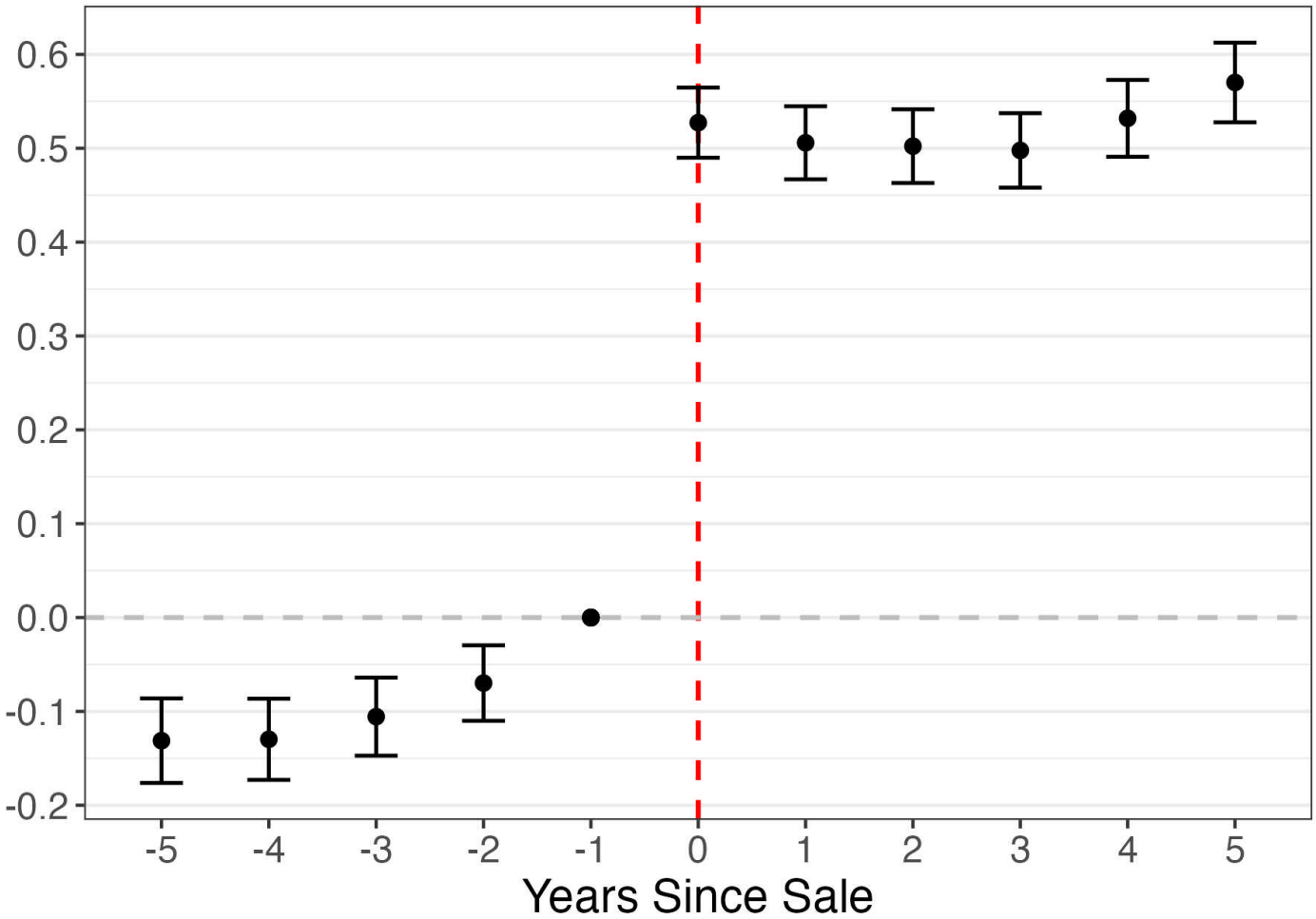
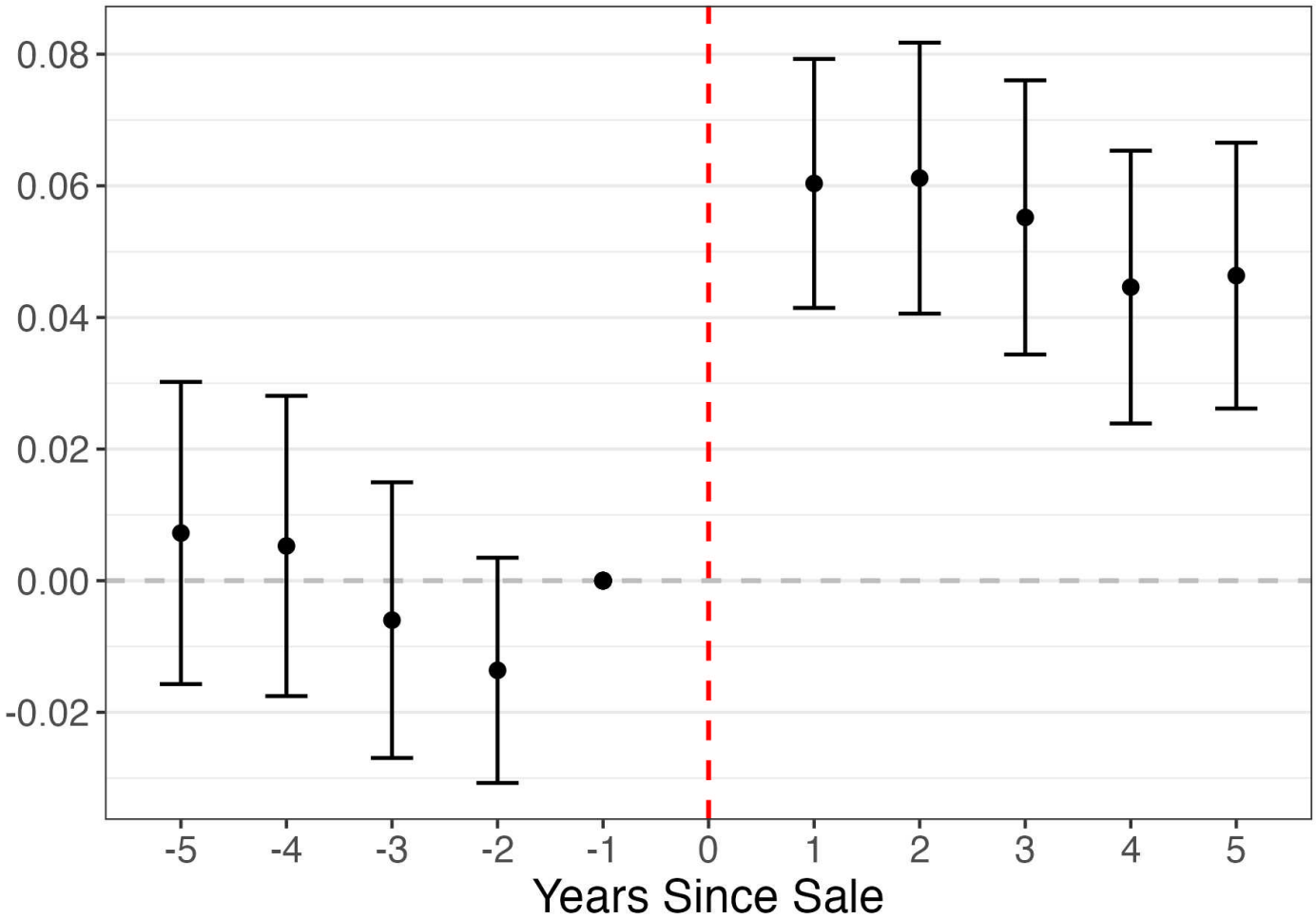
Event Study of Log Property Taxes (Pre-Post Only)

Balanced



$$\ln[TaxableValue_{it}] = \sum_{t \in [-5,5]} \gamma_j \cdot D_{i,t-j} + \epsilon_{it}$$

Event Study of Log Rent (Pre-Post Only)



$$\ln[Rent_{it}] = \sum_{t \in [-5,5]} \gamma_j \cdot D_{i,t-j} + \lambda_{g,t} + \alpha_i + \gamma_{m_t} + \epsilon_{it}$$

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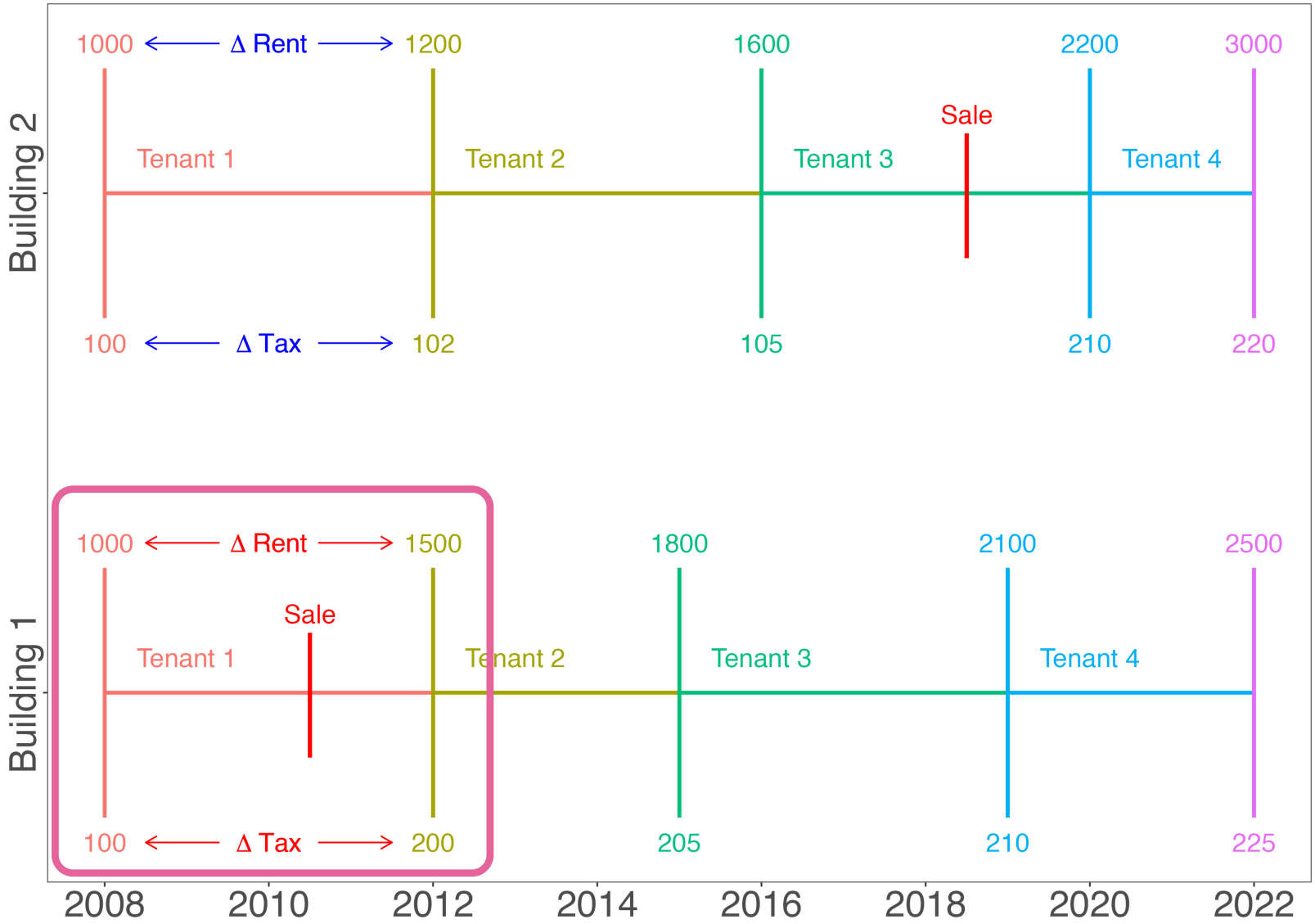
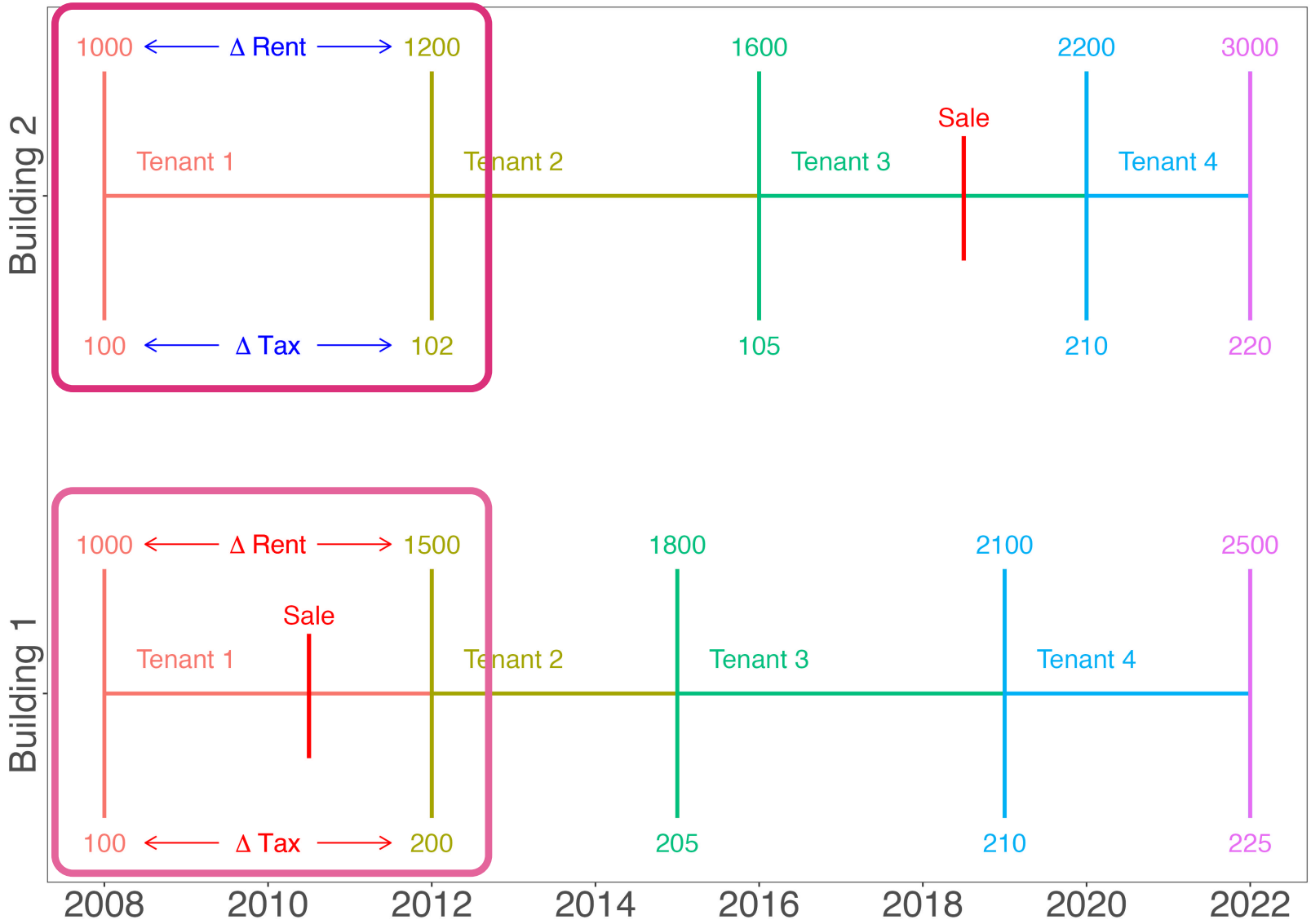
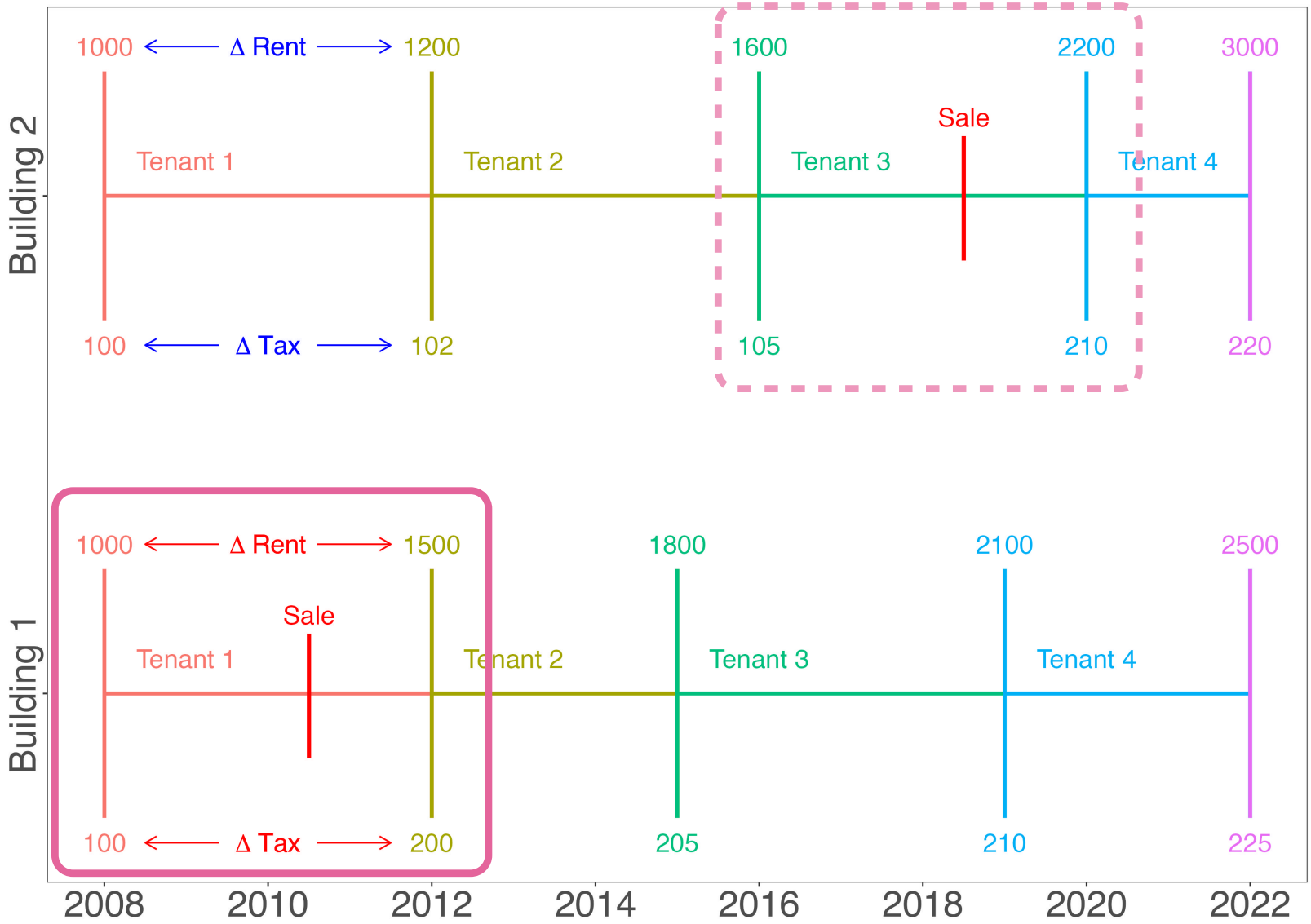
Data Visualization



Data Visualization



Data Visualization



Pass-Through Specification

For unit i, with a new tenant in periods $t-k$ and t, in Census tract g, with rent R and unit taxable value TV:

$$\begin{aligned}\Delta \ln[R_{i,g,t,t-k}] = \beta_1 \Delta \ln[TV_{i,g,t,t-k}] \\ + \beta_2 \mathbb{1}\{Sale_{i,t-k,t}\} \\ + \beta_3 \mathbb{1}\{Sale_{i,t-k,t}\} \cdot \Delta \ln[TV_{i,g,t,t-k}] \\ + \lambda_{g,t,t-k} + \alpha_i + \gamma_{m_t,m_{t-k}} + \epsilon_{i,t,t-k}\end{aligned}$$

Where:

- $\Delta \ln[R]$ controls for unobservables captured in pre-sale rent
- $\lambda_{g,t,t-k}$: Tract $\times$ Year$_t$ $\times$ Year$_{t-k}$ FE: Time-varying nbhd trends
- α_i: Unit FE: Unit-specific characteristics
- $\gamma_{m_t,m_{t-k}}$: Month$_t$ $\times$ Month$_{t-k}$ FE: Seasonality in rent prices
- SEs clustered by building: Within-building error correlation

Pass-Through Estimation

Conversion | Logs vs. Levels | Pure Control

Table: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:		
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$		
	(1)	(2)	(3)
$\Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.050^{***}	0.036^{***}	-0.004
	(0.005)	(0.005)	(0.009)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$		0.029^{***}	0.017^{***}
		(0.004)	(0.005)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$			0.048^{***}
			(0.010)
Implied Pass-Through Per \$1			\$0.53
Observations	97,017	97,017	97,017
Adjusted R^2	0.698	0.699	0.699
Note:			*p<0.1; **p<0.05; ***p<0.01

Logs vs. Levels

Table: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:	
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$	Monthly Rent
	(1)	(2)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.048^{***}	
	(0.010)	
Monthly Per-Unit Property Tax		0.553^{***}
		(0.104)
Implied Pass-Through Per \$1	\$0.53	\$0.55
Observations	97,017	121,398
Adjusted R^2	0.699	0.669
Note:	*p<0.1; **p<0.05; ***p<0.01	

Back

Roadmap of Empirical Results

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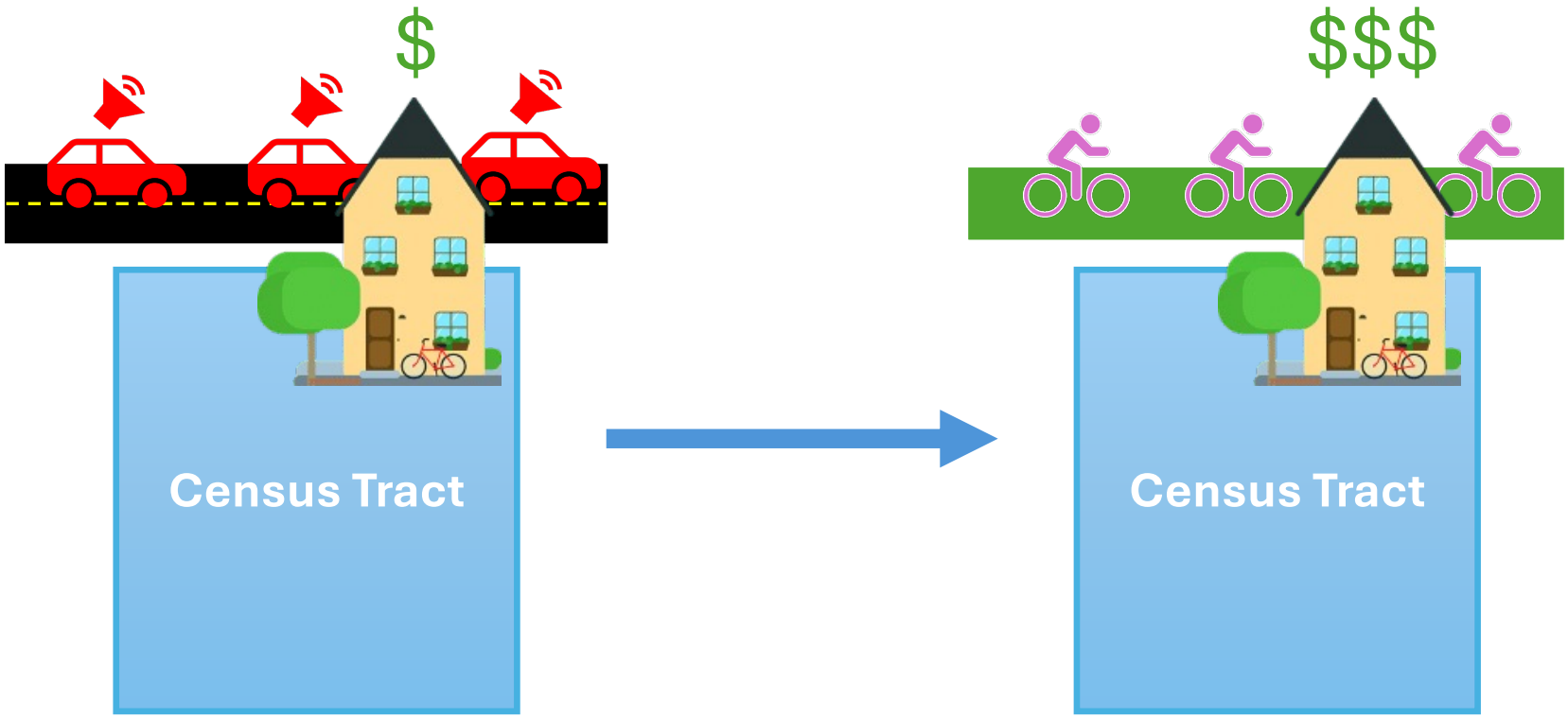
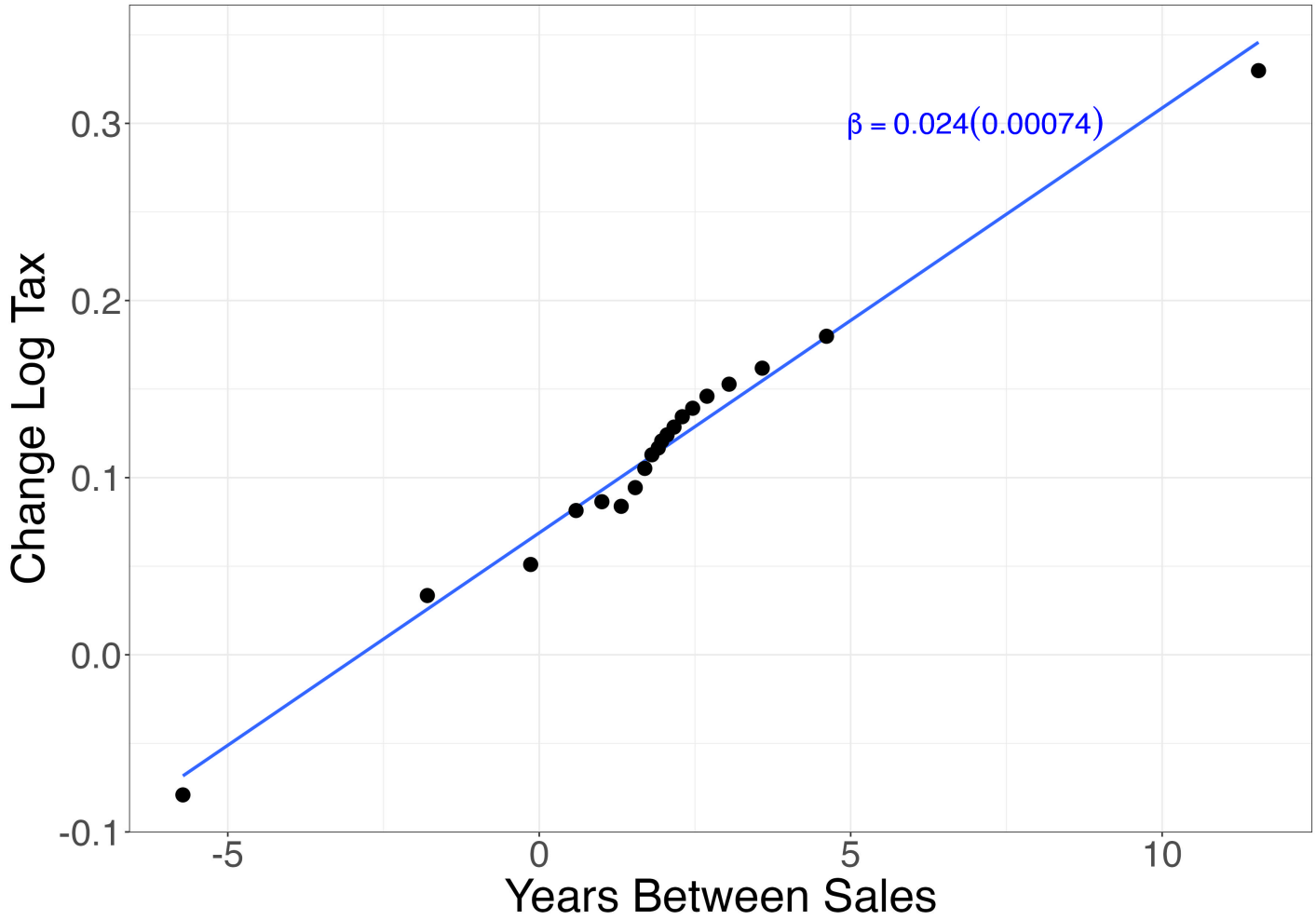
IV: Motivation



- Potential issue: Amenity change increases purchase price (taxes) and rent simultaneously
- Solution: Instrument for Δ Log Tax with years between sales
- Exclusion restriction: Years btw sales only affect rent through taxes

IV: Change in Log Taxable Value

Idea: Years between sales instruments for Δ Log Tax. Larger number of years $\implies$ larger taxable value change.



IV: Change in Log Taxable Value

Idea: Years between sales instruments for Δ Log Tax. Larger number of years $\implies$ larger taxable value change.

First Stage:

$$\begin{aligned}\mathbb{1}\{Sale_{i,t-k,t}\} \cdot \Delta \ln[TV_{i,g,t,t-k}] = \pi_1 \mathbb{1}\{Sale_{i,t-k,t}\} \cdot Yrs_{i,t} \\ + \pi_2 \mathbb{1}\{Sale_{i,t-k,t}\} \\ + \lambda_{g,t,t-k} + \alpha_i + \gamma_{m_t,m_{t-k}} + \epsilon_{i,g,t,t-k}\end{aligned}$$

Structural Equation:

$$\begin{aligned}\Delta \ln[R_{i,g,t,t-k}] = \gamma_1 \mathbb{1}\{Sale_{i,t-k,t}\} \cdot \Delta \ln[TV_{i,g,t,t-k}] \\ + \gamma_2 \mathbb{1}\{Sale_{i,t-k,t}\} \\ + \lambda_{g,t,t-k} + \alpha_i + \gamma_{m_t,m_{t-k}} + \epsilon_{i,g,t,t-k}\end{aligned}$$

IV: Results

IV Levels | IV Purchase Price Control

Table: IV: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:		
	$\Delta \ln[Rent]$	Sale $\times$ $\Delta \ln[TV]$	$\Delta \ln[Rent]$
	(1)	(2)	(3)
$\Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	−0.0003		
	(0.010)		
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.018***	0.398***	−0.006
	(0.005)	(0.033)	(0.016)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	0.045***		0.081***
	(0.011)		(0.022)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ Yrs Since Last Sale		0.021***	
		(0.003)	
Specification	Original	First Stage	2SLS
Implied Pass-Through Per $1	$0.49		$0.89
F-statistic	39.5	46.62	49.43
Observations	95,414	95,414	95,414
Note:			*p<0.1; **p<0.05; ***p<0.01

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5. Robustness Checks
   - Landlord Size
   - Renovations

Robustness Checks

1. Are my results driven by landlord size?
   - Do large landlords purchase buildings from 'mom-and-pop' landlords and raise rents?
   - Link Berkeley properties by the owner's mailing address to determine landlord size
   - Method: Add change in landlord size after sale to OLS regression

Landlord Size: Summary Statistics

Table: Landlord Summary Statistics

	Min	p25	p50	p75	Max
Units Owned (All)	1	4	12	39	786
Units Owned (Sold, Old Landlord)	1	6	18	49	786
Units Owned (Sold, New Landlord)	1	6	18	62	786
Change in Units Owned (Sold)	-757	-4	0	4	782

- Median landlord owns 12 units
- Median landlord engaging in sale is slightly bigger
- Majority of sales occur between similarly-sized landlords

Landlord Size: Direct Test

Alt. Spec.

Table: Effects of Sale-Triggered Property Tax Changes on Rent by Landlord Status

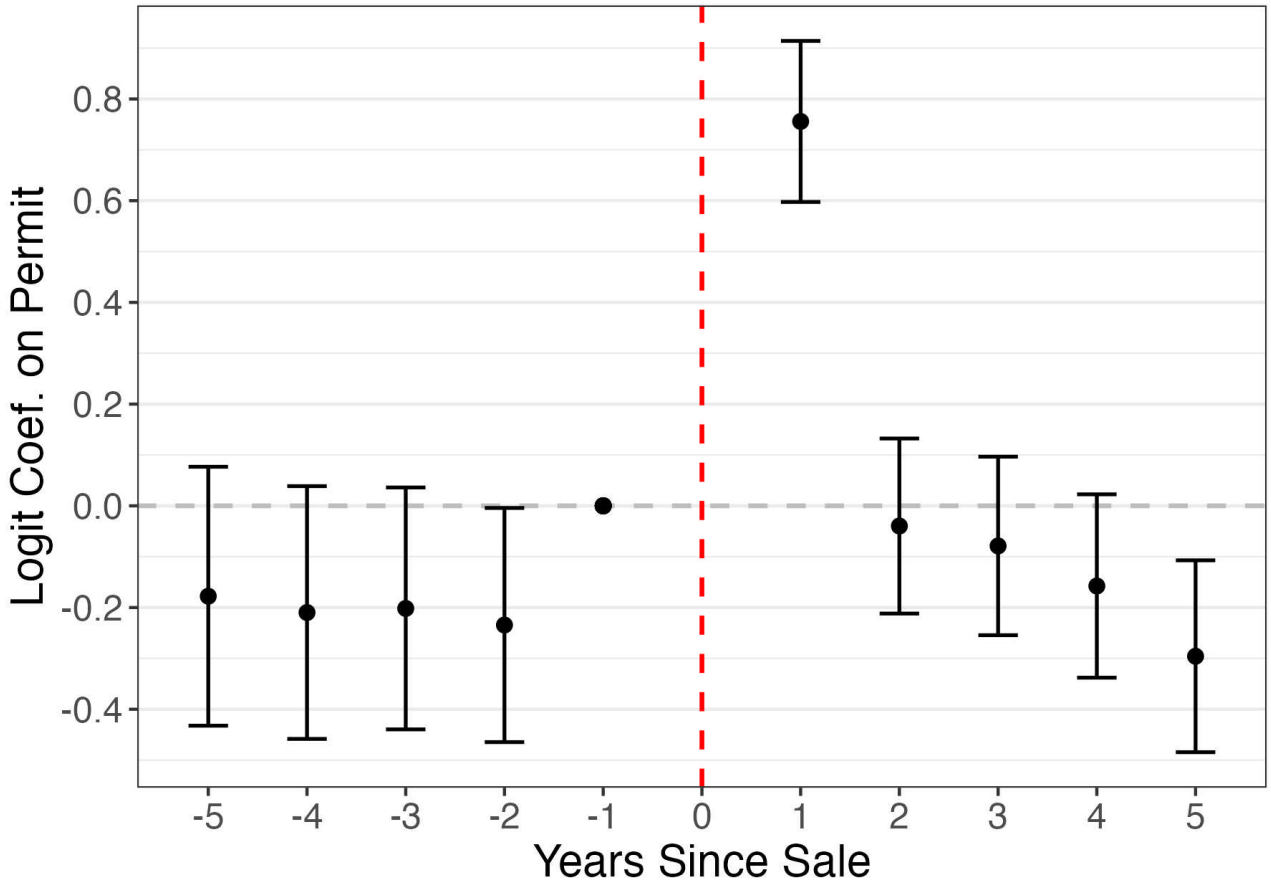
	Dependent variable:	
	Δ Log Rent	
	(1)	(2)
$\Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	−0.004	−0.004
	(0.009)	(0.009)
Sale	0.017***	0.018***
	(0.005)	(0.005)
Sale x $\Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	0.048***	0.046***
	(0.010)	(0.010)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$ x Δ Units Owned		0.0001***
		(0.00002)
Implied Pass-Through Per $1	$0.53	$0.51
Observations	97,017	97,017
Adjusted R^2	0.699	0.699
Note:	*p<0.1; **p<0.05; ***p<0.01	

Robustness Checks

1. Are my results driven by landlord size? **No**
2. Are my results driven by renovations?
   - Do new landlords renovate after a sale and justifiably raise rents?
   - Use **city building permits**: Required for any construction, alterations, repairs; any work on gas/electrical/plumbing
   - Method: Create 'NLP Score' for each permit, using a regularized Lasso regression of change in rent on all frequently observed words

Renovations: What's in the Permits?

Renovations: Permits More Likely Post-Sale



- Probability increases from 4.7% $\rightarrow$ 9.5% after sale, consistent with Benmelech et al. (2023) Event Study, t=–2
- Permits are common, occur in 74% of buildings Sale/Permit Freq.

Renovations: Results

Table: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:	
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$	
	(1)	(2)
$\Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	−0.004	−0.004
	(0.009)	(0.009)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.017***	0.016***
	(0.005)	(0.005)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.048***	0.044***
	(0.010)	(0.009)
Number of Permits		−0.003***
		(0.001)
NLP Permit Score		0.273***
		(0.020)
Implied Pass-Through Per $1	$0.53	$0.49
Observations	97,017	97,017
Adjusted R^2	0.699	0.702
Note:	*p<0.1; **p<0.05; ***p<0.01	

Renovations: "90s Kitchens" in 2024

(a) 1725 Oxford St, 2024

(b) 1749 Oxford St, 2024

Outline

Overview

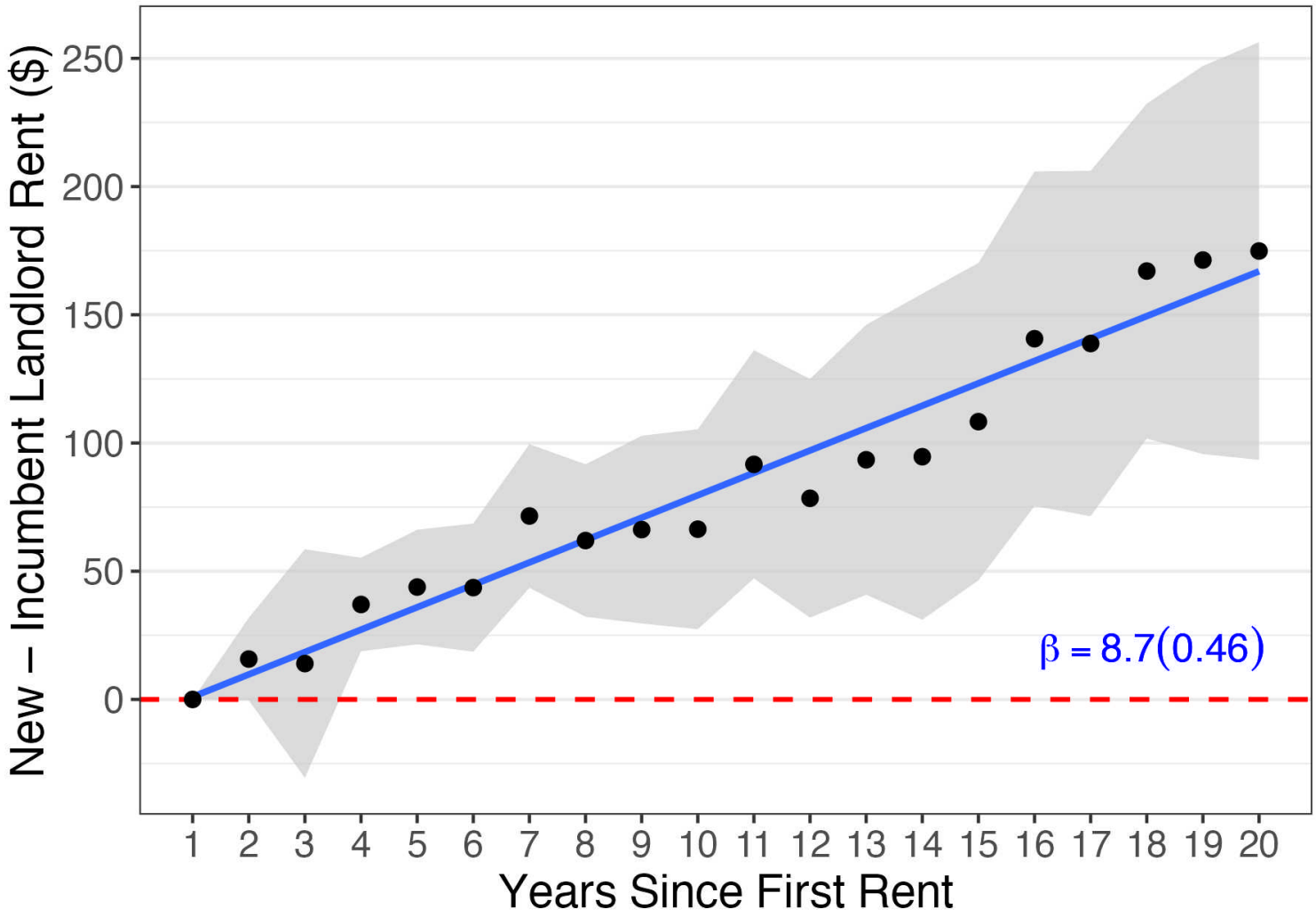
Goals:

1. Explain **positive relationship between rent and property taxes**
2. Explain why below-market taxes $\rightarrow$ below-market rents

Mechanism:

1. Incumbent landlord is inattentive to the market-rate rent
   - Potential reason: No informative tax cost shocks
2. Below-market rents create an opportunity for more 'sophisticated' or knowledgeable landlord
3. Sophisticated landlord buys property from inattentive landlord, taxes $\uparrow$ and rent $\uparrow$
4. Sophisticated landlord becomes inattentive over time
5. Cycle repeats

Inattention: New Tenant Rent Gap by Landlord Duration



$\Longrightarrow$ Incumbent landlords **drift** from new landlord rent by \$9 per year

$\Longrightarrow$ Annual profit difference of \$540 in year $t = 5$

Inattention: Setup

Let market rent for unit i in period t equal $R^*_{i,t}$. New landlords set rent correctly at $R^*_{i,t}$. Incumbent landlords are less attentive to the market rate, but set rent correctly (at first) in time $t = 1$.

Then, rent is set as follows:

$$R^* = \begin{cases} R^*_{i,t} & \text{if new landlord} \\ \theta R^*_{i,t} + (1-\theta) R^*_{i,t=1} & \text{if old landlord} \end{cases}$$

$\implies$ θ is degree of attentiveness, $1 - \theta$ is reliance on unit's initial rent

Inattention: Test

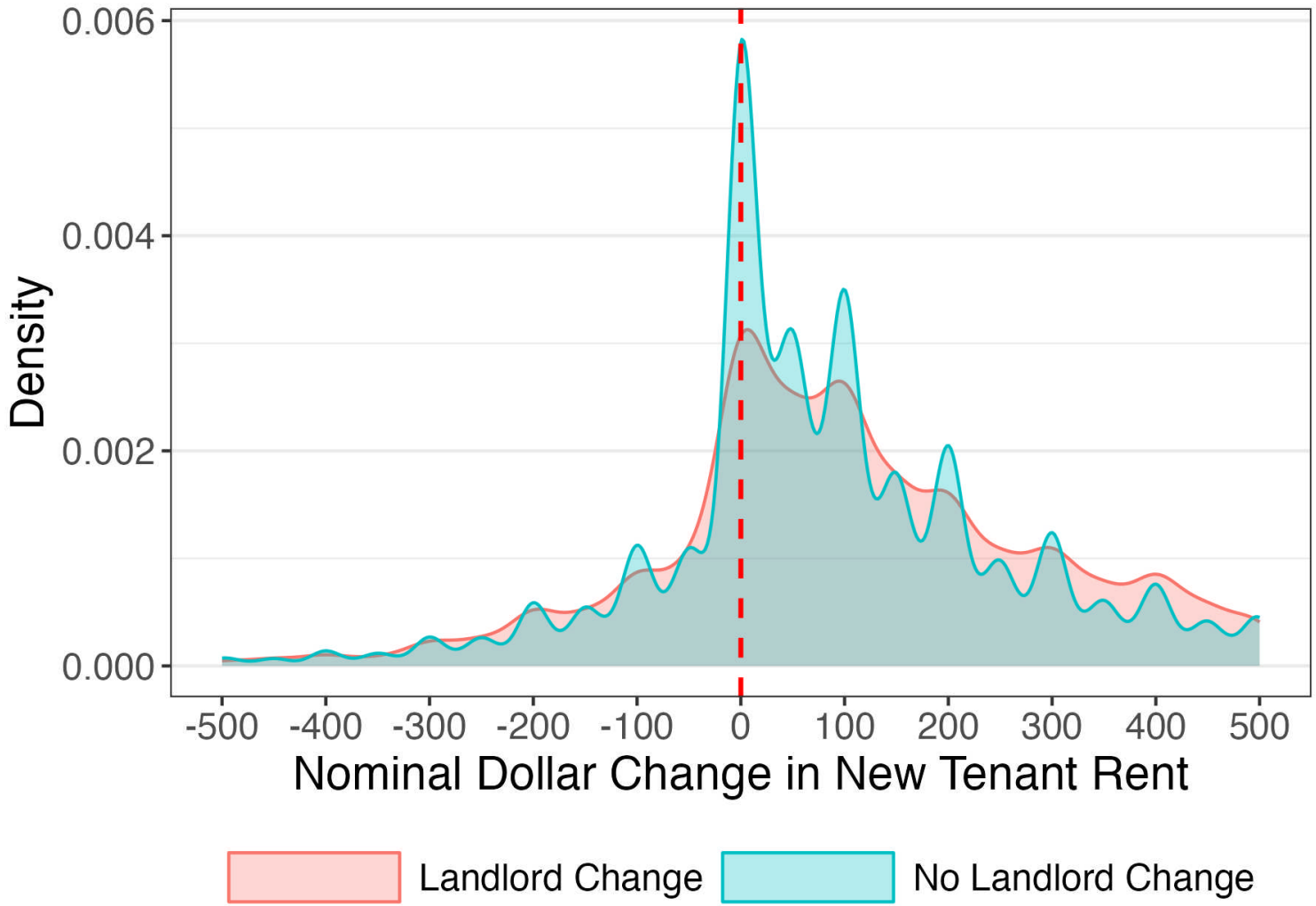
Split by Size

Table: Test of Inattention Model

	Dependent variable:
	Log Rent$_t$
Log New Landlord $R^*_{g,t,beds}$	0.227***
	(0.013)
Log $R^*_{i,g,t-k=1}$	0.769***
	(0.023)
Num. Units Owned by Landlord	0.0001**
	(0.00002)
Observations	80,073
Adjusted R^2	0.909
Note:	*p<0.1; **p<0.05; ***p<0.01

- Attentiveness to market-rate rent: $\theta = 0.23$
- Reliance on initial rent: $1 - \theta = 0.77$

Rent Stickiness Percent



Reproduced from Baker and Wroblewski (2024)

Overview

Goals:

1. Explain positive relationship between rent and property taxes
2. Explain why below-market taxes $\rightarrow$ below-market rents

Mechanism:

1. Incumbent landlord is inattentive to the market-rate rent ✓
   - Potential reason: No informative tax cost shocks
2. **Below-market rents create an opportunity** for more 'sophisticated' or knowledgeable landlord
3. **Sophisticated landlord buys property from inattentive landlord**, taxes $\uparrow$ and rent $\uparrow$
4. Sophisticated landlord becomes inattentive over time
5. Cycle repeats

Landlord Entry and Exit: Setup

Landlord faces a trade-off between rent and probability of finding a tenant. The landlord maximizes profit (rent minus costs):

$$\max_R \quad \underbrace{\alpha(R)}_{P(\text{Rented})} (R - C) + \underbrace{(1 - \alpha(R))}_{P(\text{Vacant})}(0 - C)$$

Neoclassical:

$$R^* = \frac{-\alpha(R)}{\alpha'(R)}$$

Heterogeneous landlord sophistication:

$$R^*_{it} = \frac{-\alpha(R, s_{it})}{\alpha'(R, s_{it})}$$

$\implies$ More sophisticated landlords can charge higher rents

$\implies$ Purchase opportunity for more sophisticated landlords

Landlord Entry and Exit: Transactions

Landlord j decides whether to make an offer on landlord i's property. She will do so if the **rent gap exceeds the tax gap**:

$$\pi_{jt} > \pi_{it}$$
$$R^*_{jt} - T_{jt} > R^*_{it} - T_{it}$$
$$R^*_{jt} - R^*_{it} > T_{jt} - T_{it}$$

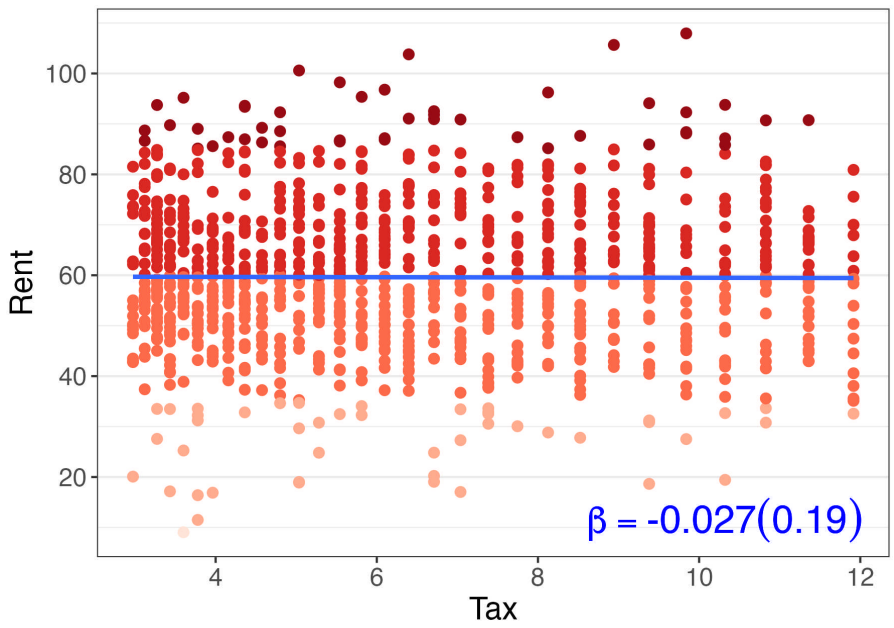
$\Longrightarrow$ The higher the rent a landlord can charge, the higher the tax burden she can bear

$\Longrightarrow$ Sales from low-s landlords to high-s landlords generate a **positive relationship between R^*_{jt} and T_{jt}**

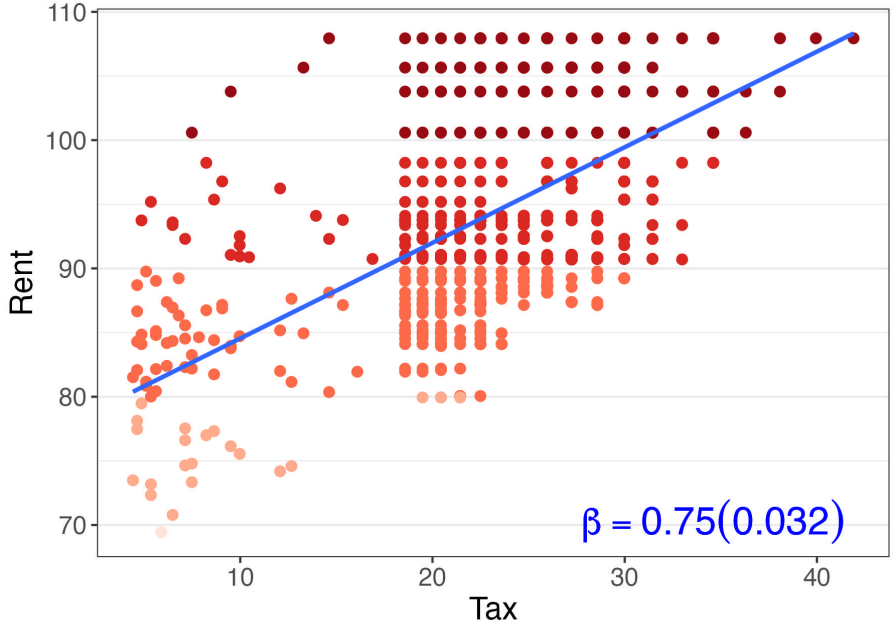
Tie to Empirics

Landlord Entry and Exit: Visual of Theory

Data



(a) Period 0

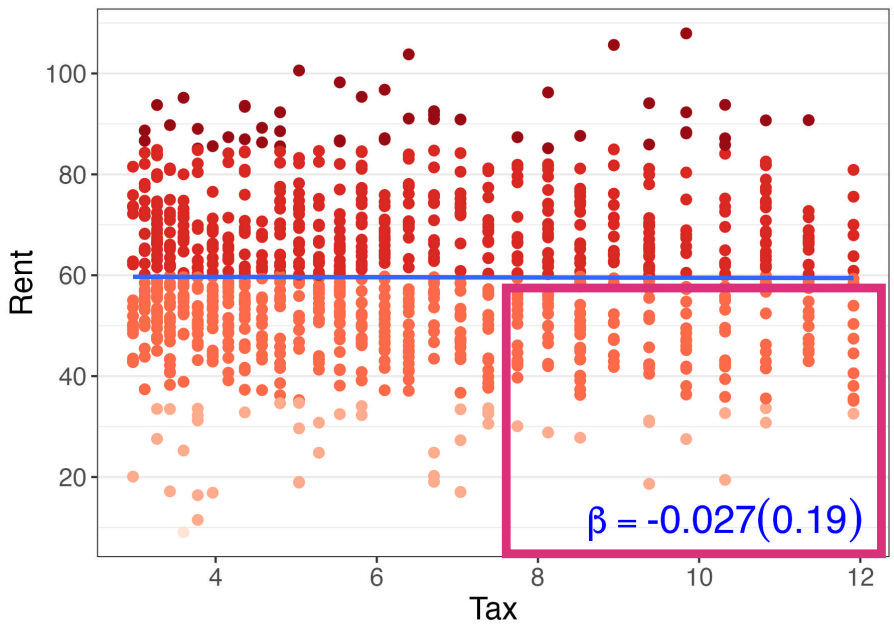


(b) Period 20

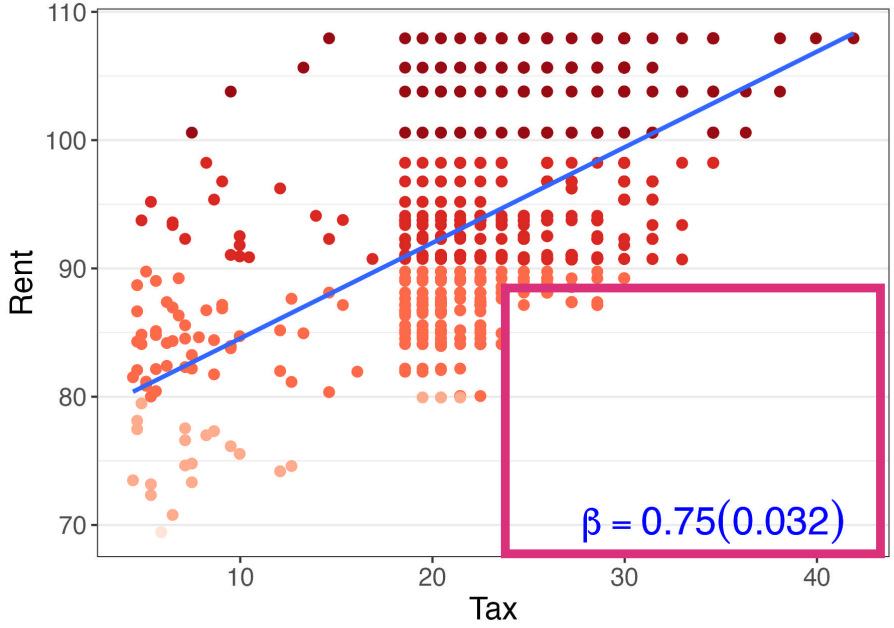
- Sale occurs if $R^*_{jt} - R^*_{it} > T_{jt} - T_{it} \implies$ **high** rent gap, **low** tax gap
  - Bottom right corner $\rightarrow$ sold
- Sale will not occur if **low** rent gap, **high** tax gap
  - Top left corner $\rightarrow$ not sold

Landlord Entry and Exit: Visual of Theory

Data



(a) Period 0

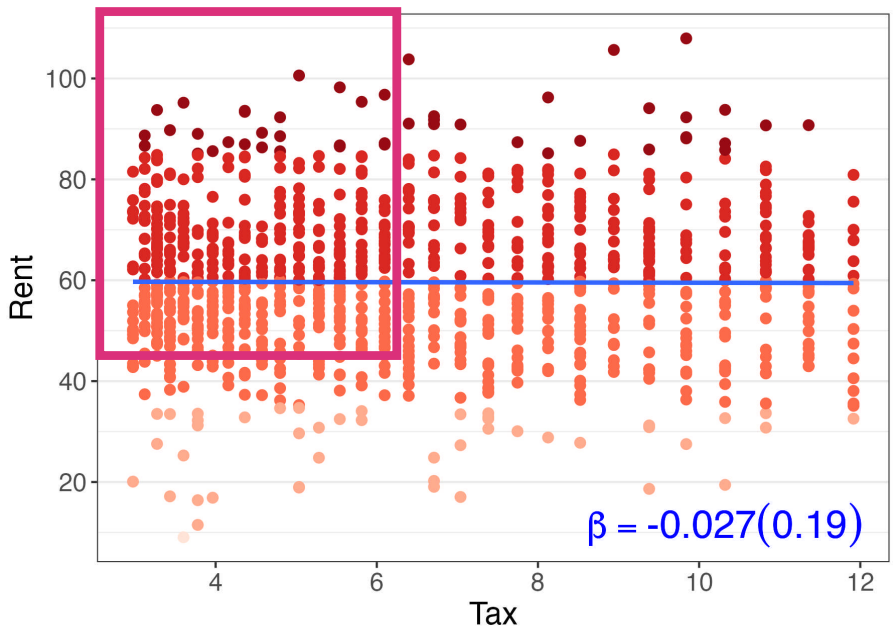


(b) Period 20

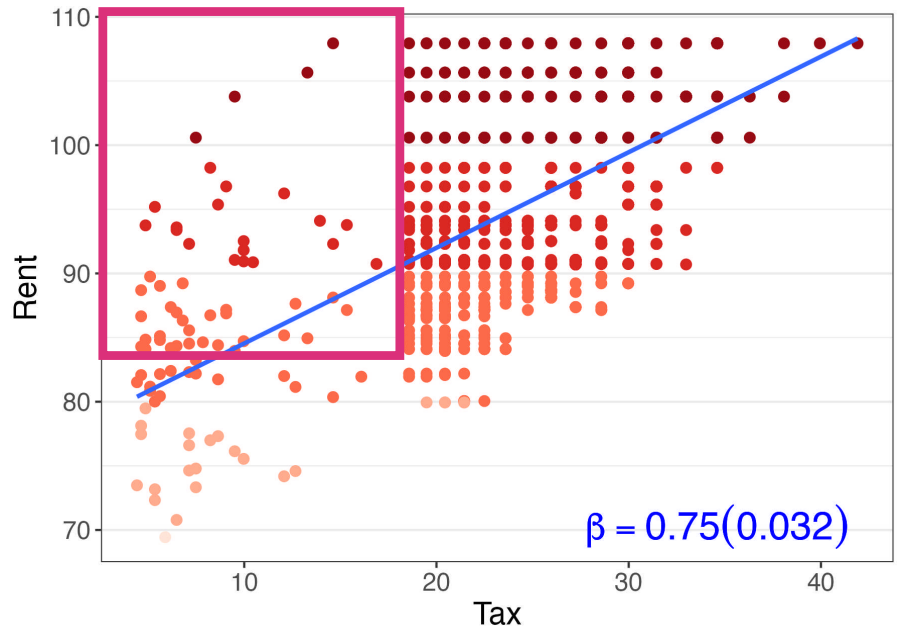
- Sale occurs if $R^*_{jt} - R^*_{it} > T_{jt} - T_{it} \implies$ **high** rent gap, **low** tax gap
  - Bottom right corner $\rightarrow$ sold
- Sale will not occur if **low** rent gap, **high** tax gap
  - Top left corner $\rightarrow$ not sold

Landlord Entry and Exit: Visual of Theory

Data



(a) Period 0



(b) Period 20

- Sale occurs if $R^*_{jt} - R^*_{it} > T_{jt} - T_{it} \implies$ **high** rent gap, **low** tax gap
  - Bottom right corner $\rightarrow$ sold
- Sale will not occur if **low** rent gap, **high** tax gap
  - Top left corner $\rightarrow$ not sold

Landlord Entry and Exit: Testable Prediction

Prediction: Sales less likely to occur if **low** rent gap, **high** tax gap

- Rent gap proxied by Rent Decile
  - Residualized (year×tract, month, beds) most recent new-tenant rent observation in the building
  - Assign decile based on other residualized rents in that year
  - 1: lowest residualized rents, 10: highest
- Tax gap proxied by Years Since Sale
  - Instrument for the tax gap from the IV
  - The longer a property has been off-market, the larger the change in taxes

Expect:

- Higher relative rent $\rightarrow \downarrow$ rent gap $\rightarrow \downarrow$ probability of sale
- More years off market $\rightarrow \uparrow$ tax gap $\rightarrow \downarrow$ probability of sale

Landlord Entry and Exit: Testable Prediction Plot

Prediction: Sales less likely to occur if **low** rent gap, **high** tax gap

Table: Effect of Rent Decile and Years Off-Market on Probability of Sale

	Dependent variable:
	Probability of Sale$_t$
Rent Decile$_{t-1}$	-0.066^{***}
	(0.006)
Years Since Sale$_{t-1}$	-0.027^{***}
	(0.002)
Tract$\times$Year$_t$ FE	Y
Observations	75,489
Note:	*p<0.1; **p<0.05; ***p<0.01

- Higher relative rent $\rightarrow \downarrow$ rent gap $\rightarrow \downarrow$ probability of sale
- More years off market $\rightarrow \uparrow$ tax gap $\rightarrow \downarrow$ probability of sale

Taking Stock: Inattention & Landlord Entry/Exit

1. Incumbent landlord is inattentive to the market-rate rent
   - Drift from market rent by \$9 per year
   - Partially update to market-rate rent, attentiveness $\theta = 23\%$
2. Below-market rents create an opportunity for more 'sophisticated' or knowledgeable landlord
3. Sophisticated landlord buys property from inattentive landlord, taxes $\uparrow$ and rent $\uparrow$
   - Sale more likely when rent gap is high and tax gap is low
4. Sophisticated landlord becomes inattentive over time
   - Potential reason: No informative tax cost shocks
5. Cycle repeats

Notably, this model matches the data better than the neoclassical benchmark, a simple model of search frictions, and reference dependence.

DMP Ref. Dep.

Policy Implications

- Rent rebates to tenants with older, incumbent landlords
  - Prop. 13 proponents correct
- Blunt policy instrument
  - Who gets the cheaper units? Who are we helping?
- What happens if Prop. 13 is repealed and property taxes ↑?
  - **Channel 1 (shown):** Incumbent landlords want to sell → Bought by high-sophistication landlords → Rent increases
  - **Channel 2** (likely): Incumbent landlords forced to be attentive → Rent increases
  - Increased tax revenue could provide means-tested rent assistance

Outline

Conclusion

- **Do renters bear the incidence of property taxation?**
  - Yes, pass-through of \$0.50-\$0.89 per \$1
  - Robust to landlord size, renovations
- **How do landlords price?**
  - They pass on heterogeneous cost shocks
  - Incumbent landlords price below market, 'incorrectly'
- Contribution:
  - Unique quasi-experimental setting
  - Novel near-universal unit-level rent data
  - Evidence of tax incidence on renters
  - Evidence of non-standard landlord pricing behavior

Thank you!

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Appendix

Balance Tables

Table: Sale Balance Table: Buildings

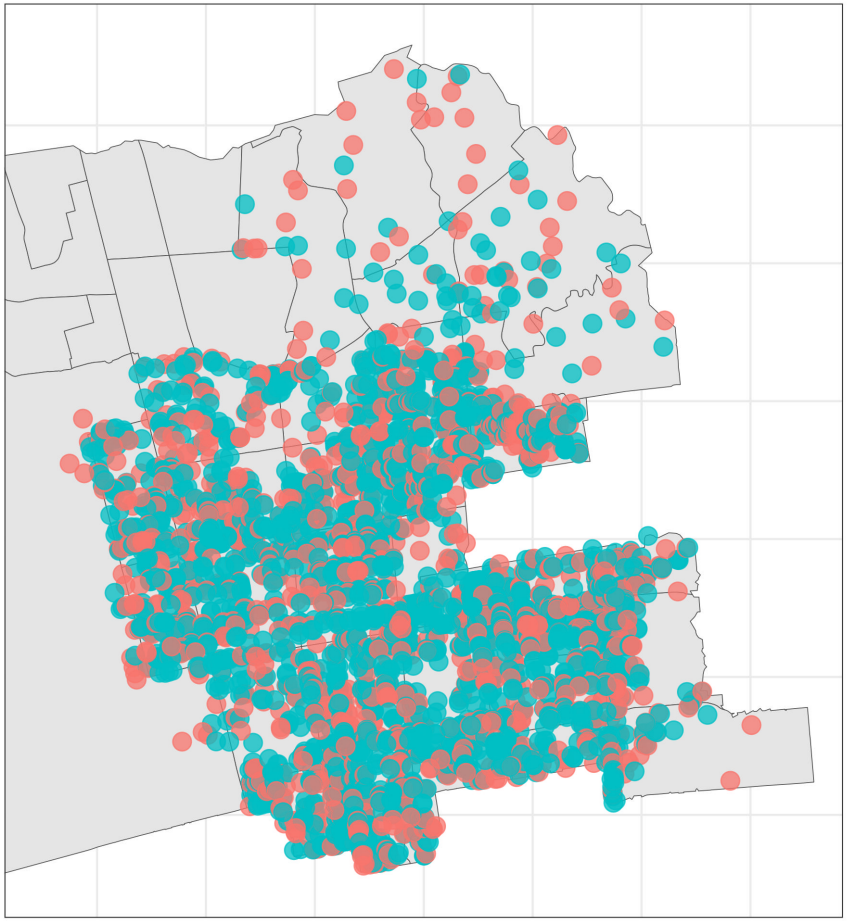
Ever Sold	N	Units	Beds	Mean Rent	Median Rent
No	1314	4	1.6	1494.9	1096.9
Yes	2276	5.4	1.5	1369.7	1071.2

Table: Permit Balance Table: Buildings

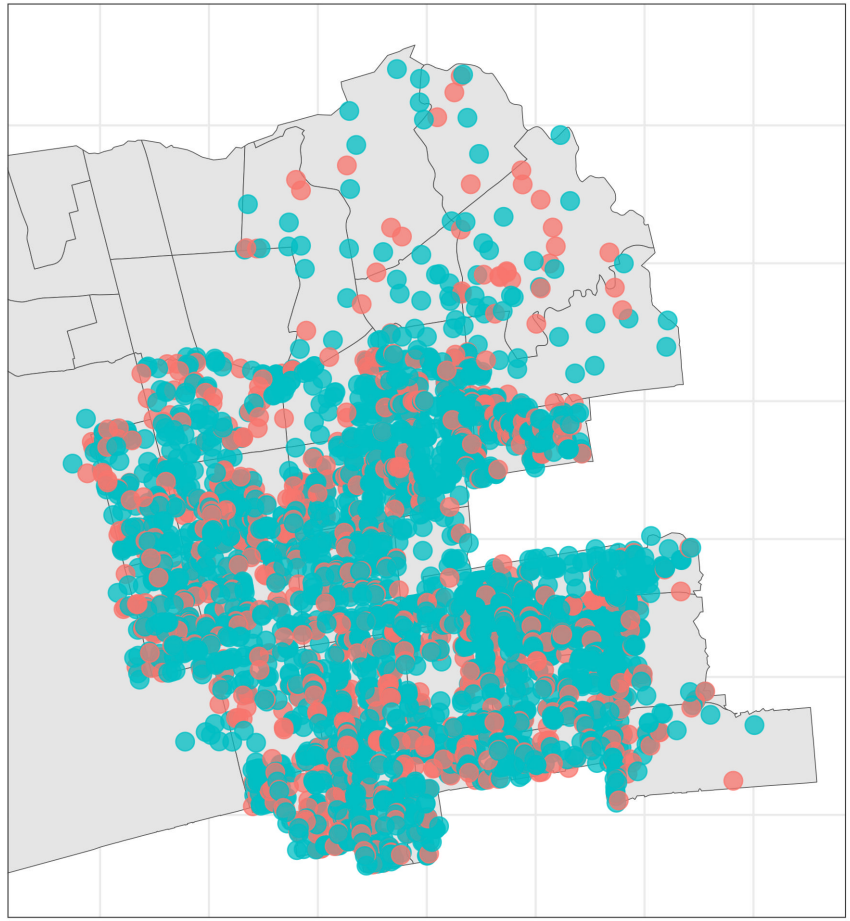
Ever Permit	N	Units	Beds	Mean Rent	Median Rent
No	924	2.7	1.7	1551	1152.3
Yes	2666	5.7	1.5	1368.6	1065.6

Back

Maps



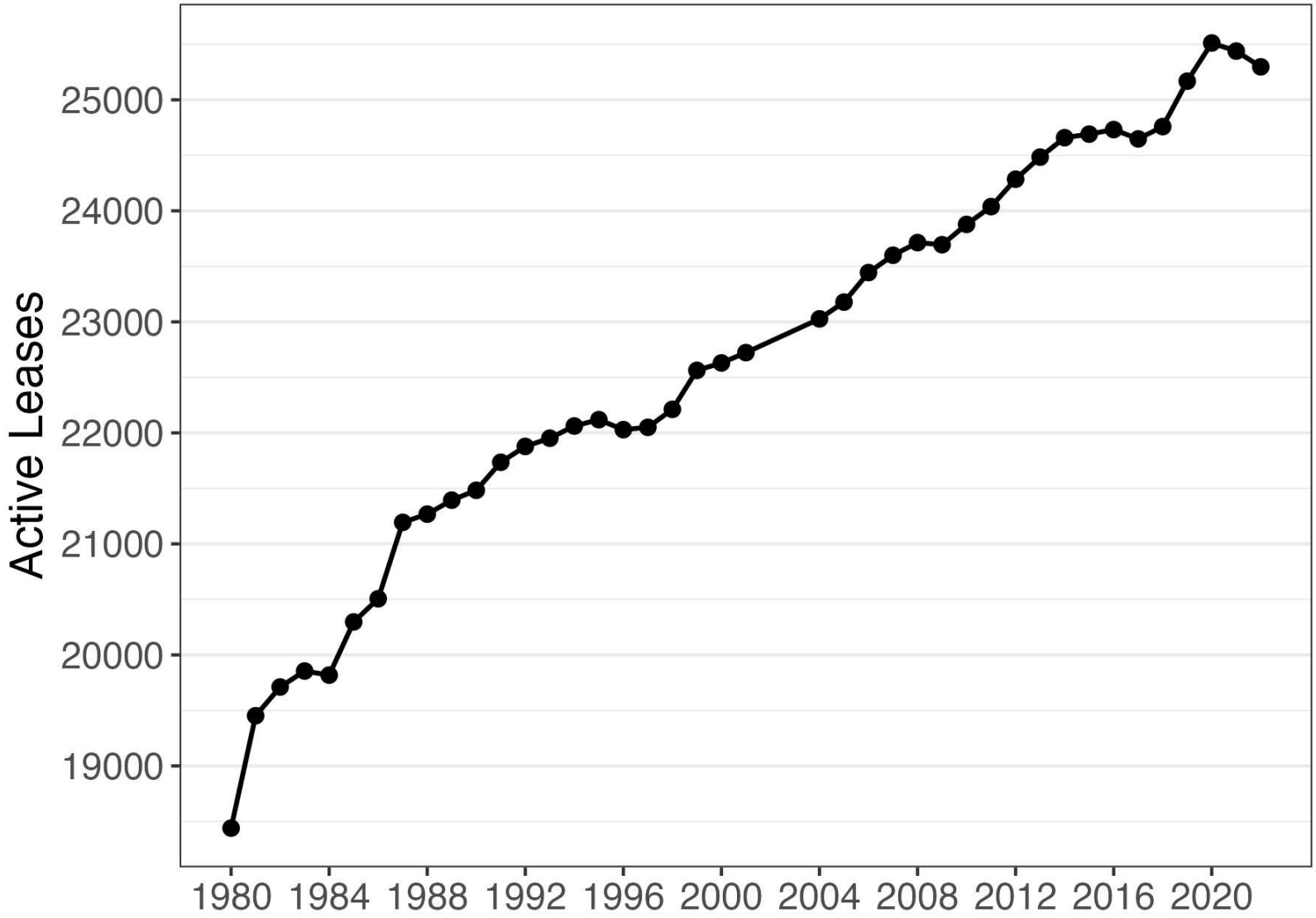
(a) Buildings with Sales



(b) Buildings with Permits

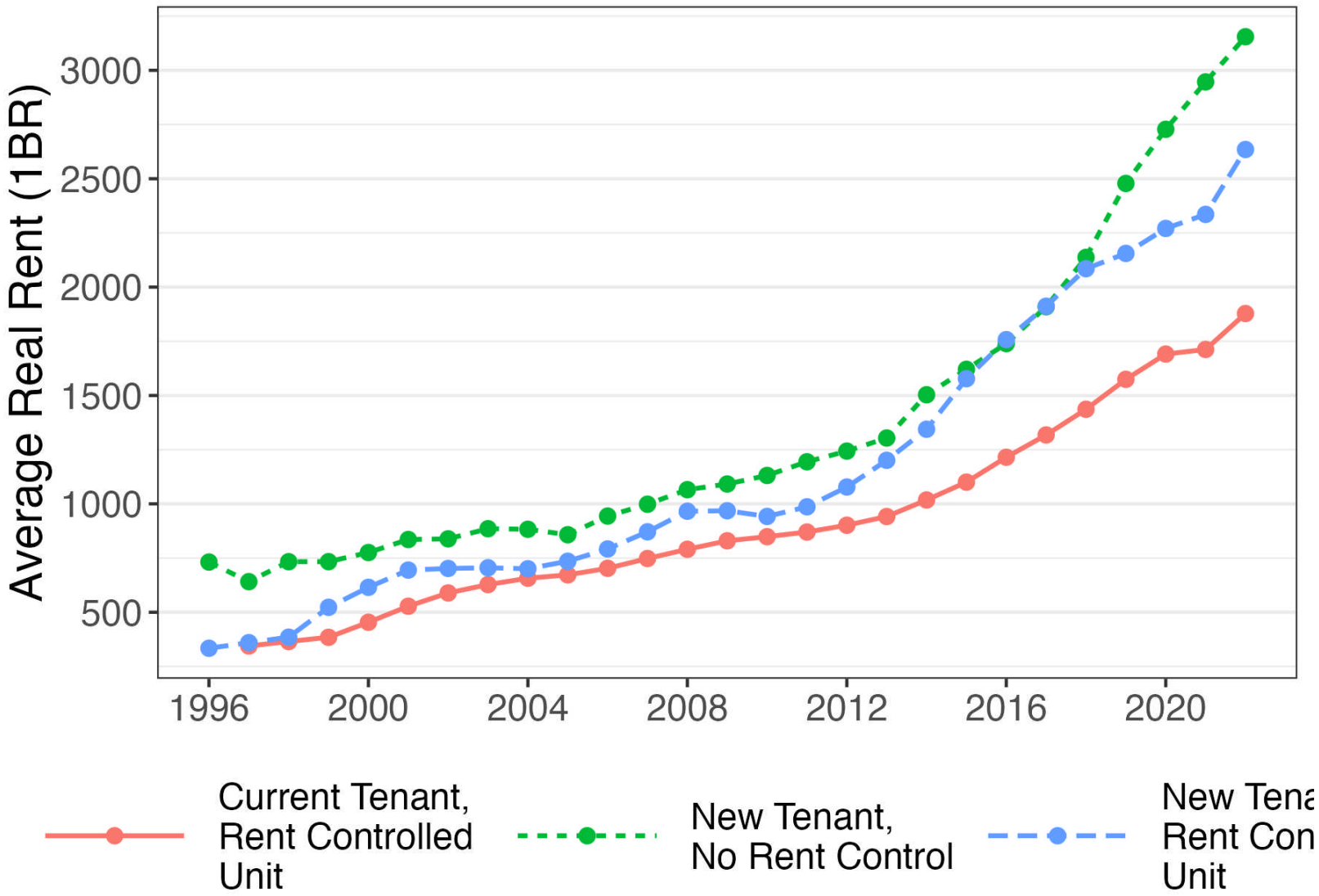
Back

Rent: Active Leases



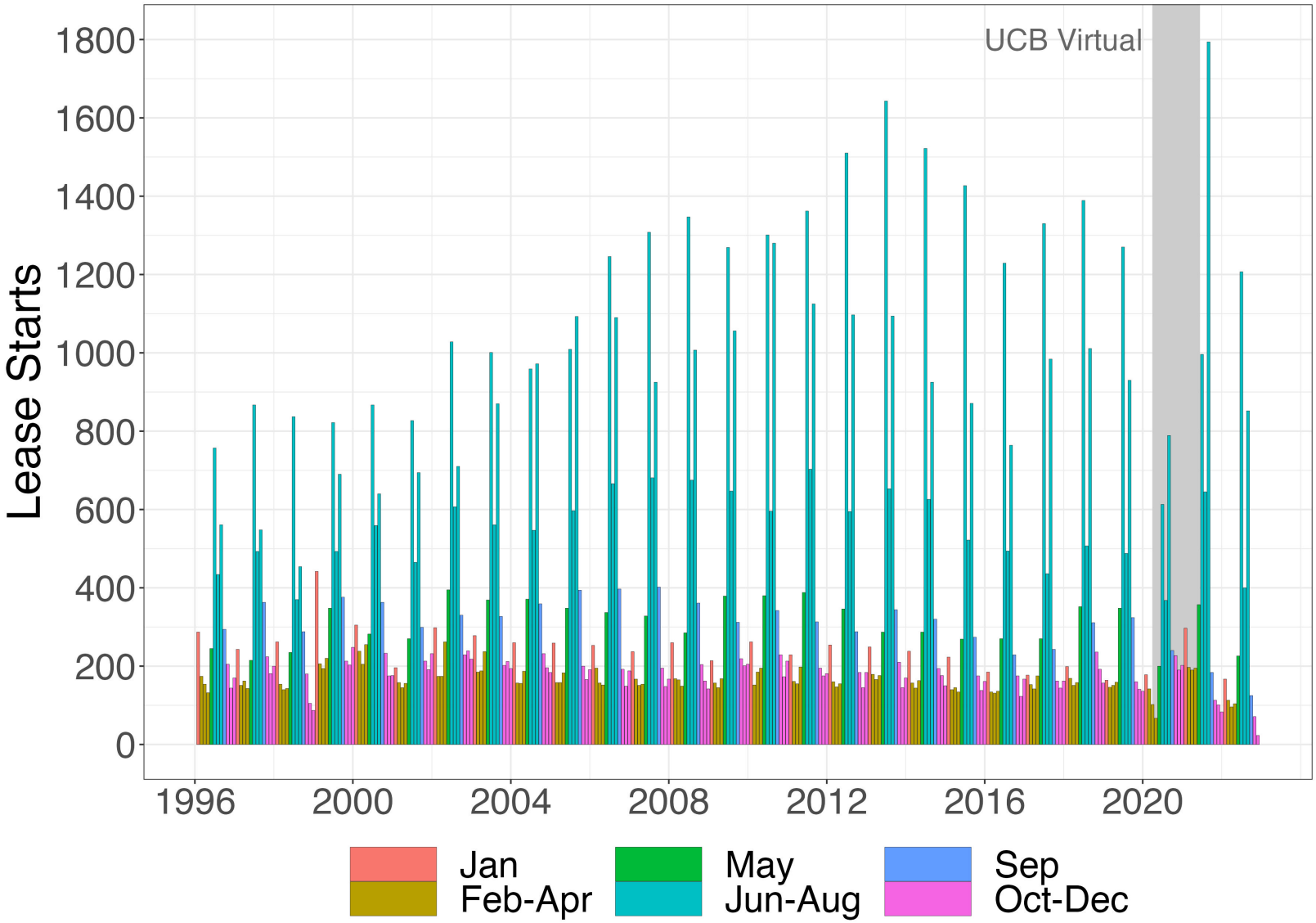
Back

Real Rent Over Time



Back

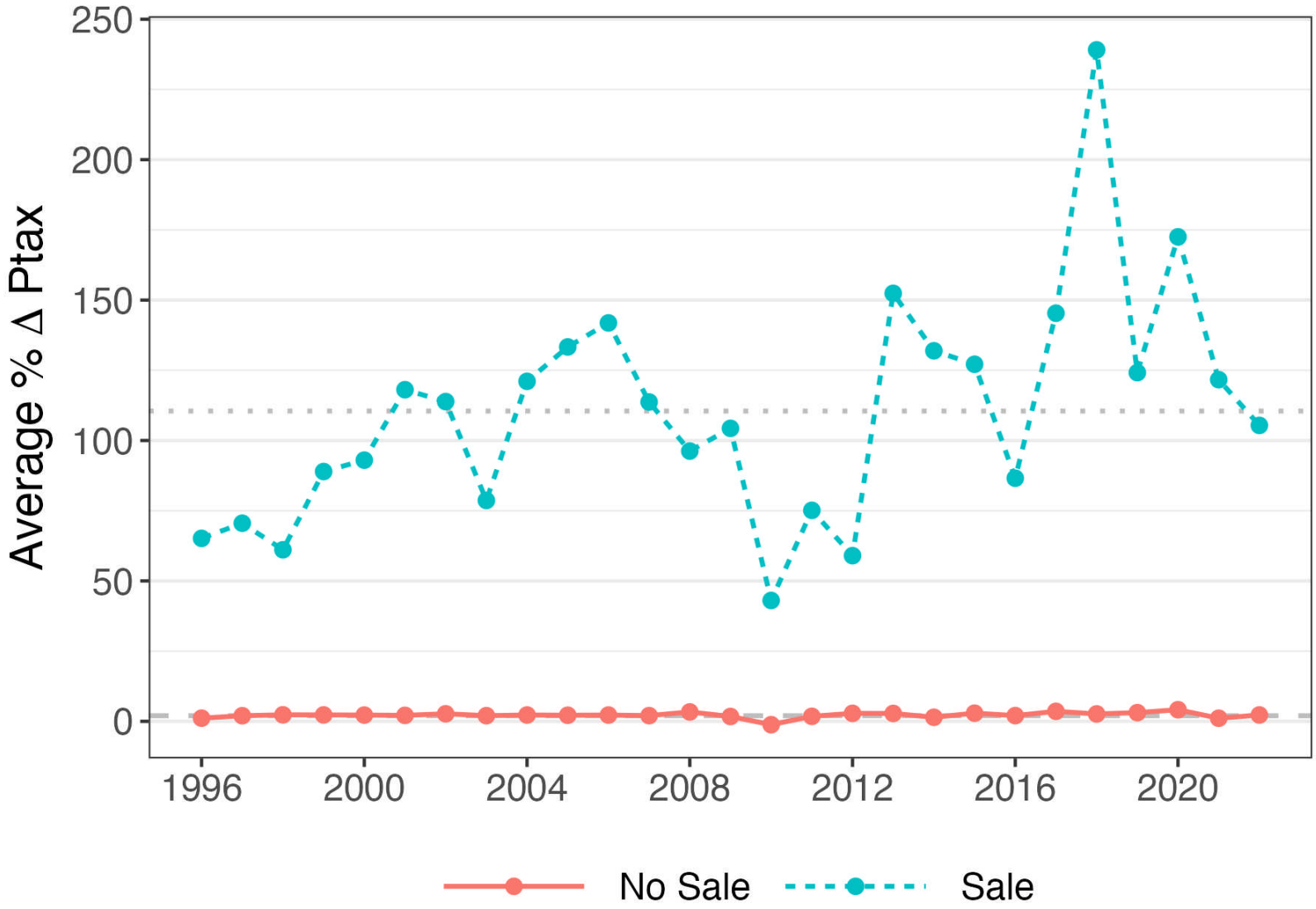
Rent: Lease Starts



Baker & Wroblewski (2024): Rents are higher in the summer months

Back

Identifying Sales



Back

Sale and Permit Frequency

Table: Sample Sales and Reassessments

	Buildings	Units	Tenant Spells
Sold	2276	9874	15019
Reassessed	442	1864	2008
Total	3590	17367	97017

Table: Sample Building Permits

	Buildings	Units	Tenant Spells
Permits	2666	12465	32139
Total	3590	17367	97017

Back to Data Back to Permit Event Study

Building Permits

Need a permit to:

- "Construct, enlarge, alter, repair, move, demolish or change the occupancy of a building or structure"
- "Erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system"

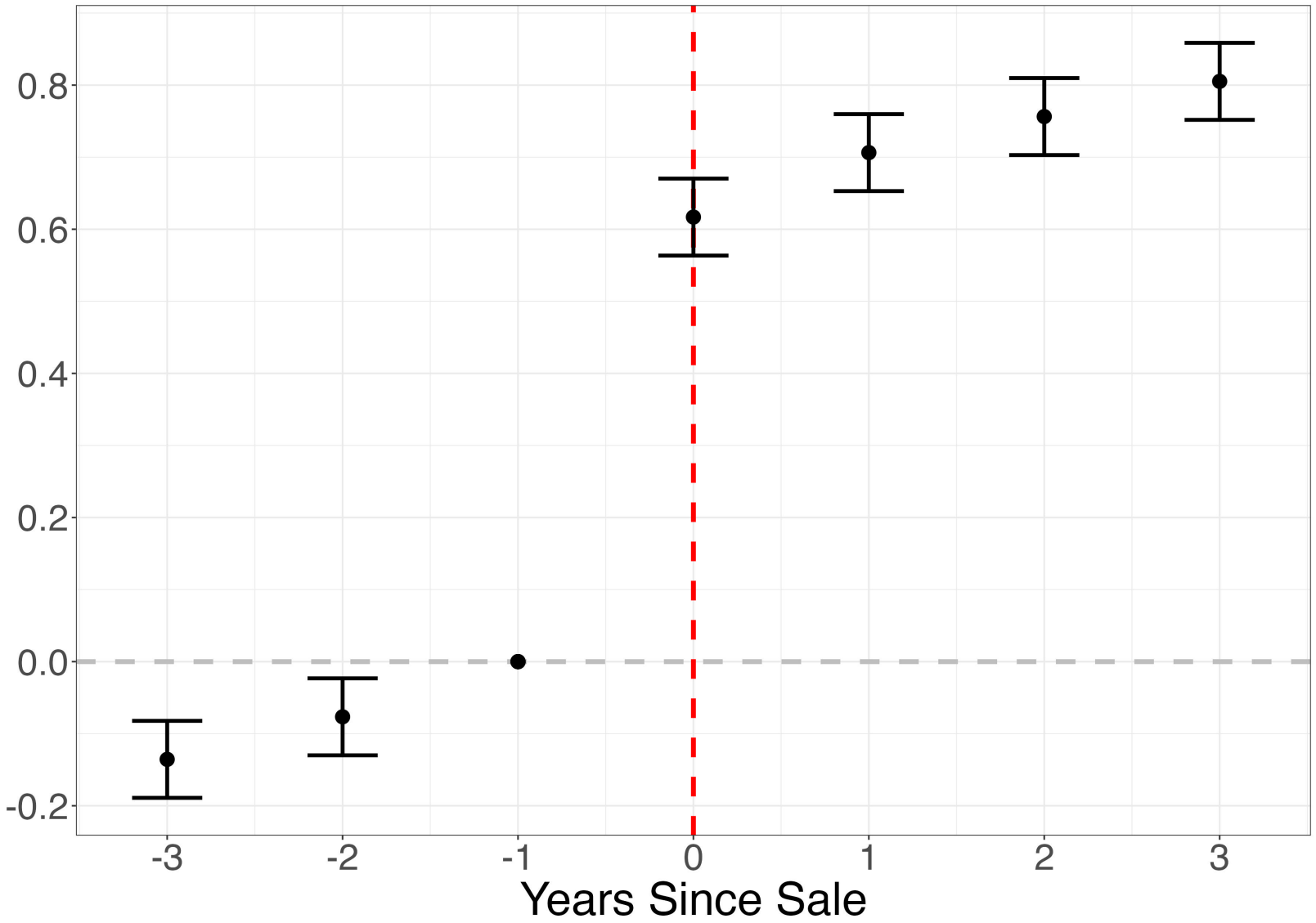
Do not need a permit for:

- "Painting, papering, tiling, carpeting, cabinets, counter tops, and similar finish work"

Assumption: most 'finish work' captured in previous permits (these words are often seen in permit summaries); same type of data used in Diamond and McQuade (2019), Benmelech et al. (2023)

Back

Balanced Event Study: Log Property Taxes



Back

Interpreting the Elasticity

To convert the elasticity into a dollar-for-dollar β, I can multiply by the median ratio of rent to property taxes of $\frac{R}{p} = 11$ for sold properties:

$$\epsilon = \frac{\Delta R}{\Delta p} \times \frac{p}{R}$$
$$0.048 = \beta \times \frac{1}{11}$$
$$\beta = 0.53$$

$\Longrightarrow$ This implies pass-through of \$0.53 per \$1.

Back

Baseline vs. Pure Control

Table: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:	
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$	
	(1)	(2)
$\Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	−0.004	−0.008
	(0.009)	(0.014)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.017***	0.009*
	(0.005)	(0.005)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.048***	0.058***
	(0.010)	(0.014)
Implied Pass-Through Per $1	$0.53	$0.64
Observations	97,017	43,850
Adjusted R^2	0.699	0.727
Note:	*p<0.1; **p<0.05; ***p<0.01	

Back

Landlord Size: Test 2

Divide landlords into quartiles, and add a dummy variable for a sale from landlord in size Quartile X to size Quartile Y, with Q1 containing the smallest landlords and Q4 containing the largest landlords.

$$
\begin{aligned}
\Delta_{t,t-k} \log Rent_i = \ldots &+ \delta \times \{Sale_{t,t-k} \times \Delta_{t,t-k} \log TotalTaxableValue_i\} \\
&+ \beta_{1,2} \times \{Sale_{t,t-k} \times 1[Q_1 \to Q_2]\} \\
&+ \beta_{1,3} \times \{Sale_{t,t-k} \times 1[Q_1 \to Q_3]\} \\
&+ \beta_{1,4} \times \{Sale_{t,t-k} \times 1[Q_1 \to Q_4]\} \\
&+ \beta_{2,1} \times \{Sale_{t,t-k} \times 1[Q_2 \to Q_1]\} \\
&+ \beta_{2,3} \times \{Sale_{t,t-k} \times 1[Q_2 \to Q_3]\} \\
&+ \beta_{2,4} \times \{Sale_{t,t-k} \times 1[Q_2 \to Q_4]\} \\
&\vdots
\end{aligned}
$$

Back

Landlord Size: Test 2

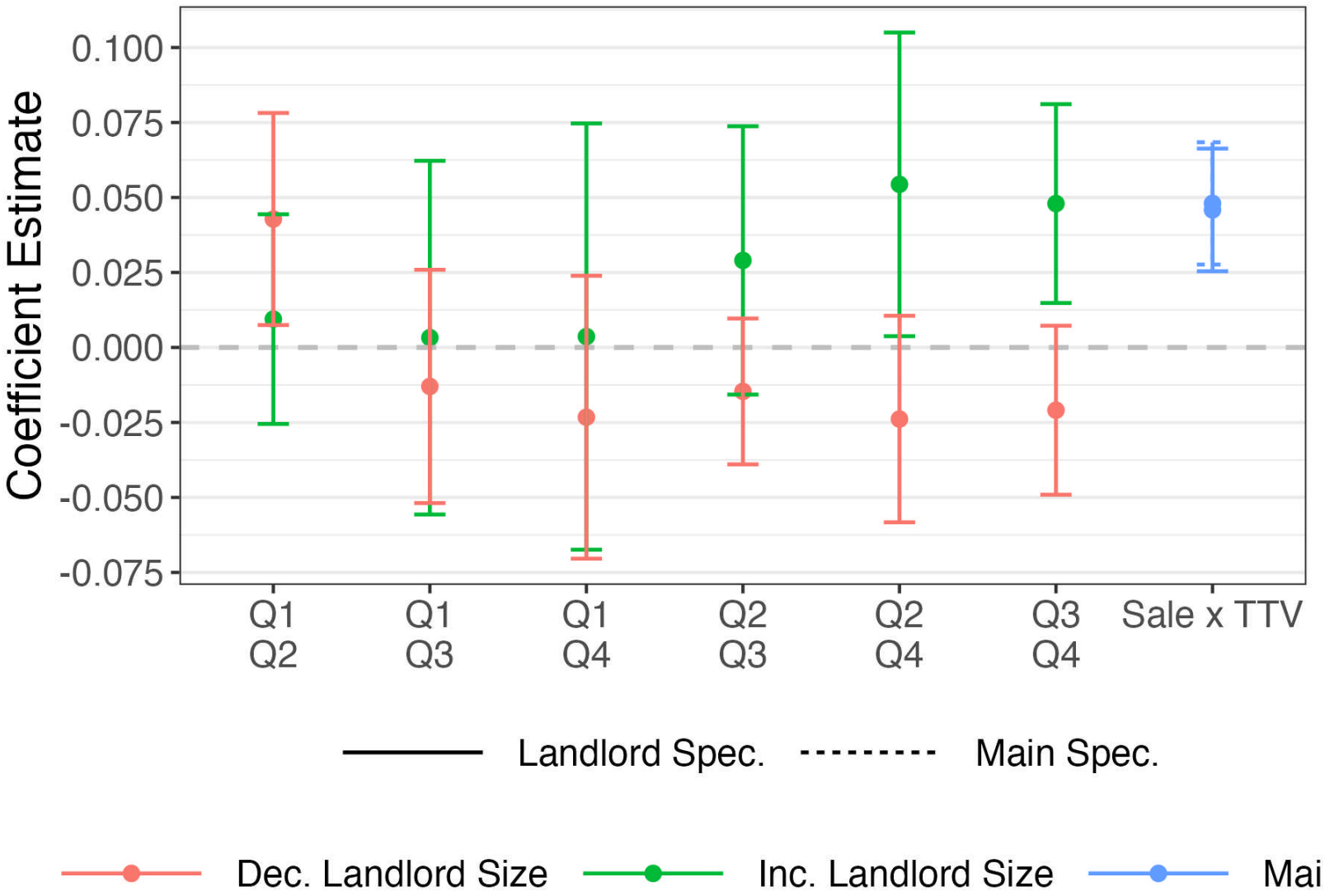


Table Back

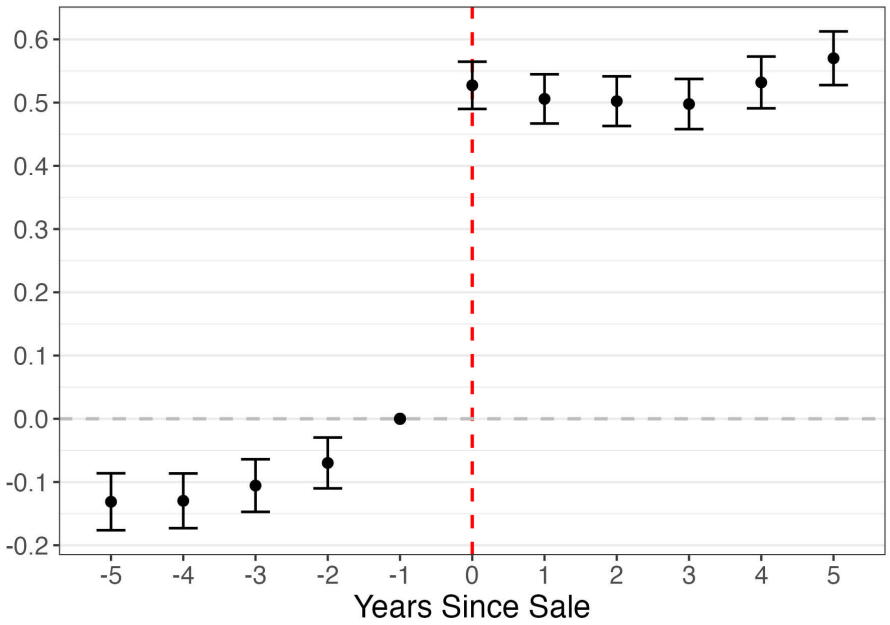
Landlord Alt. Spec.

	Dependent variable:		
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$		
	(1)	(2)	(3)
$\Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	−0.004	−0.003	−0.004
	(0.009)	(0.010)	(0.009)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.017***	0.014***	0.018***
	(0.005)	(0.005)	(0.005)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.048***	0.046***	0.046***
	(0.010)	(0.010)	(0.010)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*1 → *Landlord Q*2		0.009	
		(0.018)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*1 → *Landlord Q*3		0.003	
		(0.030)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*1 → *Landlord Q*4		0.004	
		(0.036)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*2 → *Landlord Q*1		0.043**	
		(0.018)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*2 → *Landlord Q*3		0.029	
		(0.023)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*2 → *Landlord Q*4		0.054**	
		(0.026)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*3 → *Landlord Q*1		−0.013	
		(0.020)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*3 → *Landlord Q*2		−0.015	
		(0.012)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*3 → *Landlord Q*4		0.048***	
		(0.017)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*4 → *Landlord Q*1		−0.023	
		(0.024)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*4 → *Landlord Q*2		−0.024	
		(0.018)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ *Landlord Q*4 → *Landlord Q*3		−0.021	
		(0.014)	
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta_{t_{ij}-k_{ij},t_{ij}}$ Number of Units			0.0001***
			(0.00002)
Implied Pass-Through Per $1	$0.53	$0.50	$0.51
Observations	97,017	97,017	97,017
Adjusted R^2	0.699	0.700	0.699

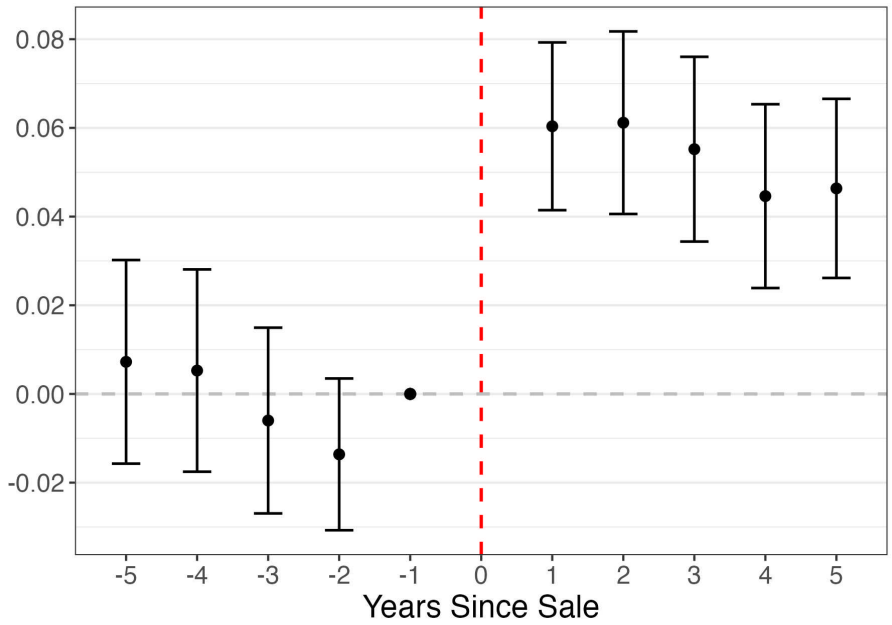
*p<0.1; **p<0.05; ***p<0.01

Back

Event Study



(a) Property Taxes



(b) New Tenant Rent

Back

Turnover

Table: Tenant Spell Length by Sold/Unsold Status

	Average Spell Length (Years)		
Spell Year End	Not Sold	Sold	Post-Sale
1999-2004	2.1	2.9	1.8
2005-2009	2.3	3.9	2.2
2010-2014	2.5	5.1	2.7
2015-2022	2.9	6.0	3.0

- Longer spells in buildings that are sold
- After a sale, tenants do not seem to be pressured out

Back

Turnover: Ever Sold Buildings

Table: Tenant Spell Length by Sold/Unsold Status, Ever Sold Buildings

	Spell Length (Years)		
Spell Year End	Not Sold	Sold	Post-Sale
1999-2004	2.0	2.5	1.4
2005-2009	2.1	3.1	1.5
2010-2014	2.2	3.9	1.6
2015-2022	2.5	4.4	1.7

- Longer spells in buildings that are sold
- After a sale, tenants do not seem to be pressured out

Back

IV: Dollars

Table: IV in Levels: Effects of Sale-Triggered Property Tax Changes on Rent

	Dependent variable:		
	Monthly Rent	Monthly Per-Unit TV	Monthly Rent
	(1)	(2)	(3)
Monthly Per-Unit Property Tax	0.617***		0.876***
	(0.109)		(0.246)
Years Since Sale		−3.116***	
		(0.282)	
Num. Units - Landlord	0.358***	0.080**	0.337***
	(0.063)	(0.031)	(0.072)
Specification	Original	First Stage	2SLS
Implied Pass-Through Per $1	$0.62		$0.88
F-statistic	29.78	122.09	28.89
Observations	92,114	92,114	92,114
Adjusted R^2	0.646	0.810	0.645
Note:			*p<0.1; **p<0.05; ***p<0.01

Back

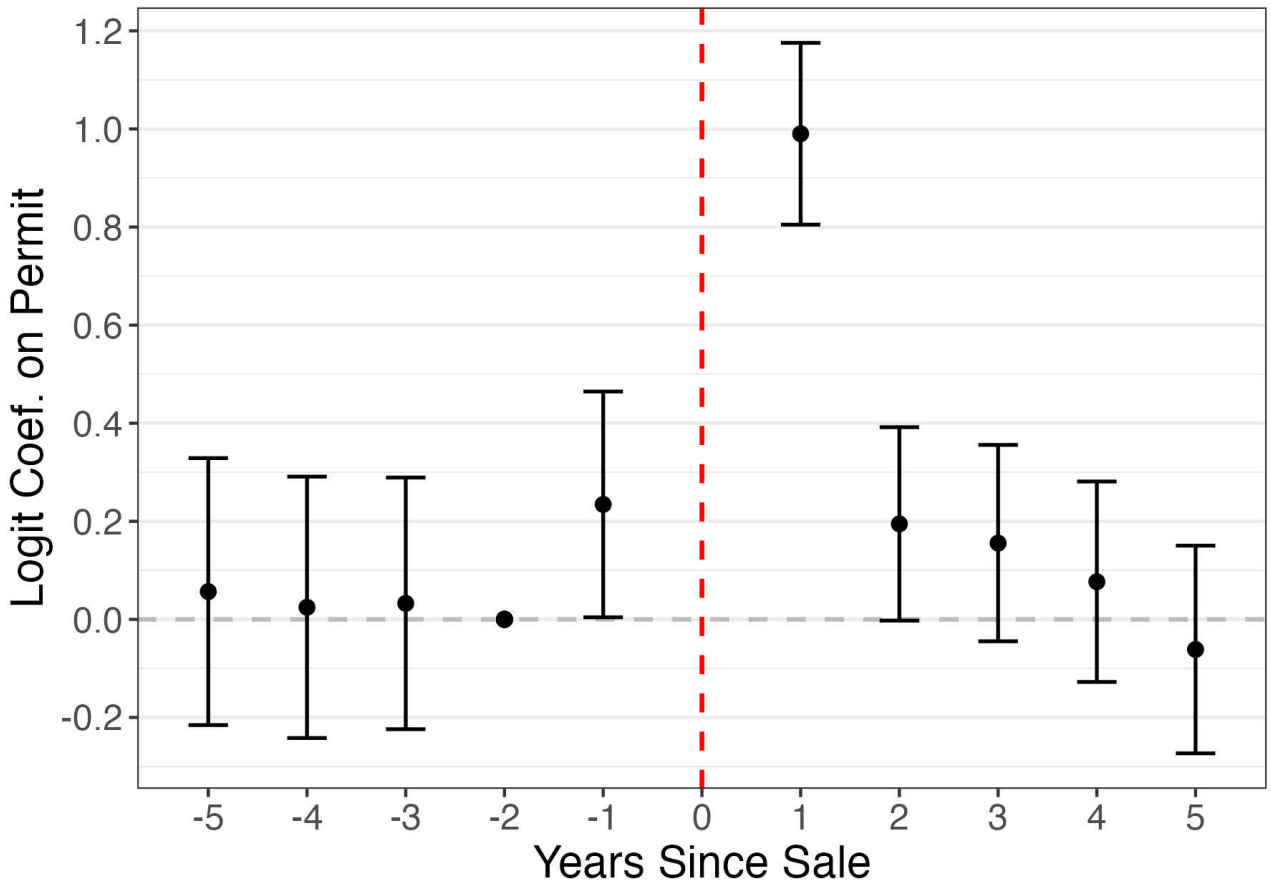
IV: Control for Purchase Price

Table: IV: Effects of Sale-Triggered Property Tax Changes on Rent With Sale Price Control

	Dependent variable:		
	$\Delta \ln[Rent]$	Sale $\times$ $\Delta \ln[TV]$	$\Delta \ln[Rent]$
	(1)	(2)	(3)
$\Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	−0.003		
	(0.010)		
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.021***	−2.908***	−0.067
	(0.006)	(0.269)	(0.078)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ Current Sale Price		0.242***	0.005
		(0.020)	(0.007)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{t_{ij}-k_{ij},t_{ij}}]$	0.047***		0.071***
	(0.011)		(0.021)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times$ Yrs Since Last Sale		0.023***	
		(0.003)	
Specification	Original	First Stage	2SLS
Implied Pass-Through Per $1	$0.51		$0.78
F-statistic	44.14	77.65	41.63
Observations	96,646	96,646	96,646
Note:			*p<0.1; **p<0.05; ***p<0.01

Back

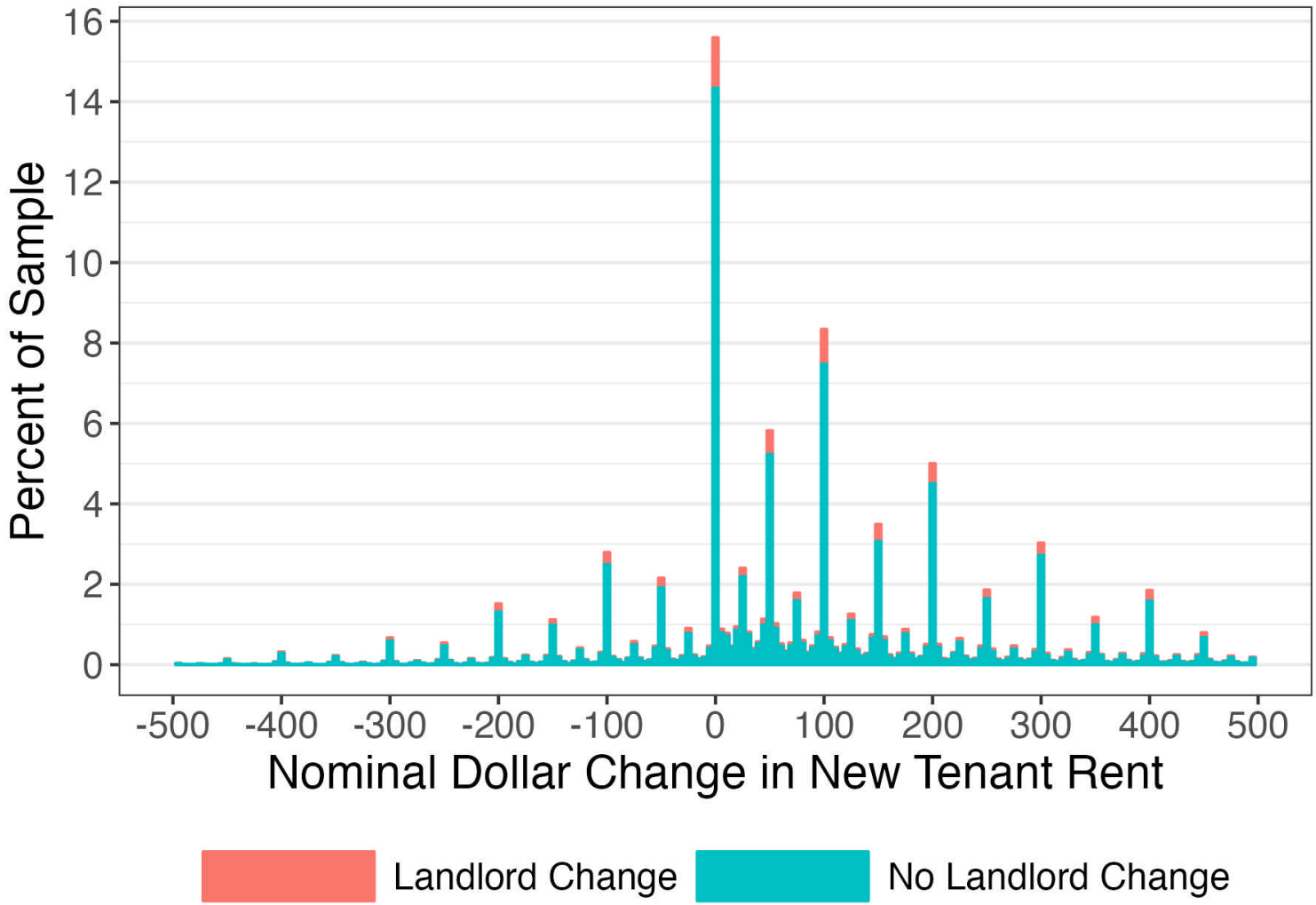
Renovations: Permits More Likely Around Sale



- Probability increases from 3.6% $\rightarrow$ 4.5% $\rightarrow$ 9.1% $\rightarrow$ 4.3%, consistent with Benmelech et al. (2023)

Back

Rent Stickiness



Reproduced from Baker and Wroblewski (2024) Back

Inattention: Test by Landlord Size

Table: Test of Inattention Model

	Dependent variable:			
	Log Rent$_t$			
	(1)	(2)	(3)	(4)
Log New Landlord $R^*_{g,t,beds}$	0.269^{***}	0.194^{***}	0.300^{***}	0.175^{***}
	(0.019)	(0.019)	(0.025)	(0.024)
Log $R^*_{i,g,t-k=1}$	0.645^{***}	0.758^{***}	0.683^{***}	0.880^{***}
	(0.025)	(0.027)	(0.028)	(0.041)
Size Quartile	$Q1$	$Q2$	$Q3$	$Q4$
Observations	19,433	20,191	20,265	20,184
Adjusted R^2	0.894	0.901	0.926	0.943
Note:				*p<0.1; **p<0.05; ***p<0.01

Back

Landlord Entry and Exit: Transactions (Empirical)

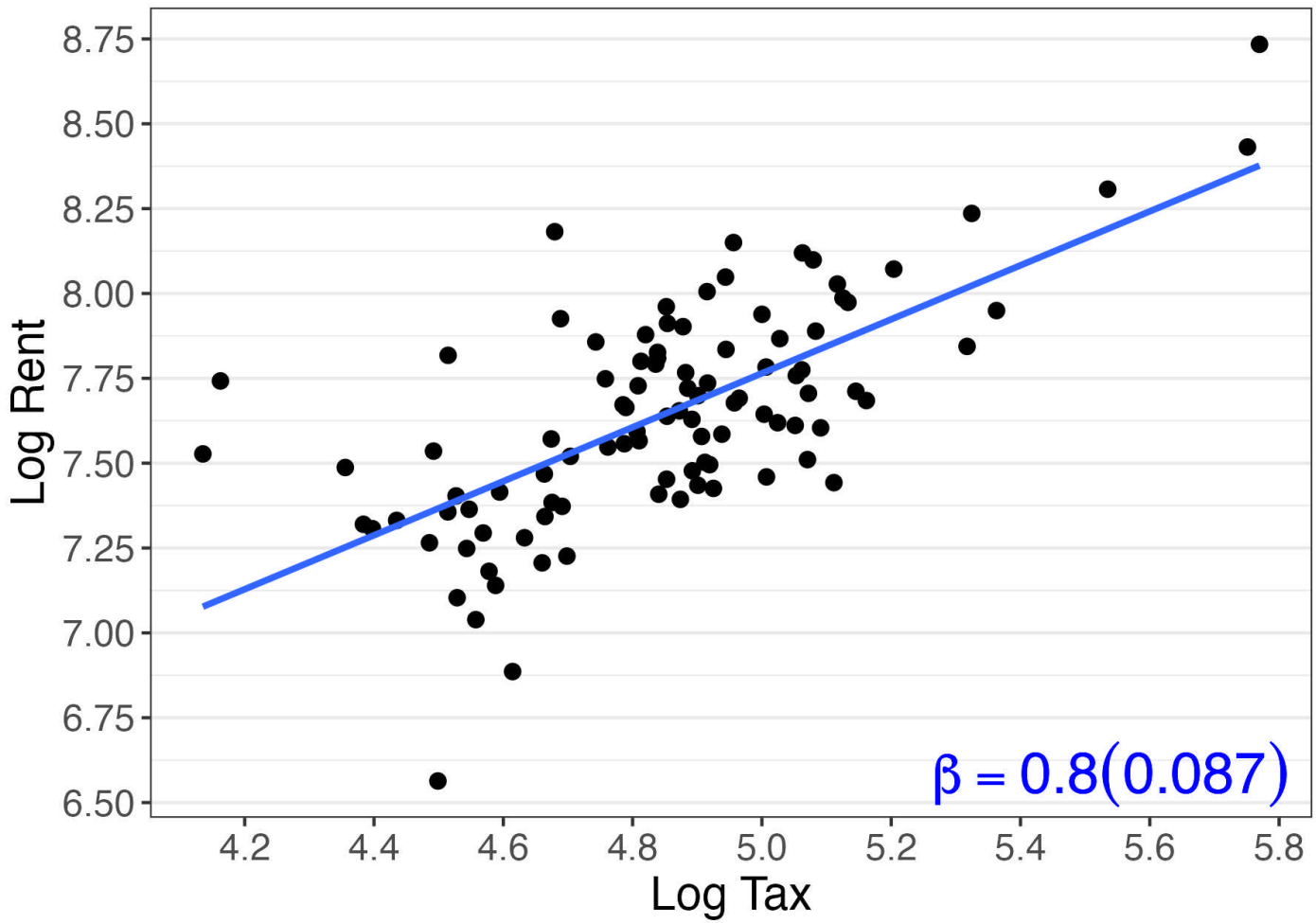
Landlord j decides whether to make an offer on landlord i's property. She will do so if the **rent gap exceeds the tax gap**:

$$
\begin{aligned}
R^*_{jt} - R^*_{it} &> T_{jt} - T_{it} \\
\frac{R^*_{jt} - R^*_{it}}{R^*_{it}} &> \frac{T_{jt} - T_{it}}{T_{it}} \times \frac{T_{it}}{R^*_{it}} \\
\implies \Delta \ln[R] &> \Delta \ln[TV] \times \frac{T_{it}}{R^*_{it}} \\
\implies \Delta \ln[R] &> \Delta \ln[TV] \times 0.045
\end{aligned}
$$

Where I find an average rate of pass-through of 0.048 for sales that occur, which is just larger than 0.045.

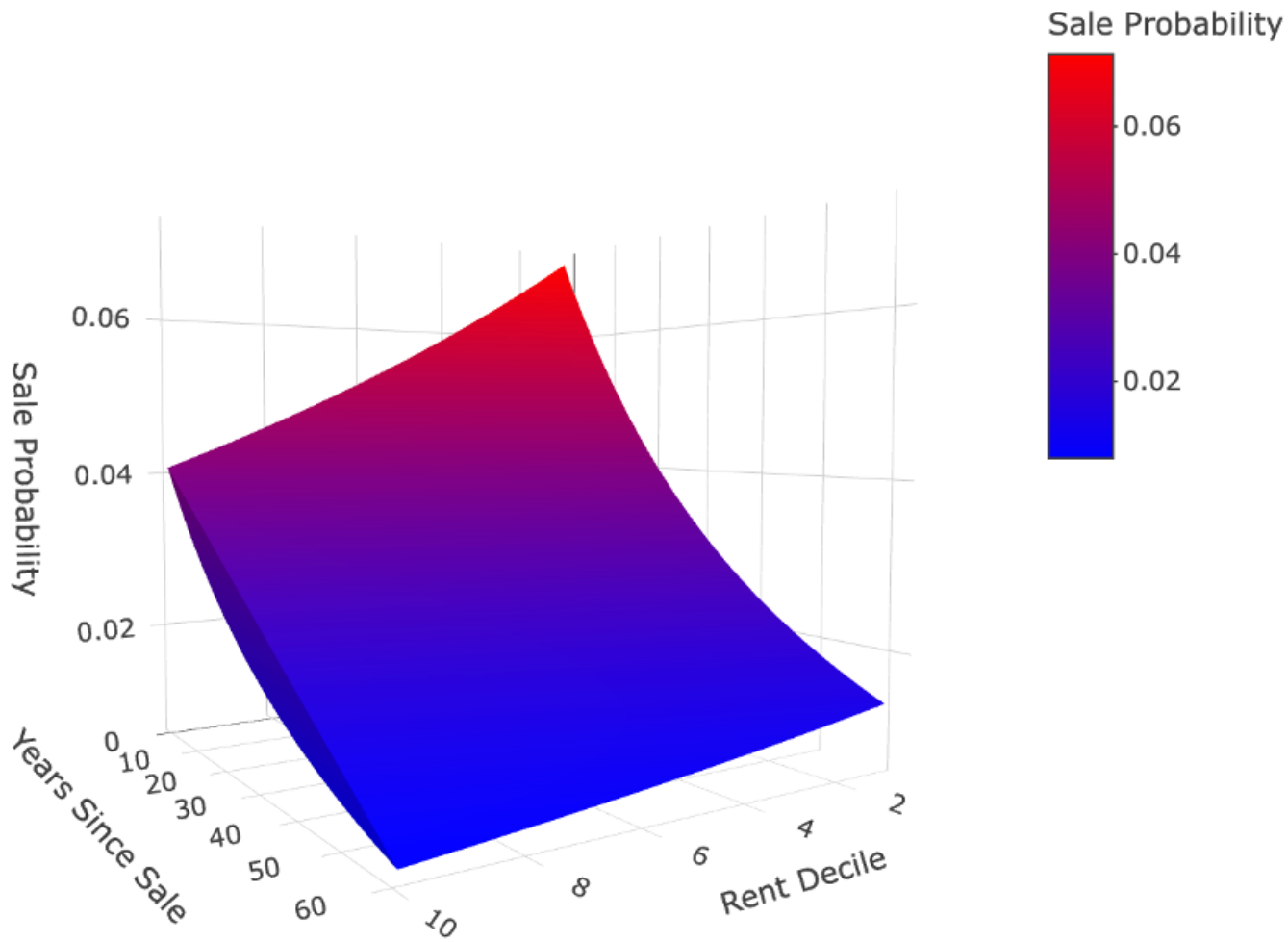
Back

Landlord Entry and Exit: Visual of Data, 2019



Back

Landlord Entry and Exit: Testable Prediction



Back

Predictions of DMP

Model summary for S = amenity value (ex. sqft), m = maintenance cost, β = bargaining strength of tenant, $\theta q(\theta)$ = vacancy rate:

$$R = (1 - A(\theta))(S + h) + A(\theta)m$$

$$A(\theta) = \frac{\beta(r + \delta) + \beta\theta q(\theta)}{r + \delta + \beta\theta q(\theta)}$$

- Tight market (many vacancies, few searchers): $R = m$
- Loose market (few vacancies, many searchers): $R = (1 - \beta)(S + h) + \beta m$
- $\implies$ Pass-through is lowest when vacancy rate is low, highest when vacancy rate is high

$\implies$ **Opposite of what I find in the data**

Back

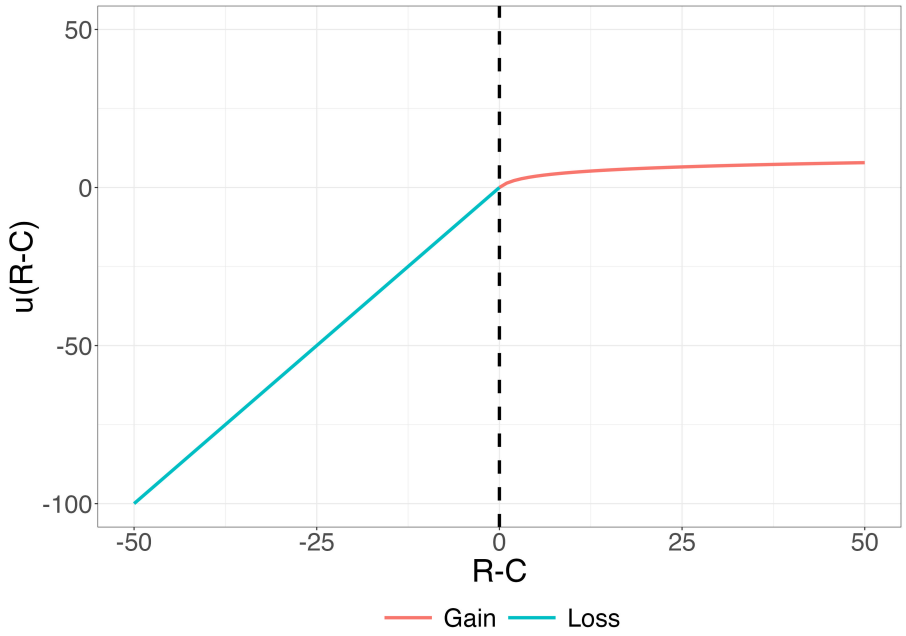
Testing the DMP

	Dependent variable:	
	$\Delta \ln[Rent_{t_{ij}-k_{ij},t_{ij}}]$	
	(1)	(2)
$\Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	−0.004	−0.005
	(0.009)	(0.011)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}}$	0.017***	0.029***
	(0.005)	(0.007)
$\text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$	0.048***	0.050***
	(0.010)	(0.013)
ΔVacancy $\text{Rate}_{t_{ij}-k_{ij},t_{ij}}$		−0.395***
		(0.067)
ΔVacancy $\text{Rate}_{t_{ij}-k_{ij},t_{ij}} \times \text{Sale}_{t_{ij}-k_{ij},t_{ij}} \times \Delta \ln[TV_{i,g,t_{ij},t_{ij}-k_{ij}}]$		−0.382*
		(0.218)
Tract×$\text{Year}_t \times \text{Year}_{t-k}$ FE	Y	Y
$\text{Month}_t \times \text{Month}_{t-k}$ FE	Y	Y
Unit FE	Y	Y
Implied Pass-Through Per $1	$0.53	$0.55
Observations	97,017	62,450
Adjusted R^2	0.699	0.632

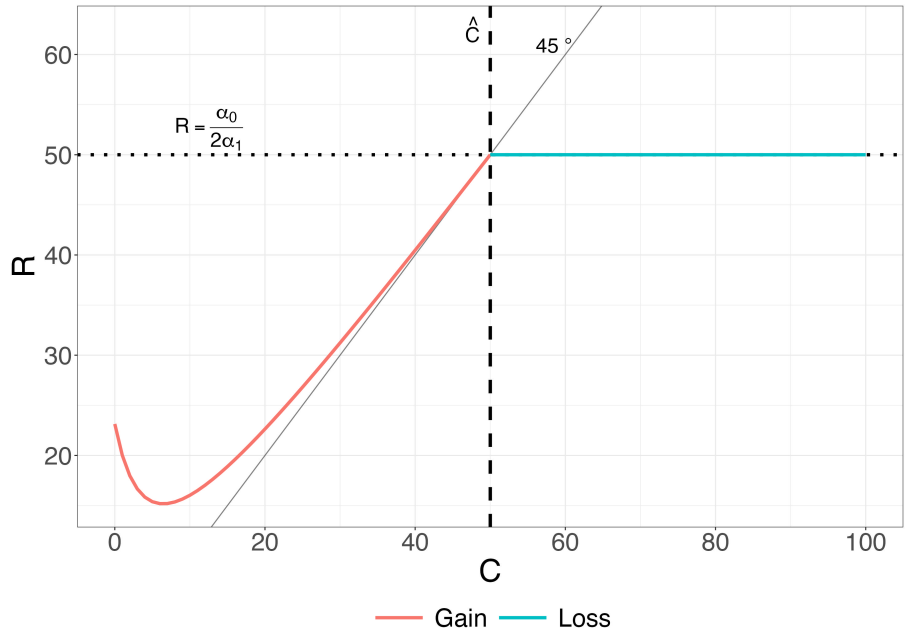
*p<0.1; **p<0.05; ***p<0.01

Back

Reference Dependence



(a) Utility



(b) Rent vs. Costs

- Gain domain:
  1. Positive relationship between tax cost and rent
  2. $R >> C$ not worth higher probability of vacancy
- Loss domain: Landlords set rent at Neoclassical Benchmark

Back