The Welfare Effects of Property Taxes

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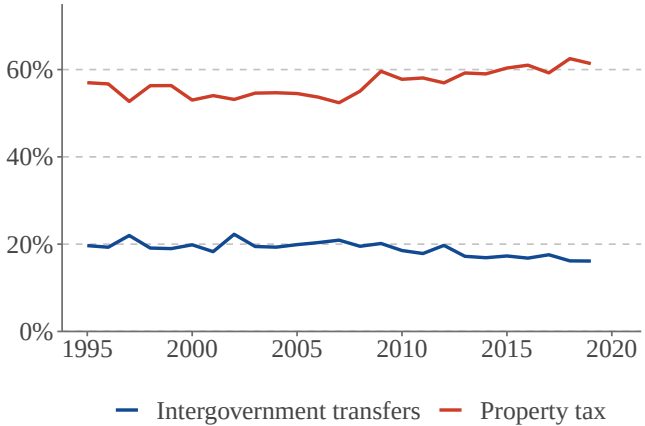
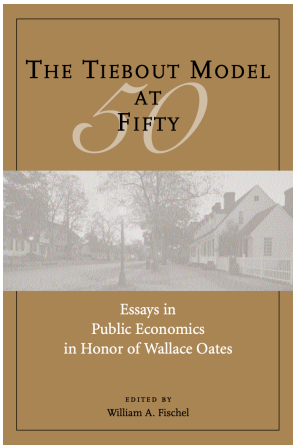
U.S. funding for local public goods heavily relies on property taxes



- $630 billion of state and local property taxes collected in 2021

Despite ubiquity, property taxes are traditionally considered second-best



- Distort incentives to remodel and build housing
- Tiebout model: local governments should charge **head taxes**
- Oates (1972): "*Since the tax price paid by the consumer reflects accurately the cost of the public goods he consumes, [a head tax] introduces no incentives for inefficient behaviour.*"

Lump-sum taxes are unpopular and perceived as unfair

- Equity gains to de facto redistribution via property taxes
- California is the only state with lump-sum taxes (due to Proposition 13)

This project

1. **Measure nominal intrajurisdictional redistribution via property taxes**
   - Bottom income quartile: households pay $1,000 *less* per year
   - Top income quartile: households pay $2,075 *more* per year

2. **Develop general equilibrium model of housing markets**
   - Households choose both quantity and quality of housing
   - Elasticity of housing expenditure share with respect to price: 0.52

3. **Simulate counterfactual welfare under different tax regimes**
   - Quantify equity-efficiency trade-off by benchmarking to head tax

Literature

- **Property taxes**
  - Avenancio-Leon and Howard (2022); Agrawal et al. (2022); Lutz (2015); Scotchmer (2002); Bruckner (2000); Oates (1999); Zodrow and Mieszkowski (1986); Hamilton (1976); Tiebout (1956)

- **Place-based redistribution**
  - Gaubert et al. (2021); Davis and Gregory (2021)

- **Quantitative spatial economics**
  - Baum Snow and Lu (2023); Couture et al. (2021); Diamond (2016); Redding and Sturm (2016); Suárez Serrato and Zidar (2016); Ahlfeldt et al. (2015); Allen et al. (2015); Allen & Arkolakis (2014)

Data

Data sources

- **Primary:**
  - **Corelogic Tax:** parcel-level property taxes from 2007-2019
  - **Corelogic Deeds:** property transactions from 2000-2019
  - **Home Mortgage Disclosure Act (HMDA):** mortgage-level income data from 1990-2019
  - Corelogic-HMDA merge following Bayer et al. (2024) Comparison to ACS

- **Supplementary:**
  - American Community Survey (ACS)
  - Zillow Housing Data (Zillow)
  - Consumer Expenditure Survey (CEX)
  - Census Transportation Planning Project (CTPP)
  - Quarterly Census of Employment and Wages (QCEW)
  - Stanford Education Data Archive (SEDA)
  - National Center for Education Statistics (NCES)
  - Baum-Snow & Lu (2024)
  - Individual Income Tax Statistics (IRS)

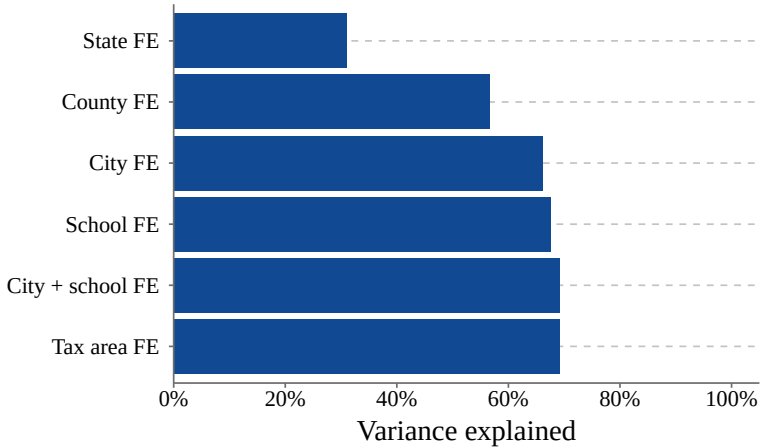
U.S. property taxation

Ad valorem tax on the assessment value of property

$$\underbrace{\textbf{Tax amount}}_{\text{Data}} = \underbrace{\textbf{Assessment value}}_{\text{Data}} \times \underbrace{\textbf{Assessment ratio}}_{\text{State statutes}} \times \textbf{Tax rate}$$

- County governments administratively assess property values and collect taxes
- State governments set assessment ratios
- Local governments (e.g., cities) set tax rates

Most tax jurisdictions are delineated by school district boundaries

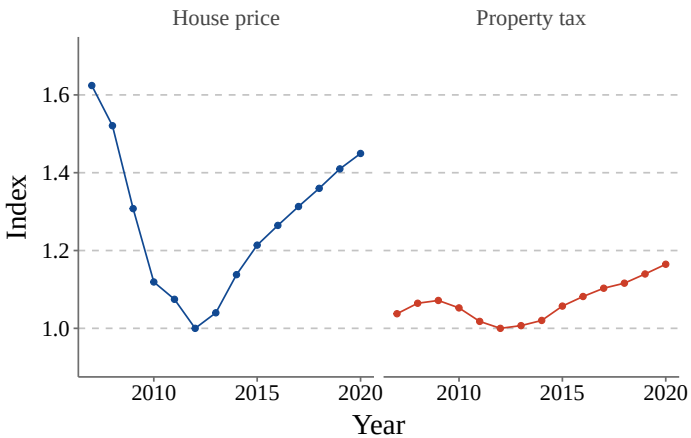


$$\underbrace{y_i}_{\text{Tax rate}} = \underbrace{\lambda_{g(i)}}_{\text{Geography FE}} + \varepsilon_i$$

i : residential parcel

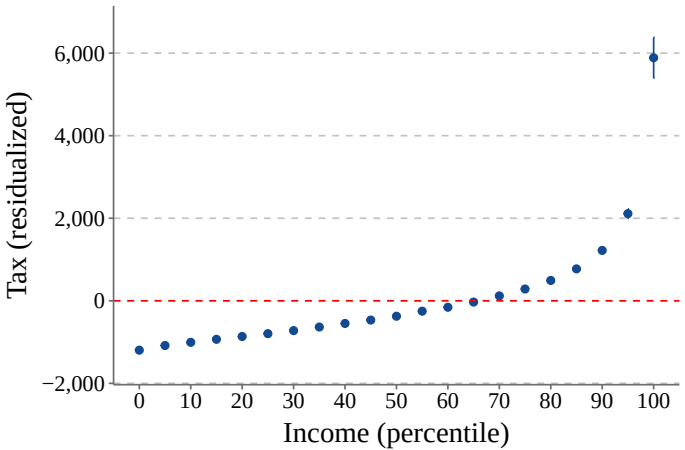
- Remaining variation due to property tax exemptions and measurement error

Local governments adjust tax rates so per parcel revenue is stable



- Price: repeat sales index; tax amount: repeat parcel index

Within school district, richer households pay more property taxes



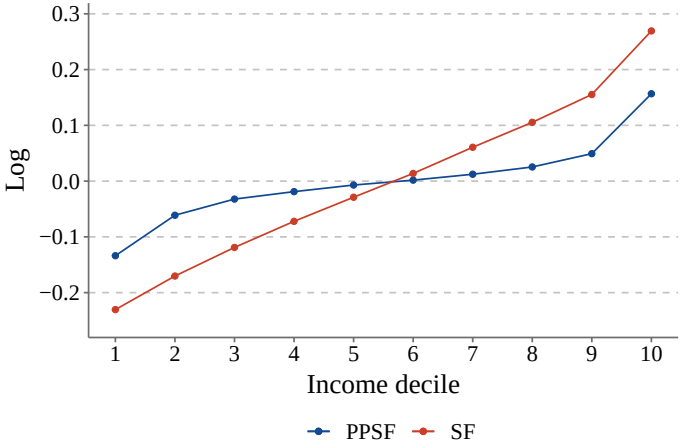
$$\text{Tax}_i - \frac{\sum_{j \in g(i)} \text{Tax}_j}{\sum_{j \in g(i)} 1}$$

i : residential parcel

g : school district

- Nominally: richer households subsidize local public goods for poorer households

Richer households consume both more housing and higher quality housing



- Sq. ft. and price per sq. ft. residualized by school district

General equilibrium effects complicate welfare analysis

Two behavioral effects from property taxes:

1. Distort consumption away from housing to non-housing **(intensive margin)**
   - Standard tax result: excess burden depends on supply and demand elasticities

2. Distort location choice **(extensive margin)**
   - Tax paid by a given household may not reflect cost of providing public good

$\Longrightarrow$ **Need model to determine economic incidence**

Model of housing markets

Housing demand

- Unit mass of households, J neighborhoods
- Household i of type θ derives utility from neighborhood j:

$$u_{ij} = \log\left(\left(\underbrace{\alpha_\theta \alpha_j}_{\text{Taste}}\left(\underbrace{h_{Lj}^{\delta_{\theta j}}}_{\text{Low quality housing}}\underbrace{h_{Hj}^{1-\delta_{\theta j}}}_{\text{High quality housing}}\right)^{\frac{\eta-1}{\eta}} + \underbrace{c^{\frac{\eta-1}{\eta}}}_{\text{Non-housing consumption}}\right)^{\frac{\eta}{\eta-1}}\right) + \underbrace{\beta G_j}_{\text{Public good}} + \underbrace{A_{\theta j}}_{\text{Amenities}} + \underbrace{\sigma \varepsilon_{ij}}_{\text{EV type I}}$$

- Subject to budget constraint:

$$\underbrace{w_\theta}_{\text{Wage}} - \underbrace{T_j}_{\text{Head tax}} = \underbrace{r_{Hj}}_{\text{Rent}}\underbrace{(1+\tau_{Hj})}_{\text{Ad valorem tax}} h_{Hj} + r_{Lj}(1+\tau_{Lj}) h_{Lj} + p_j c$$

Housing demand

Indirect utility for household i of type θ:

$$u_{ij} = \log\left((w_\theta - T_j)\left(\alpha_\theta^\eta \alpha_j^\eta \underbrace{\tilde{r}_{\theta j}^{1-\eta}}_{\text{Rent index}} (1+\tau_j)^{1-\eta} + p_j^{1-\eta}\right)^{\frac{1}{\eta-1}}\right) + \beta G_j + A_{\theta j} + \sigma\varepsilon_{ij}$$

where:

$$\tilde{r}_{\theta j} = \left(\frac{r_{Hj}}{1-\delta_{\theta j}}\right)^{1-\delta_{\theta j}} \left(\frac{r_{Lj}}{\delta_{\theta j}}\right)^{\delta_{\theta j}}$$

Housing supply

- Landowner in each neighborhood j with marginal cost:

$$c_{Hj}(x) = H_{Hj}^{0\,-\frac{1}{\gamma_{Hj}}} x^{\frac{1}{\gamma_{Hj}}}$$
$$c_{Lj}(x) = H_{Lj}^{0\,-\frac{1}{\gamma_{Lj}}} x^{\frac{1}{\gamma_{Lj}}}$$

- Assume landowners are price-takers:

$$\underbrace{\log(H_{Hj})}_{\text{Housing supply}} = \log\left(H_{Hj}^{0}\right) + \underbrace{\gamma_{Hj}}_{\substack{\text{Housing supply} \\ \text{elasticity}}} \log(r_{Hj})$$

$$\log(H_{Lj}) = \log\left(H_{Lj}^{0}\right) + \gamma_{Lj} \log(r_{Lj})$$

Local government budget constraint

- Assume fixed local public good G_j and constant (per household) marginal cost MC_j
- Denote $N_{\theta j}$ as the number of households of type θ in neighborhood j
- Balanced budget constraint:

$$T_j + \sum_{\theta} \frac{N_{\theta j}}{\sum_{\theta} N_{\theta j}} \left(h^*_{\theta L j} r_{L j} \tau_{L j} + h^*_{\theta H j} r_{H j} \tau_{H j} \right) = MC_j$$

Estimating housing demand: intensive margin

Impute owner's equivalent rent from housing transactions

- Assume houses are priced via discounted cash flow:

$$\underbrace{p}_{\text{Price}} = \frac{1}{\underbrace{\delta}_{\text{Discount rate}}} \left(\underbrace{r}_{\text{Rent}} - \underbrace{\tau p}_{\text{Property tax}} \right)$$

- Price-to-rent ratio:

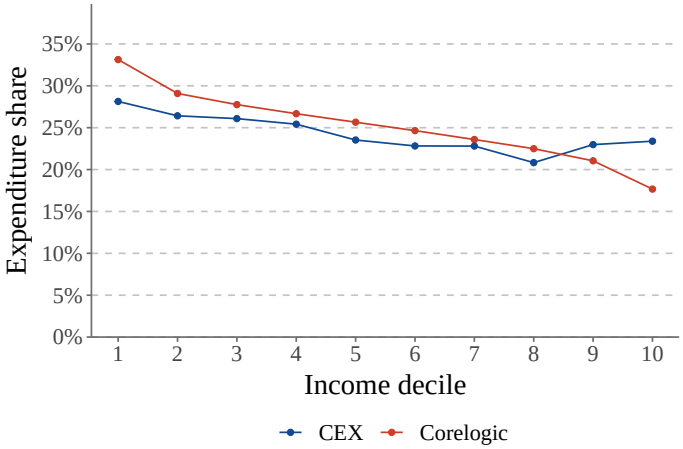
$$\frac{p}{r} = \tau + \delta$$

- Implicit rental tax rate:

$$\tau p = \frac{\tau}{\tau + \delta} r$$

- Calculate metro-level price-to-rent ratios for single-family homes (data: Zillow)

Imputed rents imply similar expenditure shares to CEX



- Expenditure share for shelter and furnishings (e.g., excluding utilities)

Model-implied reduced-form equation

Housing expenditure share for household of type θ in neighborhood j:

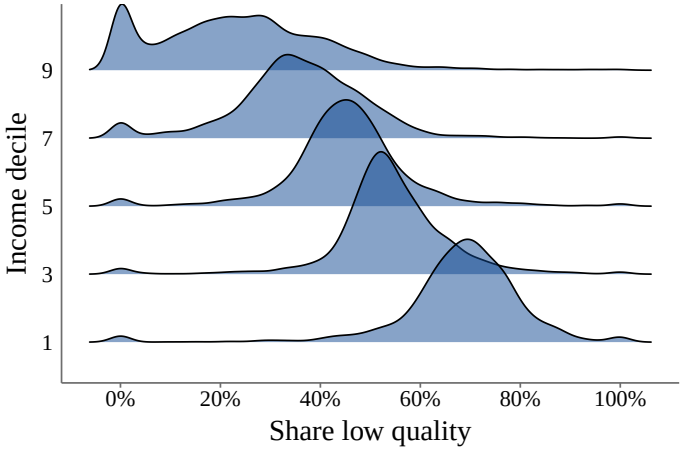
$$\underbrace{\log\left(\frac{w_\theta - p_j c_\theta}{p_j c_\theta}\right)}_{\substack{\text{Relative} \\ \text{expenditure share}}} = \underbrace{(1-\eta)\log\left(\tilde{r}_{\theta j}\right) + (1-\eta)\log\left(1+\tau_j\right) - (1-\eta)\log\left(p_j\right)}_{\text{Prices}} -$$

$$\underbrace{\eta\log\left(\alpha_\theta\right) - \eta\log\left(\alpha_j\right)}_{\text{Taste}}$$

where:

$$\tilde{r}_{\theta j} = \underbrace{\left(\frac{r_{Hj}}{1-\delta_{\theta j}}\right)^{1-\delta_{\theta j}}\left(\frac{r_{Lj}}{\delta_{\theta j}}\right)^{\delta_{\theta j}}}_{\text{Quality}}$$

Identifying quality parameter



- Low quality: bottom tercile; high quality: top tercile

Identifying elasticity of substitution

- Assume we observe neighborhood j in two different time periods. Then:

$$\Delta \log\left(\frac{w_\theta - p_j c_\theta}{p_j c_\theta}\right) = (1-\eta)\,\Delta \log(\tilde{r}_{\theta j}) + \underbrace{(1-\eta)\,\Delta \log(1+\tau_j) - \eta \Delta \log(p_j)}_{\text{"County FE"}} - \underbrace{\eta \Delta \log(\alpha_\theta)}_{\text{Income FE}} - \eta \Delta \log(\alpha_j)$$

- Instrument for $\Delta \log(\tilde{r}_{\theta j})$ with Bartik shock B_j (data: CTPP, QCEW)

- **Identification assumption:**
  - Bartik shock affects housing demand on the extensive margin, but not the intensive margin
  - Formally: $B_j \not\perp \Delta A_{\theta j}$, $B_j \perp \Delta \log(\alpha_j)$

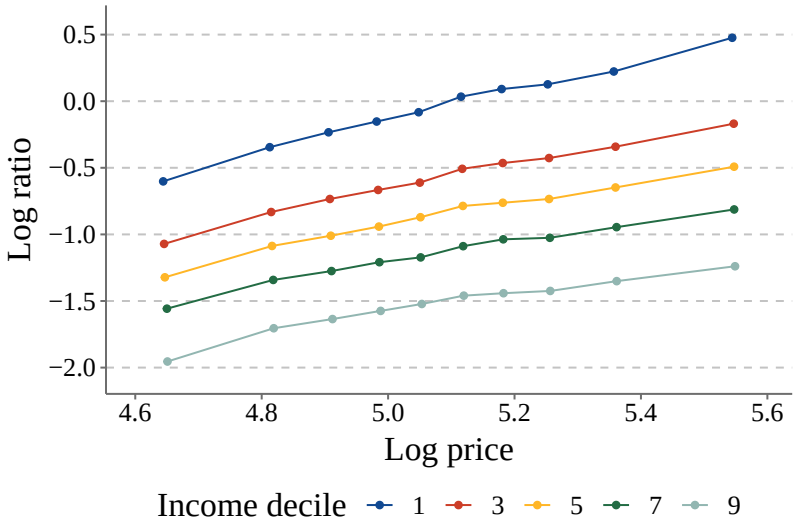
Identifying elasticity of substitution

	$\log(s) - \log(1-s)$						$\log(s)$	
	Cross-sectional		**Longitudinal**				**Longitudinal**	
	OLS	OLS	OLS	IV	OLS	IV	OLS	IV
$\log p$	0.995	0.860	0.988	1.035	0.595	0.746	0.458	0.518
	(0.047)	(0.049)	(0.014)	(0.090)	(0.022)	(0.122)	(0.016)	(0.081)
Bartik IV				1.890		1.866		1.866
				(0.287)		(0.326)		(0.326)
F-stat				563.0		696.3		696.3
Zip-income group	X	X	X	X	X	X	X	X
Income group FE	X	X	X	X	X	X	X	X
County FE		X			X	X	X	X

Longitudinal binscatter

Albouy et al. (2016): $\frac{\partial \log(s)}{\partial \log(p)} \approx 0.6$

Identifying taste parameters



Estimating housing demand: extensive margin

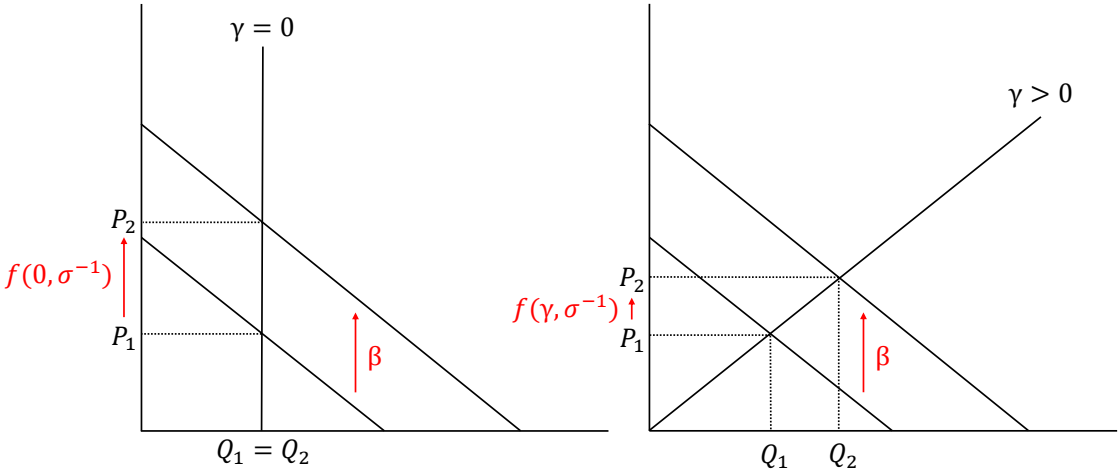
Intuition

- Model-implied comparative statics:

$$\frac{\partial \log(r)}{\partial G} \approx \frac{\sigma^{-1}}{\gamma + \eta + (1 - \eta + \sigma^{-1})\underbrace{\overline{S}}_{\substack{\text{Average} \\ \text{expenditure share}}}} \beta$$

- Trace out demand curve by comparing price changes given identical demand shocks but different supply curves

Intuition



How do we get exogenous change in local public goods?

- Estimate value of local public goods using border RDD a la Black (1999)
  - Majority of property taxes go towards schools, an *excludable* local public good
  - Proxy school district quality using test scores (data: NCES, SEDA)
  - Compare houses across school district borders within the same county, controlling for tax rates and housing characteristics

- Estimate for all elementary school districts in the U.S

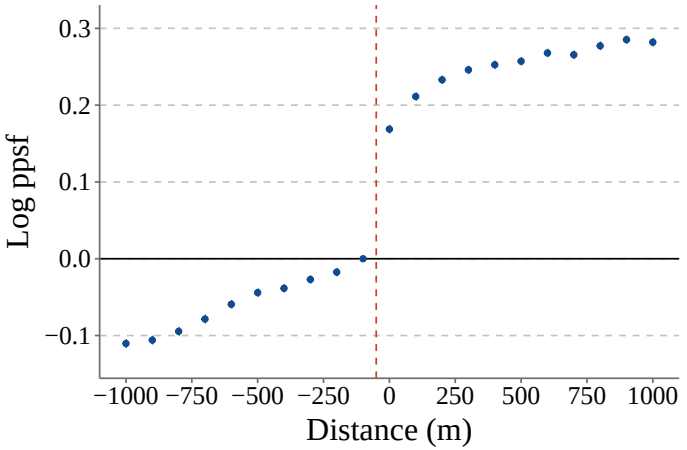
- **Identification assumption:**
  - Discrete changes in unobserved quality at school district borders are uncorrelated with housing supply elasticity (i.e., $\Delta\xi \perp \gamma$)
  - Use housing supply elasticities from Baum-Snow and Lu (2024)

Border RDD specification

$$\underbrace{\log(p_{it})}_{\text{Price / sq. ft.}} = \beta_{-1.0}\underbrace{1(-1.0km \leq Distance_{it} < -0.9km)}_{\text{Distance to border}} \times \underbrace{\Delta Test_{b(i)}}_{\text{Test score increasee}} + \ldots +$$
$$\beta_{-0.2}1(-0.2km \leq Distance_{it} < -0.1km) \times \Delta Test_{b(i)} +$$
$$\beta_{0.0}1(0.0km \leq Distance_{it} < 0.1km) \times \Delta Test_{b(i)} + \ldots +$$
$$\beta_{1.0}1(1.0km \leq Distance_{it} < 1.1km) \times \Delta Test_{b(i)} +$$
$$\underbrace{\delta X_{it}}_{\text{Covariates}} + \underbrace{\lambda_{b(i)t}}_{\text{Border-year FE}} + \varepsilon_{it}$$

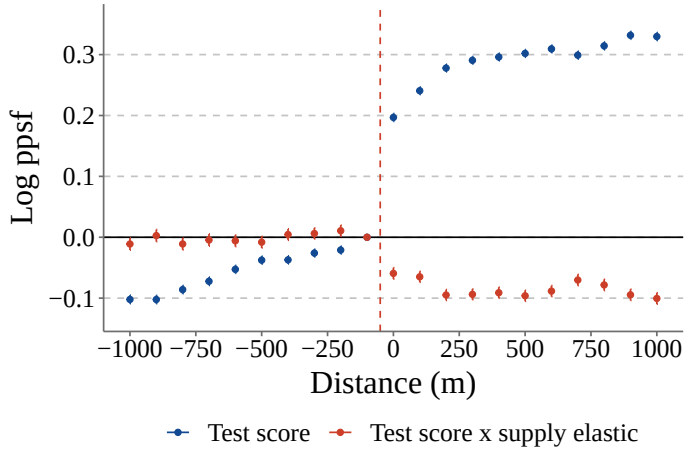
i : sale, t : year, b : border

Standard hedonic regression



- Covariates: property tax rate and housing characteristics (e.g., house age, lot sq. ft.)

Heterogeneity by housing supply elasticity



- Non-linear least squares $\implies \sigma^{-1} = 1.75$ (0.21)

Structural model

Set-up

1. **Demand parameters:** prior estimates
2. **Supply parameters:** housing supply elasticities from Baum-Snow and Lu (2024)
3. **Cost of public good:** calculate mean per residential parcel using Corelogic Tax
4. **Household shares:** calculate school district-level shares by income group using IRS
5. **Budget:** convert income to post-tax budget using ACS

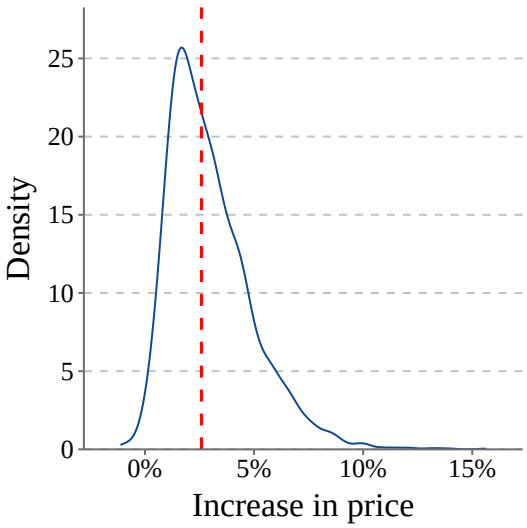
Redistribution moments

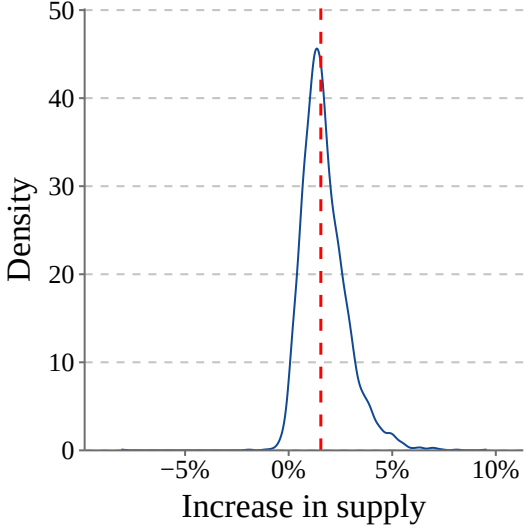
Counterfactuals

Evaluate counterfactual welfare of alternative tax regimes in general equilibrium:

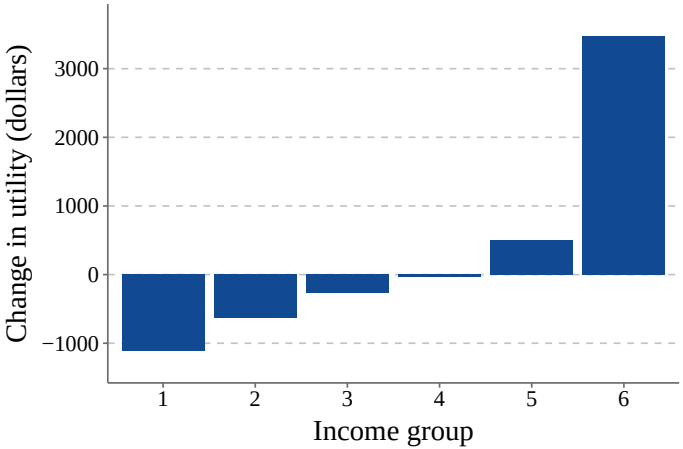
1. **Baseline:** ad valorem tax
2. **Head tax:** lump-sum tax per household

Neighborhood-level change in supply





Average change in utility by income group



- **1:** 0-25k, **2:** 25-50k, **3:** 50-75k, **4:** 75-100k, **5:** 100-200k, **6:** 200k+

Next steps

Next steps

- **Structural model:**
  - Endogenize household wages (or shut down cross-metro migration)
  - Decompose welfare effects into direct vs. behavioral
  - Consider counterfactuals that are explicitly policy-relevant

- **Data:**
  - Use Equifax income + Corelogic MLS to observe renters
  - Misc. validation / robustness checks

Appendix

HMDA income vs. ACS income

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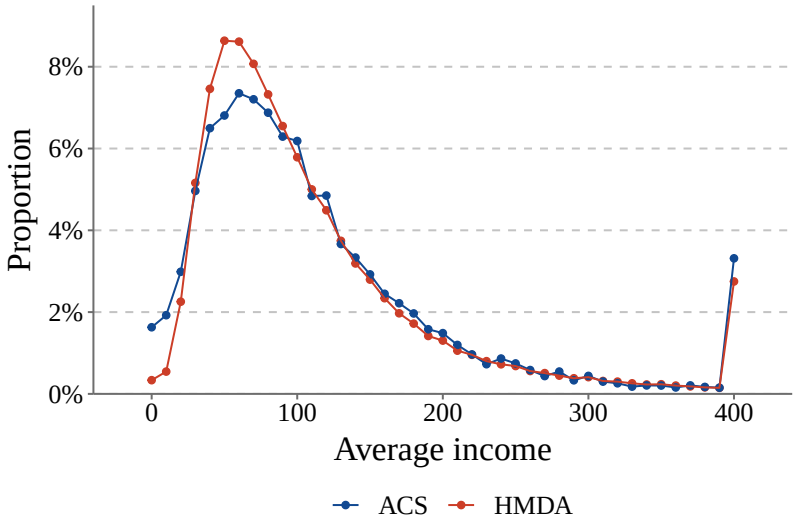

Identifying elasticity of substitution

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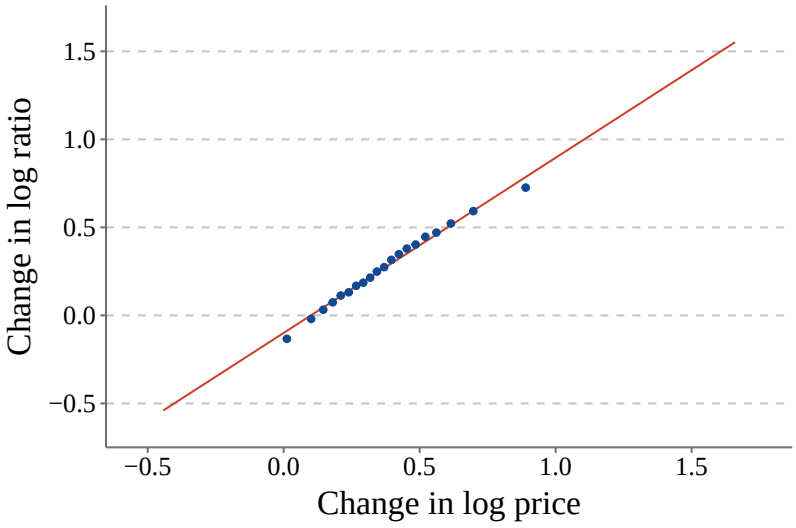

Model-implied nominal redistribution

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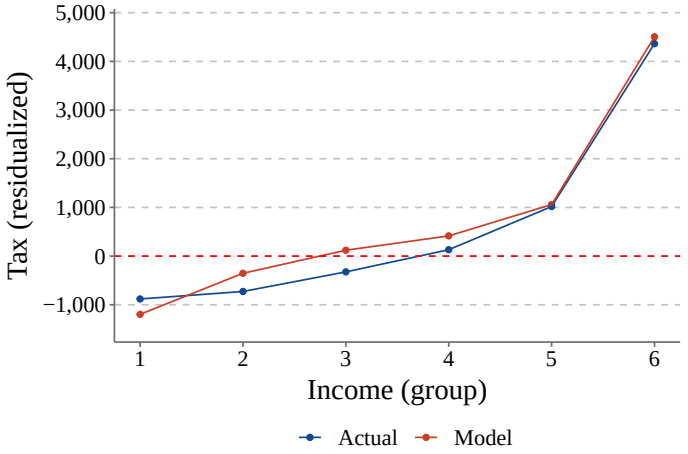

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