Regulating Firearm Markets: Evidence from California

Adam M. Rosenberg

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- Externalities: "Firearm injuries are a serious public health problem" (CDC)
  - >100k gun injuries each year, 1/3 fatal
- Market regulation: Little evidence
  - CA 2024 gun sales tax. Doubles 1918 federal rate
  - Others: Local tax (San Jose), Store ban (Chicago), Min age (21, 30), Buyback (popular)

Market regulation affects gun purchases on the margin $\rightarrow$ Ambiguity plot

- Preferences/Durability: How many gun purchases are on the margin? Owners?

- Externalities: Do marginal gun purchases harm public health?

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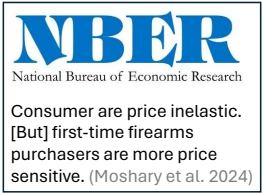
Small margin



Large margin



Maybe margin



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Small margin

Pew Research Center

3/4 owners could never see themselves not owning a gun.

Large margin

NSSF® The Firearm Industry Trade Association

Millions of first-time buyers during covid. Up 67 percent.

Maybe margin

NBER National Bureau of Economic Research

Consumer are price inelastic. [But] first-time firearms purchasers are more price sensitive. (Moshary et al. 2024)

- Externalities: Do marginal gun purchases harm public health?

No harm

National Rifle Association Incorporated 1871 of America

Criminals ... obtain their firearms through illegal channels.
Laws only affect law-abiding people.

Large harm

Annals of Internal Medicine

Cohabitants of handgun [buyers] were more ... likely to die by homicide [than] neighbors ... in gun-free homes.

Maybe harm

National Academies Sciences Engineering Medicine

Existing research studies ... do not credibly demonstrate a causal relationship between ... firearms and ... violence.
There are virtually no ... data series on firearms markets.

This paper

How do preferences, durability, and externalities determine the impacts of gun policy?

- Admin data on CA handgun purchases, firearm retailers, and fatality outcomes

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- Document facts of gun purchases marginal to entry/exit of gun retailers

$$\text{Entry} \rightarrow \underbrace{\text{Gun sales up 30\%}}_{\text{Marginal purchases}} \;\&\; \underbrace{\text{Gun owners up 12\%}}_{\text{Marginal owners}} \rightarrow \underbrace{\text{Homicides up 13\%}}_{\text{Negative externalities}}$$

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- Build model of gun demand in which durable gun ownership affects fatalities

$$\text{Heterogeneity} \rightarrow \text{Higher willingness to pay} \Leftrightarrow \text{Costlier externality} \rightarrow \text{Adverse selection}$$

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- Analyze counterfactual taxes and regulations for CA handgun market

Policy	CA 2024 tax	Optimal tax
Effect	Max revenue	Very high

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Policy	CA 2024 tax	Optimal tax	Local tax	Store ban	Min age	Buyback
Effect	Max revenue	Very high	Targeting gain	Mis-target	Efficient	Under-priced

Literature & Contributions

- **Firearm markets**: Koper and Roth (2002), Bice and Hemley (2002), Knight (2013), Brauer (2013), Depetris-Chauvin (2015), Studdert et al (2017), Balakrishna and Wilbur (2021), McDougal et al (2023), Moshary et al (forthcoming), Armona and Rosenberg (2024), Bollman et al (2025)
  - Estimate demand via revealed preference, joint with public health
- **Firearms, public health, and policy**: Krug (1968), Zimring (1968), Lott and Mustard (1997), Duggan (2001), Lang (2013, 2016), Levine and Mcknight (2017), Studdert et al (2020, 2022), Miller et al (2022) Koenig and Schindler (2023), RAND (2018), Smart et al (2021, 2023)
  - Retailer entry as instrument for ownership
- **Externalities in product markets**: Pigou (1920), Buchanan (1969), Diamond (1979), Allcott et al (2019), Jacobsen et al (2020), O'Connell and Smith (forthcoming), Jia-Barwick et al (2024), Kang (2024)
  - Selection markets tools $\rightarrow$ Correlation of preferences with externalities (Einav et al 2021)

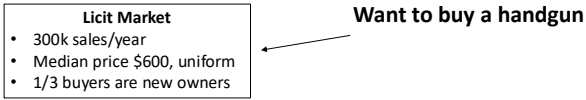
Roadmap

1. Setting and data
2. Facts of marginal purchases
3. Model (jump)
4. Counterfactual policy

Setting: CA handgun market

Want to buy a handgun

Setting: CA handgun market



Setting: CA handgun market

Licit Market
- 300k sales/year
- Median price $600, uniform
- 1/3 buyers are new owners

Want to buy a handgun

80%

Licensed retailers



- Brick and mortar
- Indie – Bass Pro Shops
- 20mi travel distance
- Entry regulation
- 992 in data, 476 entries

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CALIFORNIA DEPARTMENT OF JUSTICE
BUREAU OF FIREARMS
Dealer's Record of Sale (DROS) Worksheet

- Mandatory reporting

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Fringe

Illicit Market



- Poor data
- 3x price
- 40% of transactions fail

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Public Health & Crime

- 9k shootings/year
- Mean time to crime = 3 years
- 1/2 crime guns <10mi from buyer
- 1/2 gun homicides by legal owner

- Consumer handgun purchase and gun retailer operations
  - Transaction-level: Consumer and Retailer ID + Location + Characteristics
    - 1996–2004: ID but no location $\rightarrow$ Gun ownership$_{i,t=0}$
    - 2005–2015: ID and location $\rightarrow$ Estimation and counterfactuals
  - No transaction prices $\rightarrow$ Use distance as metric (Moshary et al. 2023)
- Additional sources
  - Fatalities: Morgue records from CA department of public health
  - Crime (FBI UCR), Demographics (2010 Census), Voting (CA Redistricting), Wage (CA EDD), Income (IRS)

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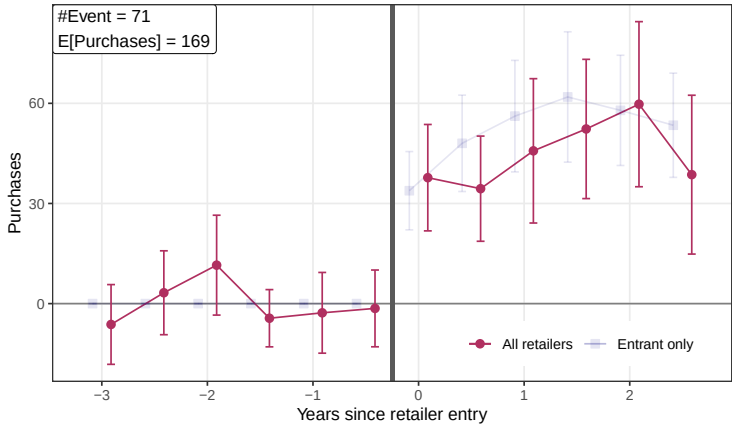
Many gun purchases on margin: Method

- Estimate event study around "clean" first entries of firearm retailers $(0 \to 1)$

$$\frac{\text{GunPurchases}_{zt}}{\text{Pop}_z} = \sum_{t'=-6}^{5} \underbrace{\beta_{t'} \text{EventPeriod}_{zt,t'}}_{\substack{\text{Average } \Delta\text{Purchases} \\ t' \text{ periods from entry}}} + \text{FE}_z + \text{FE}_t + \xi_{zt}$$

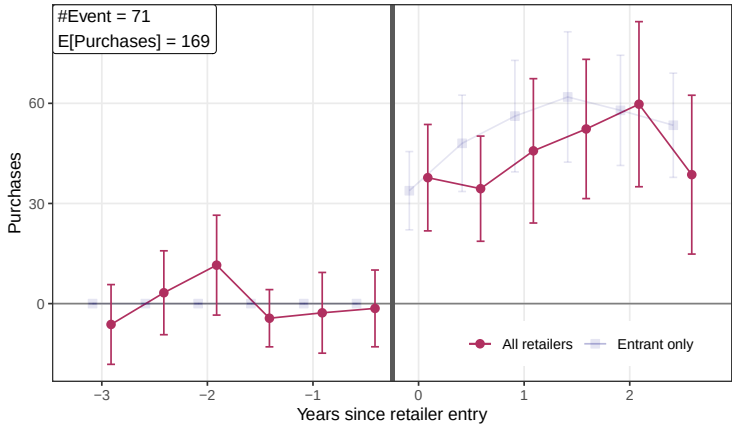
  - Zip code z, half-year t, event time t'
  - Compare zip-period post entry to others not-yet or never entered (Borusyak et al. 2024)

Many gun purchases on margin



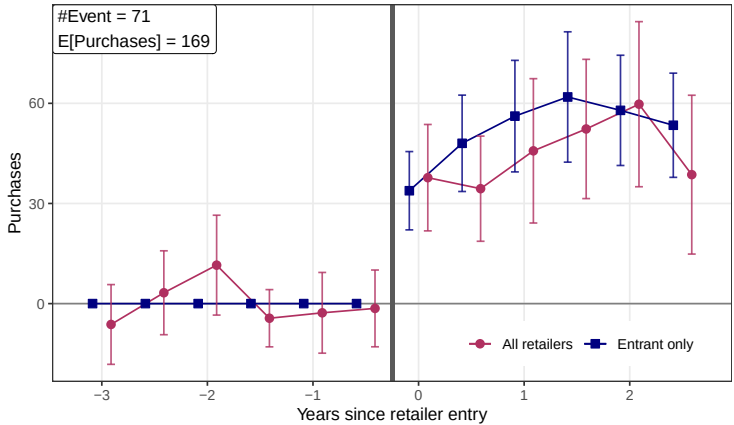
- Outcome: Purchases by consumers in entered zip at any retailer → Mkt Expansion
- Assume: Retailers do not time or position their operations on demand shock ξ_{zt} prediction

Many gun purchases on margin



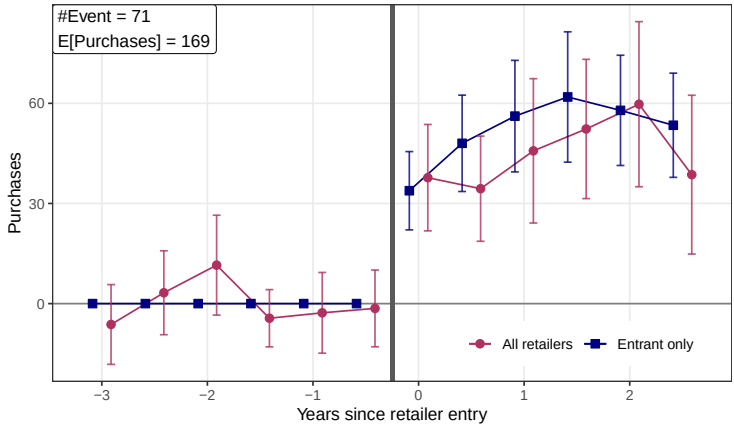
- Year 1: $\overbrace{\text{Mkt Expansion}}^{100}$

Many gun purchases on margin



- Year 1: $\overbrace{\text{Mkt Expansion}}^{100} = \overbrace{\text{Entrant Only}}^{120} - \overbrace{\text{Biz stealing}}^{20}$

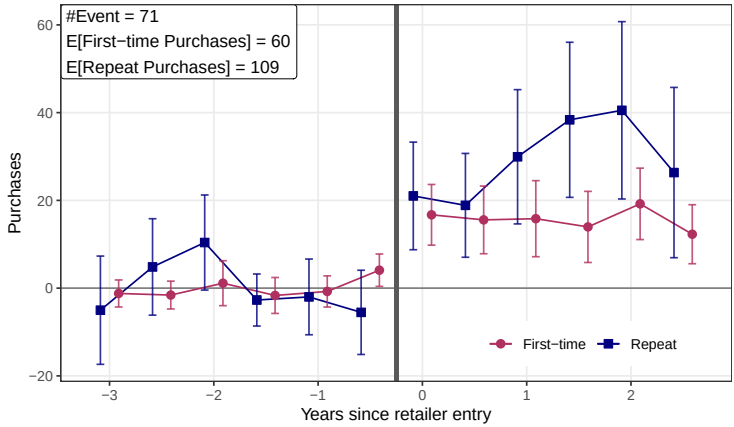
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- Year 1: $\overbrace{\text{Mkt Expansion}}^{100} = \overbrace{\text{Entrant Only}}^{120} - \overbrace{\text{Biz stealing}}^{20} \rightarrow \uparrow$Purchases 30% $\rightarrow$ Large margin

Proportional change in composition of handgun purchases

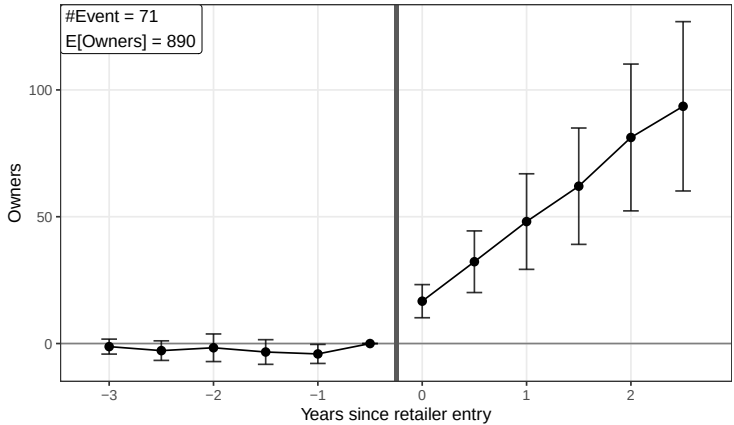
tighter controls



- ↑Purchases 30% for repeat and first-time buyers → Change in ownership

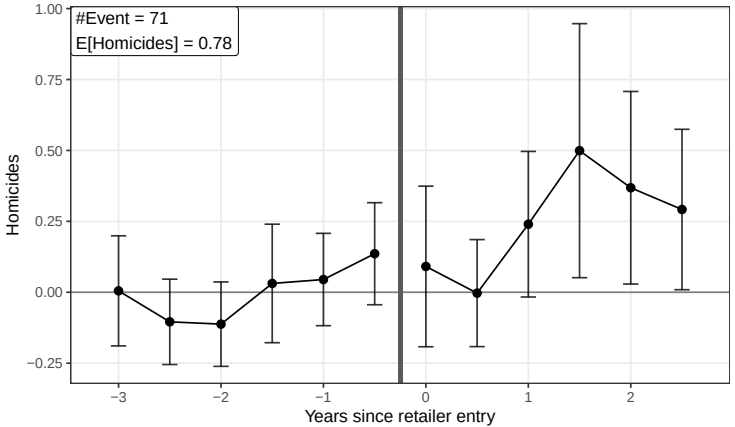
Handgun ownership grows post-entry

tighter controls



- Level change in flow of first-time purchases → Kink in growth of ownership stock

Retailer entry causes homicide fatalities tighter controls distance



- Kink in growth of ownership stock → Kink in flow of homicide fatalities

Marginal owner causes fatalities: Method

mkt expansion | lag y | lag purchase | stage 1 plot

- Regress fatalities on gun ownership, instrumenting with retailer net entry

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \mu \underbrace{\frac{\text{GunOwners}_{zt}}{\text{Pop}_z}}_{\text{IV: } \#\text{GunRetailers}_{zt}} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

  - Sample: All zip-quarters zt to increase power
  - Research design: Retailer entry/exit timing uncorrelated with fatality shock ω_{zt}

- Instrument exclusion and relevance
  - Same market expansion as event study
  - Entry and exit timing $\perp$ Lagged homicides and handgun purchases
  - First-stage F=52

Marginal owner causes fatalities

	Homicide		Suicide	
	Firearm	All-cause	Firearm	All-cause
100 handgun owners	0.040	0.047	0.011	0.016
	(0.014)	(0.015)	(0.011)	(0.018)
$E[\text{Fatalities}_{zt}]$	0.28	0.39	0.27	0.42
Zip + Quarter FE	Y	Y	Y	Y
Zip code clusters	1,304	1,304	1,304	1,304

Average entry adds 5 owners per quarter. $E[\text{GunOwners}_{zt}] = 890$.

- Increase in homicide fatalities driven by firearm-involved homicides
- Robust to event-time designs

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- Robust to event-time designs
- Heterogeneity: Entries across zips $\rightarrow$ Different marginal owners and fatality changes
  - Observables: $\underbrace{\text{Young, white, male,}}_{\text{demographic}}$ $\underbrace{\text{low-income, high-crime, and/or rural}}_{\text{geographic}}$ $\rightarrow$ More homicides

Roadmap

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Preferences, static purchases, and handgun ownership

- Consumer i in demo $x(i)$ during t: Purchases from retailer $j_t \in \mathcal{J}_{z(i)t}$, or not $j_t = 0$

$$u_{ijt} = \overbrace{\nu_i - \alpha^p_{xz} p_t + \xi_{xzt}}^{\text{extensive margin}} + \overbrace{\delta_j - \alpha^d_{xz} d_{ij} + \varepsilon_{ijt}}^{\text{retailer choice}}$$

$$u_{i0t} = \varepsilon_{i0t}$$

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- Extensive margin
  - Present value of purchase: $\nu_i = \overbrace{\psi_{xz}}^{\text{FE}} + \overbrace{\gamma_x g_{i0}}^{\text{Own pre-2005}} + \overbrace{\tilde{\nu}_i}^{N(0,\sigma_x)}$
  - Time varying: tax-inclusive price $\alpha^p_{xz} p_t$ and demand shock ξ_{xzt}

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  - Nested logit shocks for retailers ε_{ijt} and no-purchase ε_{i0t}

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- Gun ownership $g_{it} \in \{0, 1\}$ is durable + Repeated static choice $\rightarrow$ Law of motion

$$g_{it} = g_{i,t-1} + \left(1 - g_{i,t-1}\right) \times \mathbf{1}\Big(\max_{j \in \mathcal{J}_{z(i)t}} u_{ijt} > u_{i0t} \Big)$$

Externalities and fatalities

- Fatalities from externalities $e_i \in \mathbb{R}$ of gun owners $g_{it} \in \{0, 1\}$, and other sources ω_{zt}

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{E_{zt}\left[e_i \mid g_{it} = 1\right]}^{\text{avg externality of owners}} \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} + \omega_{zt}$$

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- Externalities follow linear regression: $e_i = \mu + \zeta^W W_i + \zeta^V V_i + \tilde{e}_i$
  - Intercept μ and observables $W_i = (\text{age}_i, \text{gender}_i, \text{income}_{z(i)}, \dots)$
  - Present value ν_i components $V_i = (\psi_{xz}, g_{i0}, \tilde{\nu}_i)$
  - Heterogeneity slopes $\zeta^W, \zeta^V \to$ Selection into ownership on externalities (Heckman 1979)

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  - Heterogeneity slopes $\zeta^W, \zeta^V \to$ Selection into ownership on externalities (Heckman 1979)
- Fatalities absent gun ownership: $\omega_{zt} = \kappa_z + \eta_t + \chi_x \xi_{xzt} + \tilde{\omega}_{zt}$
  - $\kappa_z + \eta_t$: Fixed effect by zip and quarter
  - $\chi_x \xi_{xzt}$: Endogeneity between fatalities and demand
  - $\tilde{\omega}_{zt}$: Residual, mean zero, independent

Estimation via exactly-identified minimum distance moments preferences externalities

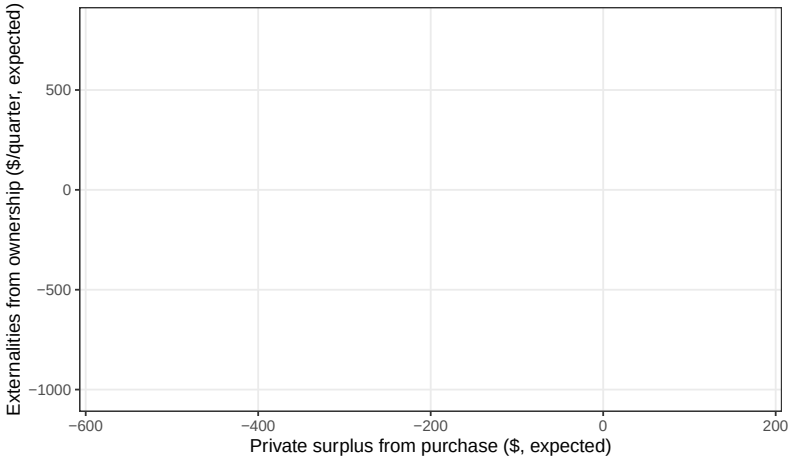
- FOCs from likelihood of handgun purchase and retailer choice
  - Identify non-linear parameters $(\gamma_x, \sigma_x, \delta_j, \alpha^d_{xz})$ likelihood
  - Calibrate price coefficient $\alpha^p_{xz} = \alpha^d_{xz} \,/\, \$\text{cost 1 mile}_z$ (Dolfen et al. 2023) go
- Match moments
  - Event study market expansion $\rightarrow$ Nesting parameter $= 0.64$ (se 0.06) moment
  - Purchase quantity by demo-zip-quarter $\rightarrow$ Common preference $\psi_{xz} - \alpha^p_{xz} p_t + \xi_{xzt}$
- Fatality errors orthogonal, conditional on demand shocks ξ_{xzt}
  - Control function $\rightarrow$ Identify externalities μ and ζ from entry/exit

  technical conditions regression diagnostics power stage 1 net entry intuition

Valuing consumer surplus, public health, and government revenue

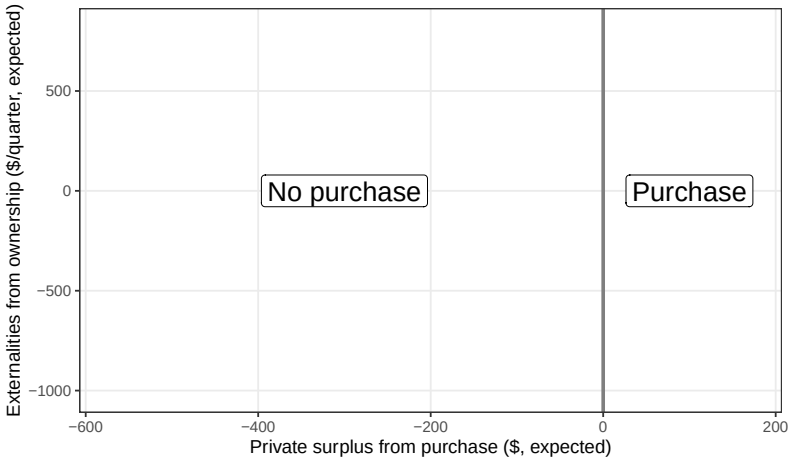
- CS: Expected value of purchasing from the best retailer, or not (Small and Rosen 1981)
  - $CS_{it} = E\left[\max_{j \in \{\mathcal{J}_{z(i)t} \cup 0\}} u_{ijt}\right] / \alpha^{p}_{xz}$
- Public health: Fiscal cost as conservative benchmark
  - Homicide = \$170k. Suicide = \$30k (San Jose 2022)
  - Includes: law enforcement, paramedics, etc.
  - Excludes: lost future wages, non-fatal incidents, well-being
- Government expenditure
  - \$1 tax revenue = \$1 social welfare (lump sum transfer)
  - Handgun price \$600. Status quo sales tax 8.75%

Preferences and externalities in California's average quarter



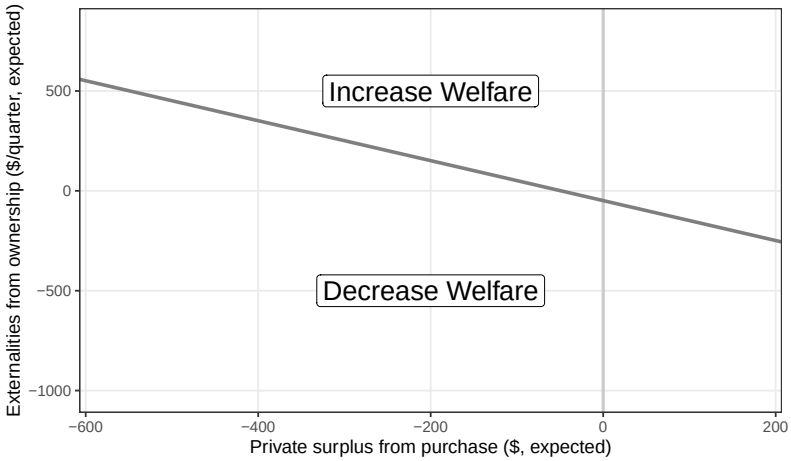
- Preferences and externalities

Preferences and externalities in California's average quarter



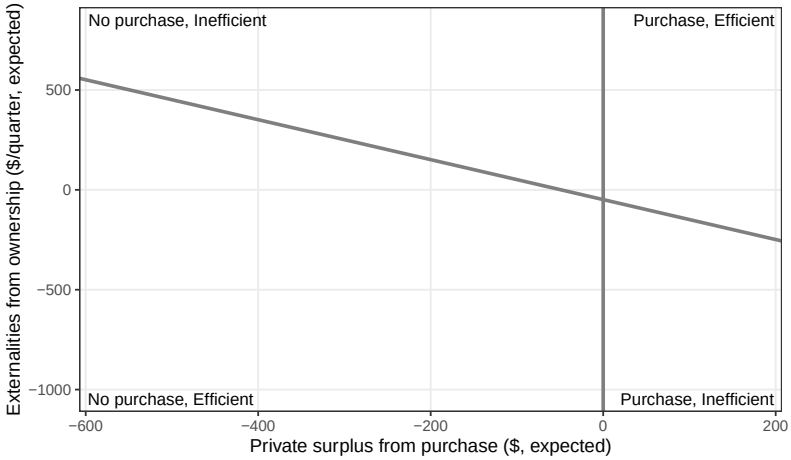
- Preferences → Gun purchase

Preferences and externalities in California's average quarter



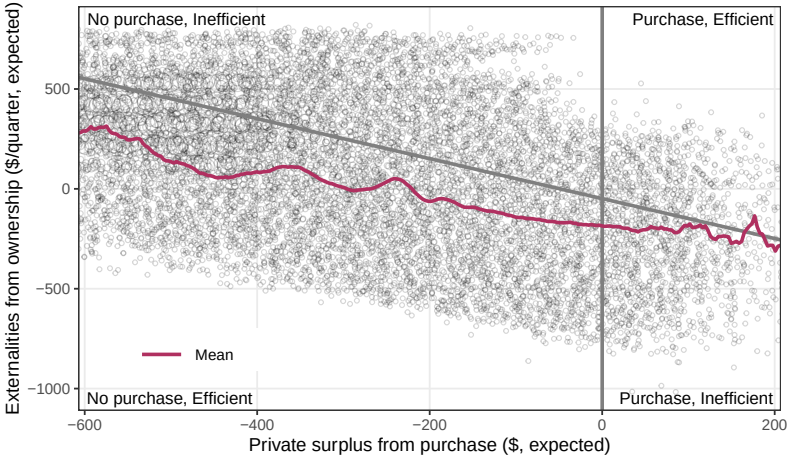
- Preferences, externalities, tax revenue $\rightarrow$ Welfare

Preferences and externalities in California's average quarter



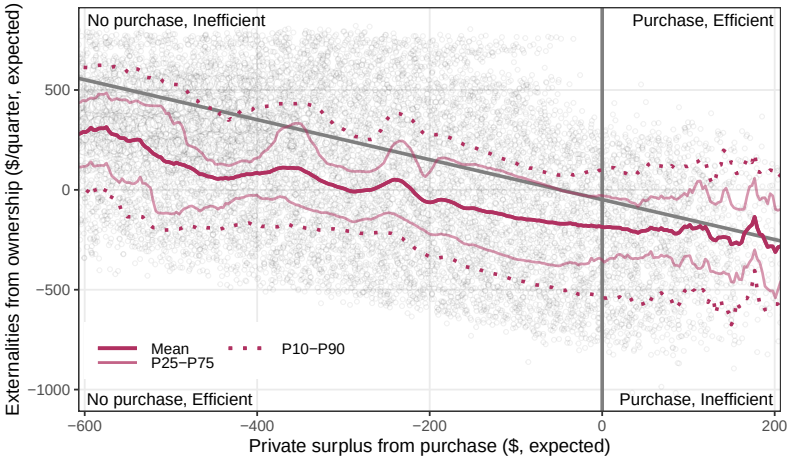
- Gun purchase → Allocative (in)efficiency

Preferences and externalities in California's average quarter



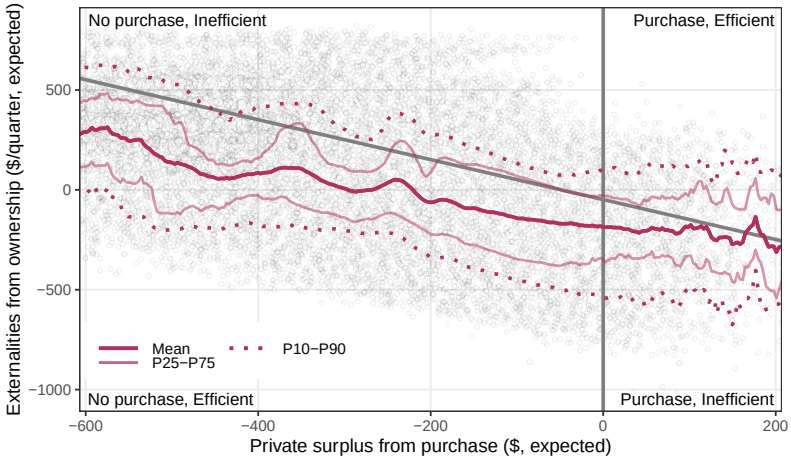
- Fitted model → Consumer distribution

Preferences and externalities in California's average quarter



- Fitted model → Consumer distribution

Preferences and externalities in California's average quarter

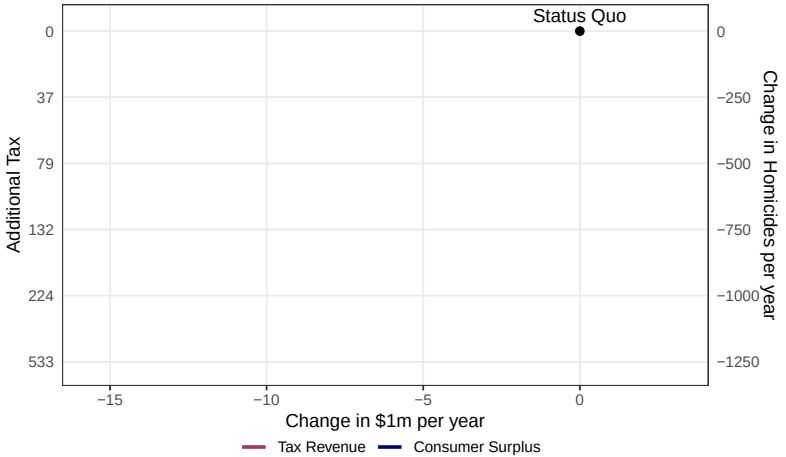


- Fitted model $\rightarrow$ Consumer distribution
- Adverse selection $\rightarrow$ Allocative inefficiency: $WTP \leq -E[\Delta\text{Welfare} \mid WTP]$

Roadmap

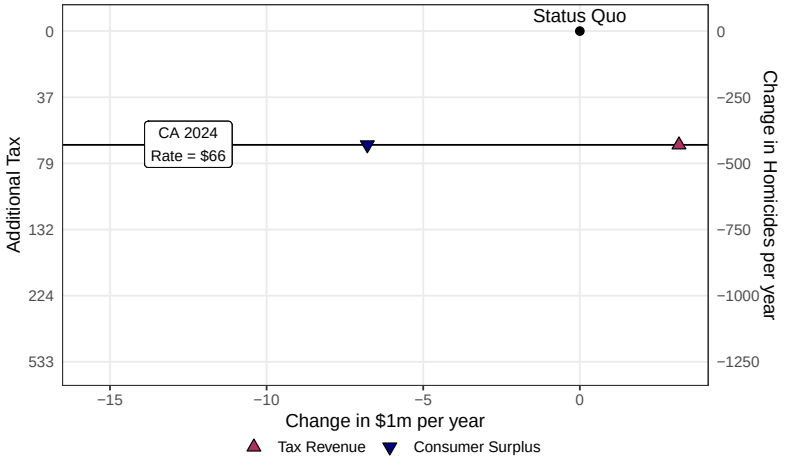
1. Setting and data
2. Facts of marginal purchases
3. Model (jump)
4. Counterfactual policy

Effect of handgun sales tax in CA



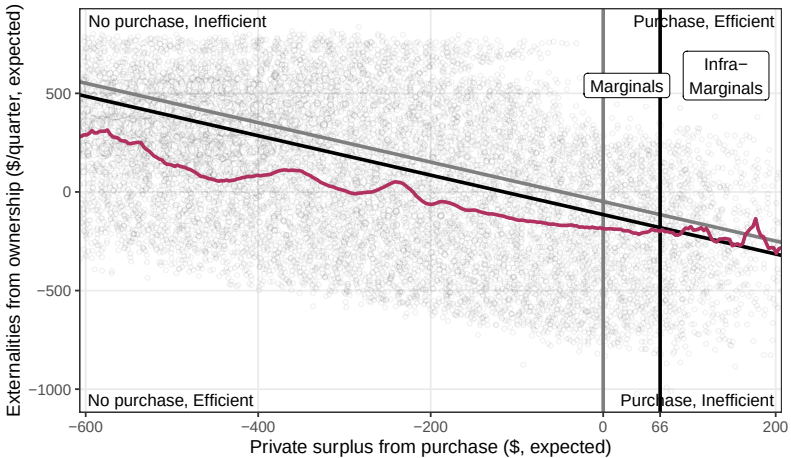
- Use tax to trace out frontier of CS, revenue, and homicides

Effect of handgun sales tax in CA



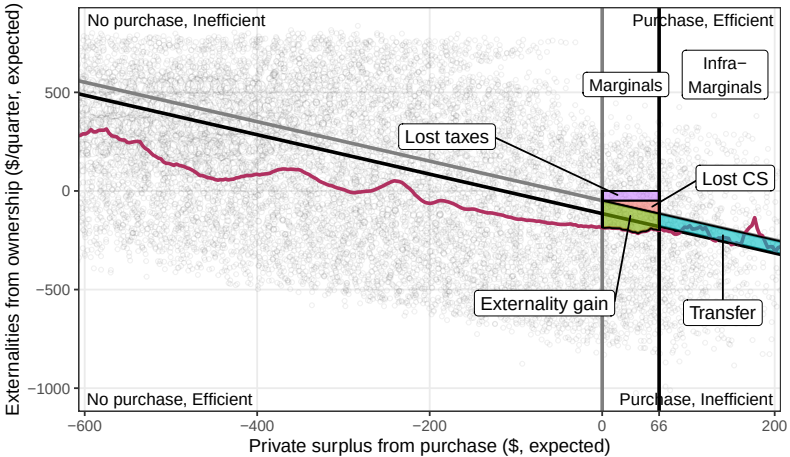
- Use tax to trace out frontier of CS, revenue, and homicides
- Raise tax \$66 → –\$7m CS, +\$1m Revenue, –400 Homicides → Sound policy (CA 2024)

Effect of handgun sales tax in CA



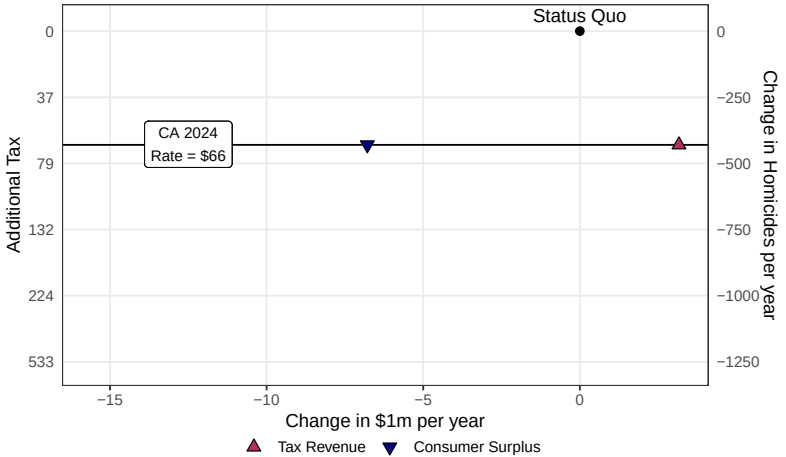
- Counterfactual tax partitions consumers at WTP = \$66

Effect of handgun sales tax in CA



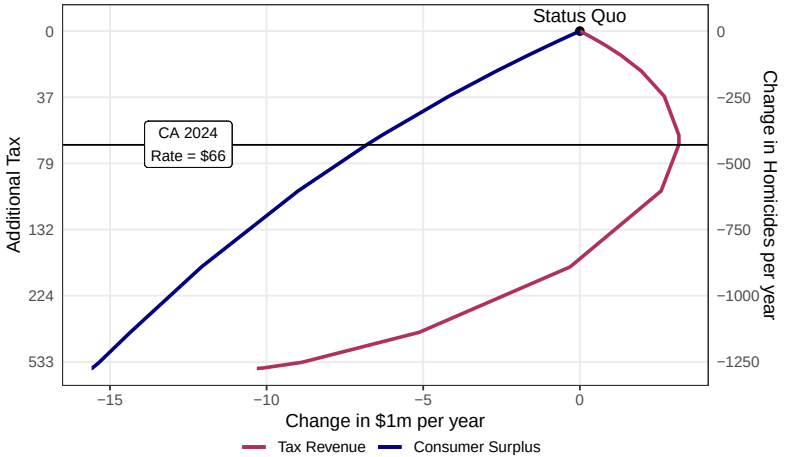
- Counterfactual tax partitions consumers at WTP = \$66
- Measure ΔCS, ΔTax revenue, ΔHomicides in average quarter

Effect of handgun sales tax in CA



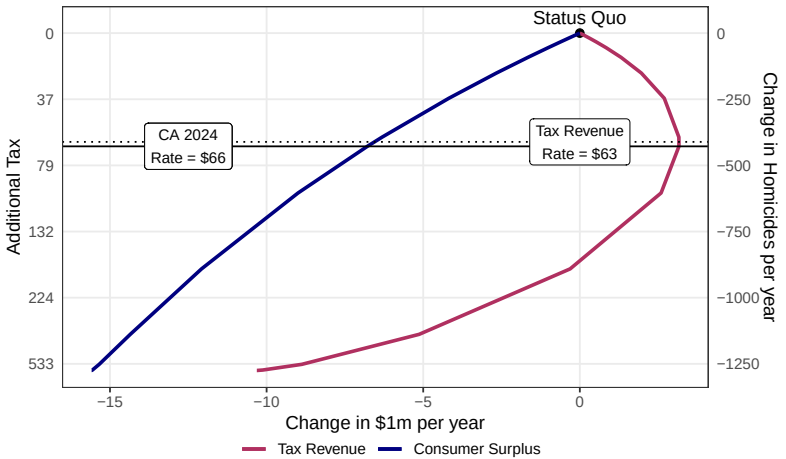
- Use tax to trace out frontier of CS, revenue, and homicides

Effect of handgun sales tax in CA



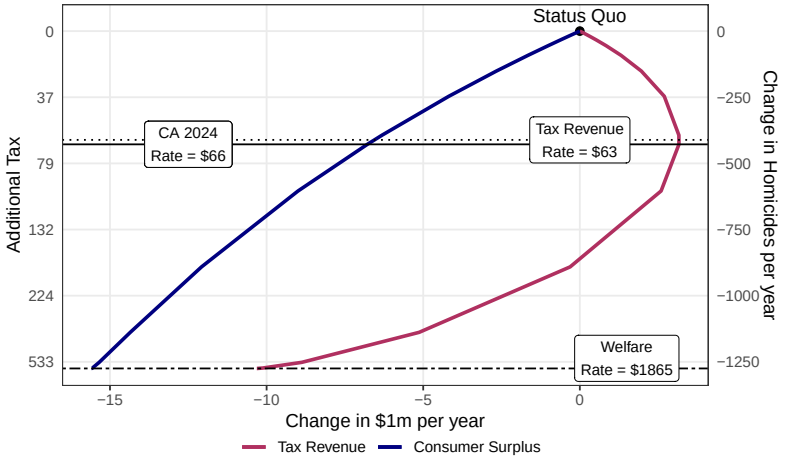
- Use tax to trace out frontier of CS, revenue, and homicides
- Solve at many counterfactual taxes

Effect of handgun sales tax in CA



- CA 2024 rate approximately maximizes tax revenue

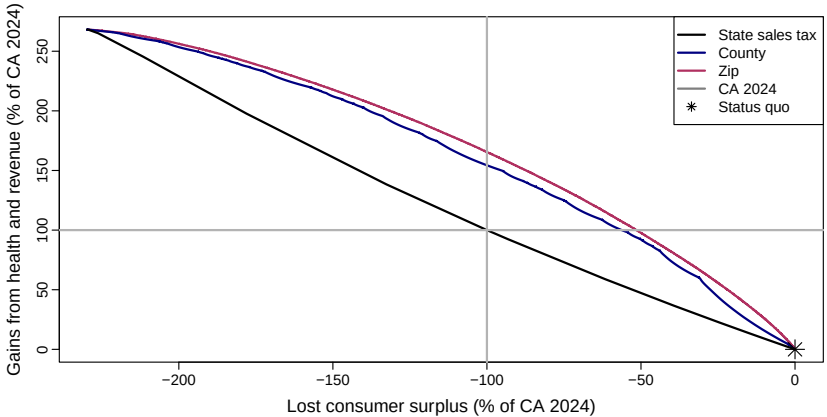
Effect of handgun sales tax in CA buyback



- Directly value fiscal cost of homicides → Shut down market
- Suppose CA 2024 were optimal $\xrightarrow{\text{invert}}$ Cost homicide = \$15k

Better policy through local taxation

map politics retail ban local age



- Set rates optimally by county, relative to CA 2024 tax:
  - Same gains → 40% smaller drop in CS
  - Same drop in CS → 50% larger gain in public health and tax revenue

Conclusion

How do preferences, durability, and externalities determine the impacts of gun policy?

- Assemble admin data on CA handgun market
- Marginal gun purchases have welfare consequences
  - Entry → More purchases & More owners → More fatalities
- Model of gun purchase and fatalities → Adverse selection
- Evaluate counterfactual policy design

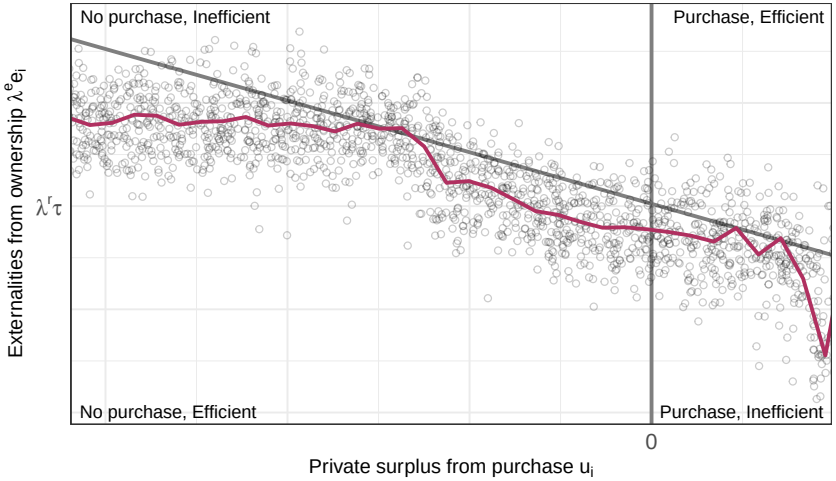
Policy	CA 2024 tax	Optimal tax	Local tax	Store ban	Min age	Buyback
Effect	Max revenue	Very high	Targeting gain	Mis-target	Efficient	Under-priced

- 8 other states considering firearm taxes (The Trace 2024)
- U.S. firearms tax when manufacturers have market power (Armona and Rosenberg 2024)

Thank you!

adam.rosenberg@stanford.edu

Ambiguous effects of marginal firearm purchase back



- Adverse selection $\rightarrow$ Allocative inefficiency: $WTP \leq -E[\Delta\text{Welfare} \mid WTP]$

DROS form

STATE OF CALIFORNIA
BOF 929 (Rev. 01/2014)

DEPARTMENT OF JUSTICE
Page 1 of 1

CALIFORNIA DEPARTMENT OF JUSTICE
BUREAU OF FIREARMS
Dealer's Record of Sale (DROS) Worksheet

CFD No.: ☐☐☐☐☐☐

DROS No.: ☐☐☐☐☐☐☐☐☐☐

Transaction Information

Transmission Date:	Transmission Time:	Delivery Date:	Delivery Time:	Gun Show Transaction ☐ Yes ☐ No
Firearm Type: ☐ Long Gun ☐ Handgun	Transaction Type: (All but "Dealer Sale" cert-list exempt) ☐ Dealer Sale ☐ Private Party Transfer ☐ Curio/Relic/Olympic/Other Exempt ☐ Loan ☐ Pawn/Consignment Return ☐ Peace Officer			Transaction exempt from 1 handgun per 30 day limit. ☐

Waiting Period Exemptions

Purchaser claims the following waiting period exemption pursuant to Penal Code sections 26950 through 26970 and 27650 through 27670.

☐ PEACE OFFICER STATUS (must have agency letter)

☐ CA FIREARMS DEALER Enter CFD Number: _____

☐ SPECIAL WEAPONS PERMIT Enter Type and Permit Number. (does not include CCW permit) Permit Type _____ Permit Number _____

☐ COLLECTOR STATUS (curio/relic only) Enter COE Number: _____

Firearm Information

Make: (Colt, Remington, etc.)	Model: (Commander, 870, etc.)	Caliber(s):	Barrel Length:	Serial Number:	Other Number: (if different)

Firearm Type:	If Long Gun:	If Handgun:			Frame Only:	New Firearm:
☐ Long Gun ☐ Handgun	☐ Rifle ☐ Shotgun	☐ Revolver ☐ Single Shot	☐ Semi-Auto ☐ Derringer:	☐ Other: _____	☐ Yes ☐ No	☐ Yes ☐ No

Firearm Origin: (USA, Italy, etc.)	Firearm Color: (Black, Green, Silver, etc.)	Comments:

DROS form back

Purchaser Information

First Name:	Middle Name:	Last Name:	Suffix:
Alias First Name:	Alias Middle Name:	Alias Last Name:	Alias Suffix:

Street Address:	City:	Zip Code:

One of the following forms of identification is required to legally purchase firearms in California: California driver license (CDL), California ID (CID) card issued by the DMV, or Military ID (MID) for active duty military accompanied by permanent duty station orders indicating that the purchaser is stationed in California.

ID Type: (check one) ☐ CDL ☐ CID ☐ MIL	ID Number:	US Citizen: ☐ Yes ☐ No	If NO, enter Alien Registration or I-94 Number and Country of Citizenship: Alien Registration or I-94 Number / Country of Citizenship

Telephone Number: ( )	Date of Birth: (mm/dd/yyyy)	Place of Birth:	Race:

Sex:	Height:	Weight:	Hair Color:	Eye Color:	HSC Number or Exemption Code: (handguns only)

☐ Yes ☐ No Has purchaser ever been convicted of a felony or of any offense specified in Penal Code sections 23515 and 29905, or convicted of assault, battery, or other misdemeanor offense specified in Penal Code section 29805 in the last 10 years?

☐ Yes ☐ No Is purchaser a danger/threat to self or others pursuant to Welfare and Institutions Code section 8100, or a person who has been admitted to a mental health facility as a danger to self or others pursuant to Welfare and Institutions Code sections 5150 through 5152 within the past 5 years?

☐ Yes ☐ No Has purchaser ever been adjudicated by a court to be a danger to others, found not guilty by reason of insanity, found incompetent to stand trial, or placed under a conservatorship, pursuant to Welfare and Institutions Code section 8103?

☐ Yes ☐ No Is purchaser currently the subject of any restraining order pursuant to Family Code section 6380?

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Signature of Purchaser _____ Date _____

Private Party Transfer (Seller Information)

First Name:	Middle Name:	Last Name:	Suffix:

Street Address:	City:	Zip Code:

ID Type: (check one) ☐ CDL ☐ CID ☐ MIL	ID Number:	US Citizen: ☐ Yes ☐ No	If NO, enter Alien Registration or I-94 Number and Country of Citizenship: Alien Registration or I-94 Number / Country of Citizenship

Date of Birth: (mm/dd/yyyy)	Place of Birth:	Race:	Sex:	Height:	Weight:	Hair Color:	Eye Color:

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Signature of Seller _____ Date _____

Dealer Information

Firearm Safety Device Description and/or Comments:	Telephone Number: ( )

Sales Person Printed Name and COE Number if Issued:

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Signature of Salesperson _____ Date _____

Falsification of information on this form is a felony punishable by up to 48 months in state prison. (Pen. Code, § 28050.)

Consumer summary statistics back

Consumers by end of 2015

	$\mathbf{1}$(Purchase) per 100 (1)	Purchases | purchase (2)	$\mathbf{1}$(Own) per 100 (3)	Distance | purchase (4)	Consumers (5)
All	4.43	1.86 (1.97)	6.31	17.34 (30.43)	28, 683, 439
Own pre-2005	28.11	2.81	100	18.12	749, 331
Not pre-own	3.79	1.67	3.79	17.01	27, 934, 108
Men	7.71	1.94	10.98	17.42	14, 151, 156
Women	1.23	1.32	1.75	16.52	14, 532, 283
White	6.74	1.90	9.48	17.52	12, 917, 359
Minority	2.53	1.76	3.71	16.95	15, 766, 080

Mean, (SD)

Zip code-quarter summary statistics back

Zip code-quarters

	1(Purchase) per 100 (1)	1(Own) per 100 (2)	Distance | purchase (3)	Homicide per 100k (4)	Suicide per 100k (5)	Units (6)	Population (7)
All	0.39 (0.33)	5.12 (3.51)	19.83 (14.95)	1.68 (5.50)	3.93 (8.88)	57, 376	21, 635
Has retailer	0.45	5.62	16.62	1.53	4.07	16, 604	27, 662
No retailer	0.36	4.91	21.14	1.75	3.88	40, 772	19, 181
High income	0.32	4.02	16.41	1.78	3.26	28, 688	33, 705
Low income	0.45	6.22	23.27	1.59	4.61	28, 688	9, 566
Dense	0.27	3.40	14.87	1.86	3.05	28, 688	28, 947
Sparse	0.50	6.84	24.81	1.51	4.81	28, 688	14, 324
High crime	0.35	4.62	18.49	2.24	3.46	28, 556	23, 284
Low crime	0.43	5.61	21.15	1.13	4.40	28, 820	20, 002
2005	0.22	3.47	19.91	1.93	3.51	5, 216	21, 635
2015	0.58	7.44	19.18	1.58	4.36	5, 216	21, 635

Mean, (SD)

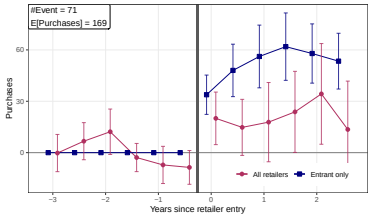
Retailer summary statistics back

Retailers

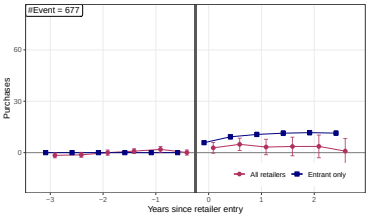
	Mean	SD	P10	P25	P50	P75	P90	Retailers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All retailers								
Sales	3829	6737	340	608	1407	3897	8615	992
Quarters	26	14	7	13	24	44	44	992
Sales/Quarter	153.4	194.8	12.49	31.56	79.67	181.12	408.97	992
Sale distance	19.02	13.86	11.45	13.89	17.12	21.09	26.67	992
Share private	0.59	0.17	0.37	0.48	0.61	0.71	0.8	992
$\mathbf{1}$(Corporate)	0.03	0.16	0	0	0	0	0	992
Panel B: Entrants								
Sales	3163	4340	494	751	1551	3842	7690	476
Quarters	18	9	7	11	16	24	32	476
Sales/Quarter	180.37	189.95	32.14	57.47	108.53	232.46	418.51	476
Sale distance	18.44	8.74	11.59	13.98	17.1	20.81	26.09	476
Share private	0.6	0.17	0.38	0.49	0.61	0.71	0.8	476

Entry effect decays with distance back

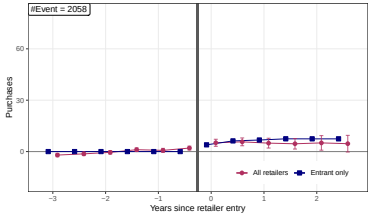
Within Zip



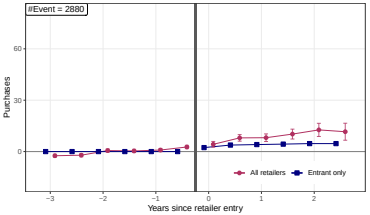
0–5 miles



5–10 miles



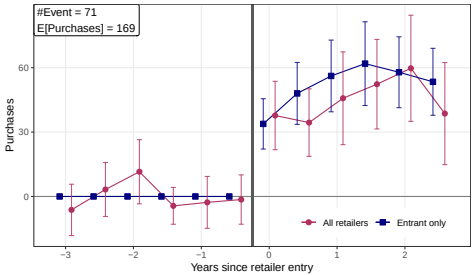
10–15 miles



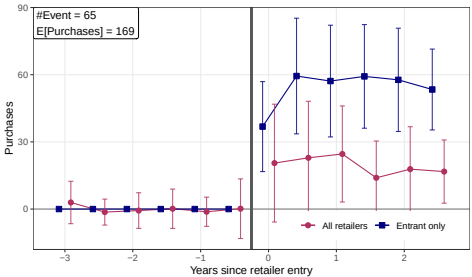
First entrants steal less business than subsequent entrants

back

First Entrant

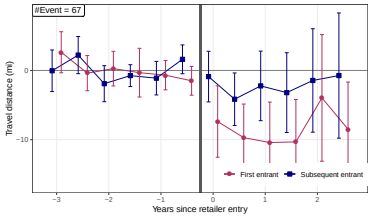


Subsequent Entrant

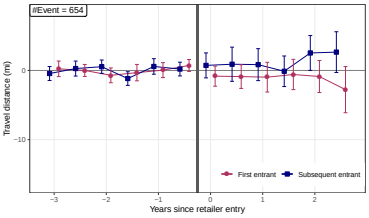


Travel distance decreases from first-entrant in zip code back

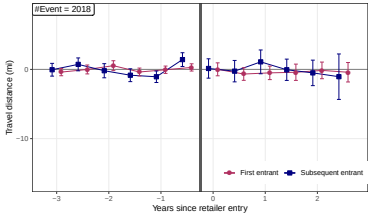
Within Zip



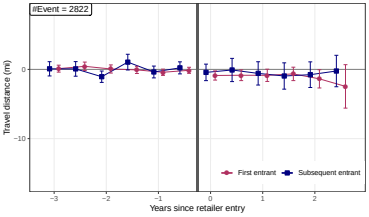
0–5 miles



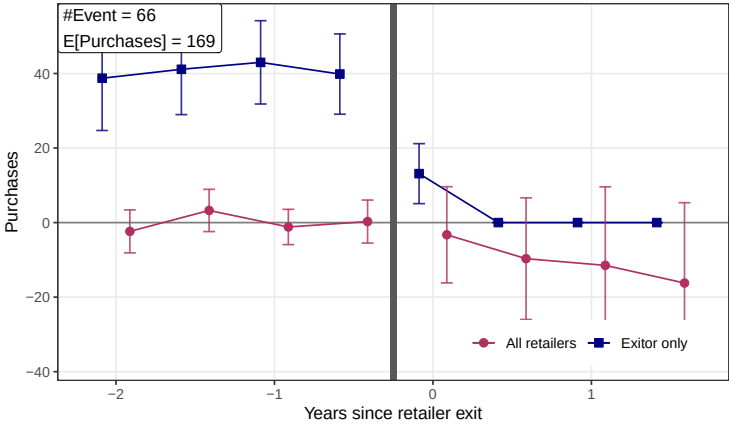
5–10 miles



10–15 miles



Exits contract market back



Predict retailer count from observables. Fixed effects absorb all variation

back

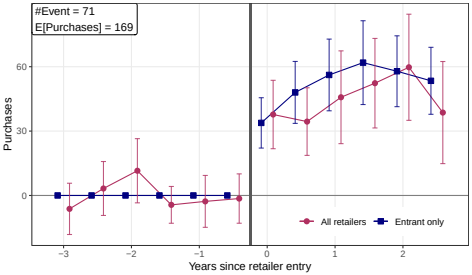
	Count of firearm retailers					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.152***	0.282***	0.198**	4.217***		
	(0.031)	(0.070)	(0.086)	(0.785)		
Population [1000s]	0.014***	0.008***	0.015***	0.010		
	(0.002)	(0.003)	(0.006)	(0.009)		
log(Income) [SD]		0.317***	0.104**	0.183***		
		(0.048)	(0.050)	(0.062)		
Population × log(Income)			0.005	0.008		
			(0.004)	(0.005)		
log(Violent crime rate) [SD]		−0.103***	−0.090***	0.008		
		(0.024)	(0.024)	(0.038)		
Population × log(Violent crime rate)				−0.004**		
				(0.002)		
log(Population / mi^2) [SD]		−0.275***	−0.015	0.108**		
		(0.032)	(0.039)	(0.043)		
Population × log(Population / mi^2) [SD]			−0.015***	−0.015***		
			(0.002)	(0.003)		
log(Population$_t$)				−0.202***	0.026	
				(0.074)	(0.060)	
log(Income$_t$)				−0.310***	−0.090*	
				(0.039)	(0.048)	
log(Congressional turnout$_t$)				0.022	0.007	
				(0.023)	(0.016)	
Congressional Share Republican$_t$				0.031	0.039	
				(0.092)	(0.043)	
log(Presidential turnout$_t$)				0.109***	0.019	
				(0.030)	(0.014)	
Presidential Share Republican$_t$				0.717***	0.086	
				(0.147)	(0.172)	
Zip code FE					Y	Y
Quarter FE					Y	Y
R^2	0.0632	0.149	0.1785	0.2215	0.8863	0.8862
F	81.4883	49.7086	38.3022	21.5784	1.3811	
Zip code clusters	1,243	1,243	1,243	1,243	1,243	1,243
Zip code-quarters	54,692	54,692	54,692	54,692	54,692	54,692

Estimate, (SE)

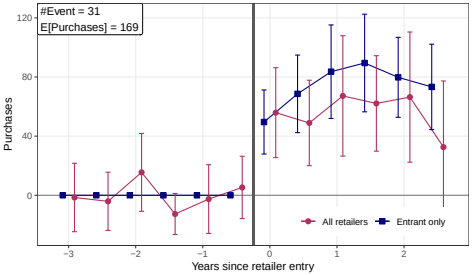
Similar results removing zips with other nearby entries

back

Preferred sample



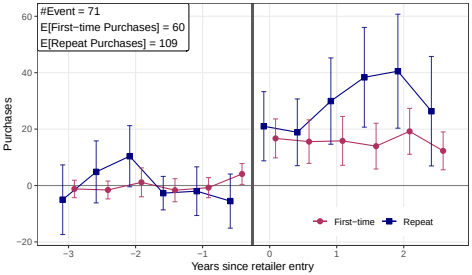
Remove zips with entry (0-5) mi away



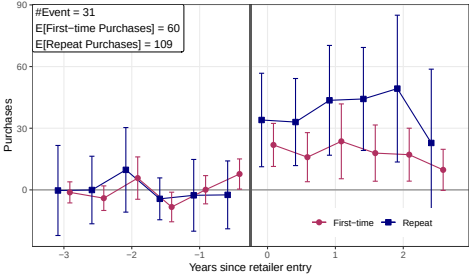
Similar results removing zips with other nearby entries

back

Preferred sample



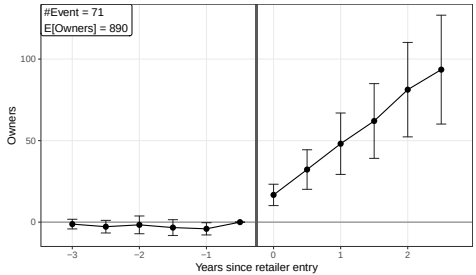
Remove zips with entry (0-5) mi away



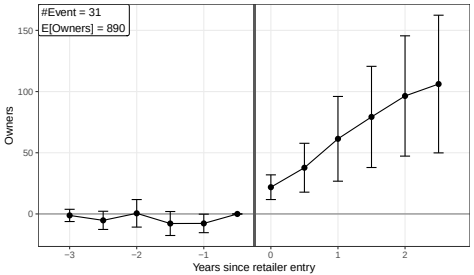
Similar results removing zips with other nearby entries

back

Preferred sample

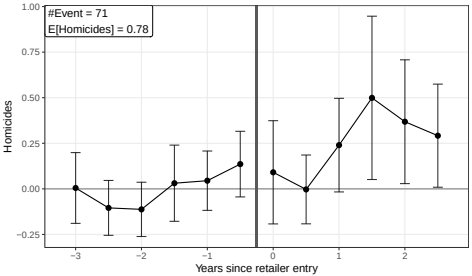


Remove zips with entry (0-5) mi away

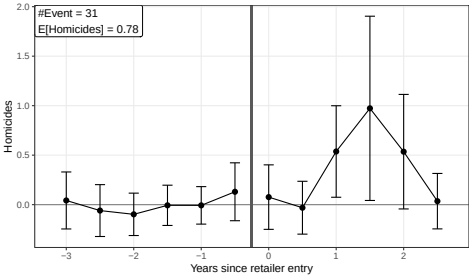


Similar results removing zips with other nearby entries back

Preferred sample



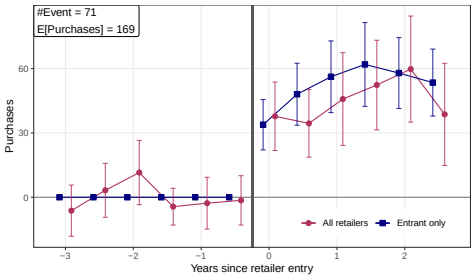
Remove zips with entry (0-5) mi away



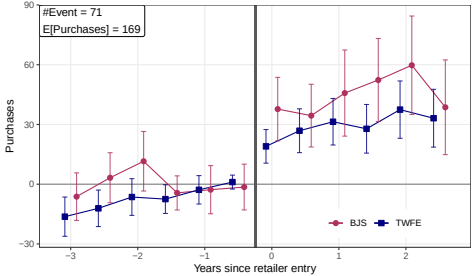
Similar results for two-way fixed effects

back

With pure controls

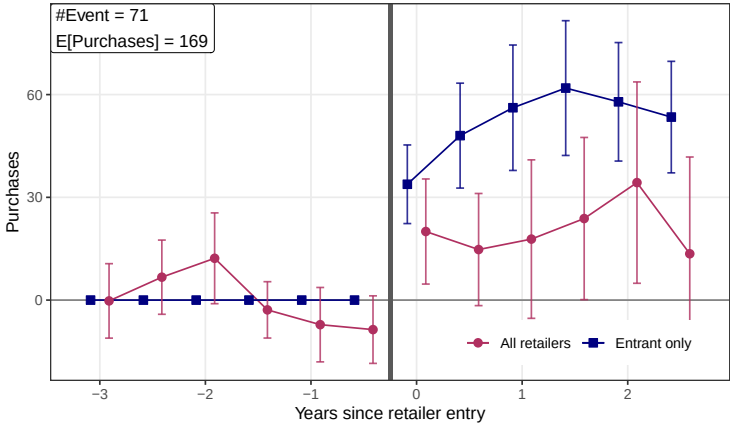


No pure controls



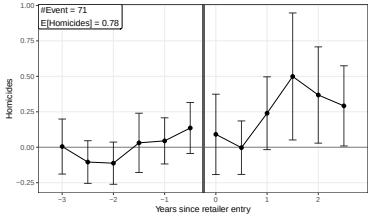
Similar results without never-entered zip codes (no pure controls)

back

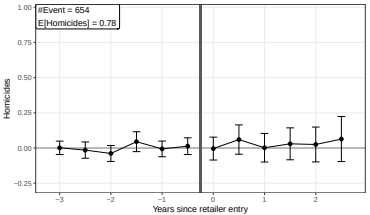


Entry effect decays with distance back

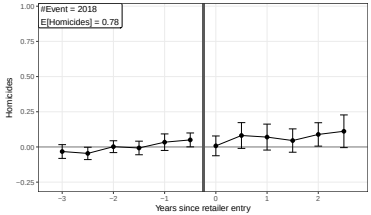
Within Zip



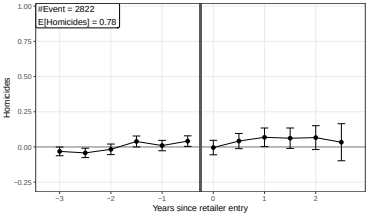
0–5 miles



5–10 miles



10–15 miles



Regression specification back

$$\text{First-stage:} \qquad \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} = \beta \#\text{GunRetailers}_{zt} + \text{FE}_z^1 + \text{FE}_t^1 + \omega_{zt}^1$$

$$\text{2SLS:} \qquad \frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \mu \frac{\widehat{\text{GunOwners}}_{zt}}{\text{Pop}_z} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

- Use entry/exit as instrument for ownership in all of CA
- Exclusion: Timing of net entry within market $\perp$ Timing of health outcomes

First stage: Entry as an instrument for gun ownership in CA

back

Market expansion (gun purchases, flow)		First stage (gun owners, stock)
Event study	Full CA	Full CA
59.6	60.6	277.2
(8.9)	(6.3)	(38.6)
		F=51.7

$$\frac{\text{Guns}_{zt}}{\text{Pop}_z} = \beta \#\text{GunRetailers}_{zt} + \text{FE}_z + \text{FE}_t + \xi_{zt}$$

- Market expansion: Same for both estimators $\rightarrow$ Same timing variation
- First stage: Strong instrument in full CA $\rightarrow$ Power for infrequent gun fatalities

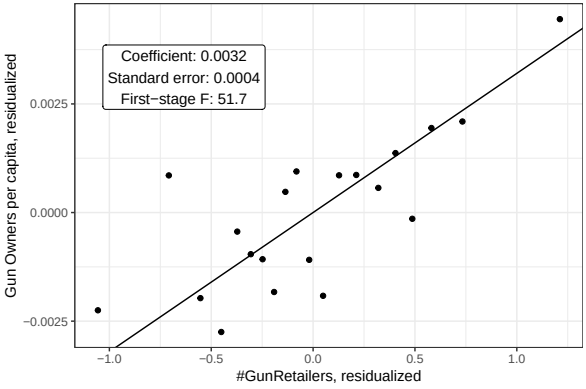
IV and OLS estimates back

	Firearm		Non-gun		Total	
	IV	OLS	IV	OLS	IV	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Assault						
Handgun owners per capita	0.00040	0.00025	0.00007	0.00002	0.00047	0.00027
	(0.00014)	(0.00003)	(0.00006)	(0.00001)	(0.00015)	(0.00003)
Panel B: Suicide						
Handgun owners per capita	0.00011	0.00011	0.00006	0.00006	0.00016	0.00017
	(0.00011)	(0.00002)	(0.00013)	(0.00003)	(0.00018)	(0.00004)
Zip code FE	Y	Y	Y	Y	Y	Y
Period FE	Y	Y	Y	Y	Y	Y
First-stage F	51.67		51.67		51.67	
Clusters	1304	1304	1304	1304	1304	1304
Observations	57,376	57,376	57,376	57,376	57,376	57,376

- Assault: Marginal owner more harmful than average
- Suicide: Marginal owner similarly harmful to average

Instrument for gun ownership with retailer net entry

back

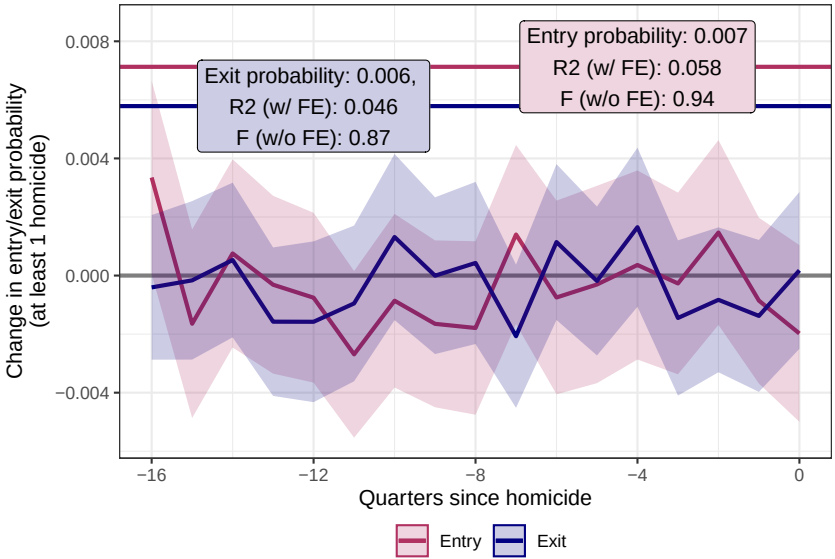


- Use entry/exit as instrument for ownership in all of CA
- Exclusion:
  Timing of net entry within market $\perp$ Timing of health outcomes

$$\frac{\text{GunOwners}_{zt}}{\text{Pop}_z} = \beta \#\text{GunRetailers}_{zt} + \text{FE}_z^1 + \text{FE}_t^1 + \omega_{zt}^1$$

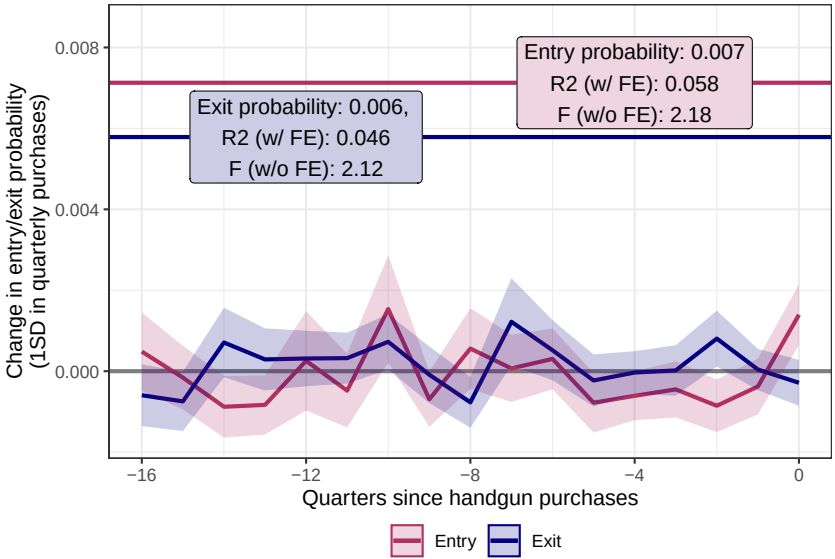
Lagged homicide fatalities do not predict current entry/exit

back

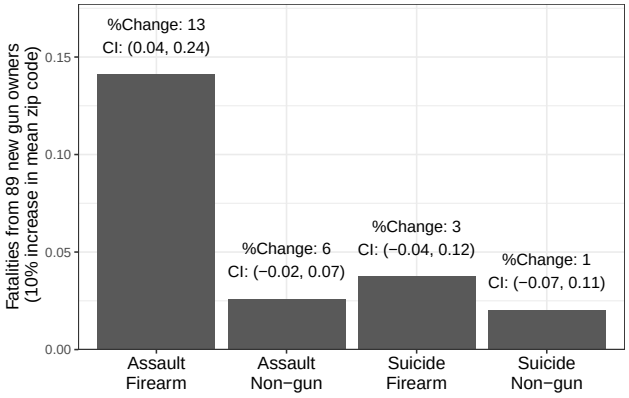


Lagged handgun purchases do not predict current entry/exit

back



Gun ownership harms public health back



- Add 1k owners for 1 year → Add 2 assault, 0.5 self-harm fatalities
- Add 1 store for 10 years → Add 1 assault, 0.25 self-harm fatalities

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \mu \frac{\widehat{\text{GunOwners}_{zt}}}{\text{Pop}_z} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

Effects on county-level crime back

	Criminal Incidents			
	Property		Violent, non-fatal	
	(1)	(2)	(3)	(4)
100 Handgun owners	−12.48	−19.89	5.62	3.07
	(14.48)	(16.01)	(3.17)	(3.31)
Depvar Mean	18741	18741	3023	3023
Gun owners Mean	20724	20724	20724	20724
Instrument	#GunRetailers	Inclusive Value	#GunRetailers	Inclusive Value
First-stage F	23	36	23	36
County FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Clusters	56	56	56	56
Observations	616	616	616	616

- Aggregate zip code first-stage to county $\sum_{z \in \text{cty}} \frac{Pop_z}{\text{Pop}_{\text{cty}}} \widehat{\text{GunOwners}}_{zt}$

Heterogeneous effects of marginal owner by observable characteristics

back

- Regress on gun ownership level and composition

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{\frac{\text{GunOwners}_{zt}}{\text{Pop}_z}}^{\text{level}} \left(\mu + \zeta \overbrace{E[\text{observables}_{xz} \mid \text{own}{=}1]}^{\text{composition}} \right)$$

$$+ \chi \vec{r} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

- Control function $\chi\vec{r}$: Stage 1 residuals of net-entry IV on level and composition of gun ownership
- ID: Variation in entries $\rightarrow$ Variation in marginal owner
- Larger homicide effects: young white men, living in low-income, high-crime rural areas. (Less so for suicide)

	Homicide			Suicide		
	All	Firearm	Non-gun	All	Firearm	Non-gun
	(1)	(2)	(3)	(4)	(5)	(6)
μ	−0.2713	−0.2618	−0.0095	−0.0517	−0.0421	−0.0096
	(0.0434)	(0.0395)	(0.0167)	(0.0505)	(0.0341)	(0.0355)
ζ^{inc}	−0.0048	−0.0036	−0.0012	0.0034	0.0021	0.0013
	(0.0019)	(0.0017)	(0.0009)	(0.0029)	(0.0019)	(0.0024)
ζ^{den}	−0.0040	−0.0044	0.0004	−0.0052	−0.0023	−0.0029
	(0.0025)	(0.0022)	(0.0011)	(0.0031)	(0.0020)	(0.0023)
ζ^{crime}	0.0017	0.0012	0.0004	0.0003	0.0005	−0.0002
	(0.0012)	(0.0010)	(0.0006)	(0.0019)	(0.0012)	(0.0013)
ζ^{male}	0.3022	0.2844	0.0178	0.0459	0.0533	−0.0074
	(0.0468)	(0.0440)	(0.0158)	(0.0521)	(0.0348)	(0.0365)
$\zeta^{<30}$	0.1047	0.1083	−0.0036	0.0630	0.0100	0.0530
	(0.0365)	(0.0321)	(0.0147)	(0.0438)	(0.0300)	(0.0332)
ζ^{white}	0.0624	0.0562	0.0063	0.0096	0.0051	0.0045
	(0.0129)	(0.0114)	(0.0046)	(0.0115)	(0.0079)	(0.0099)
χ	−0.0421	−0.0338	−0.0083	0.0045	0.0036	0.0009
	(0.0165)	(0.0156)	(0.0067)	(0.0184)	(0.0125)	(0.0137)
χ^{male}	−0.0246	−0.0220	−0.0027	0.0054	0.0017	0.0037
	(0.0047)	(0.0045)	(0.0015)	(0.0041)	(0.0025)	(0.0031)
$\chi^{<30}$	−0.0052	−0.0055	0.0003	−0.0030	0.0002	−0.0032
	(0.0024)	(0.0023)	(0.0008)	(0.0019)	(0.0012)	(0.0015)
χ^{white}	−0.0059	−0.0058	−0.0002	−0.0018	0.0003	−0.0021
	(0.0021)	(0.0018)	(0.0008)	(0.0018)	(0.0010)	(0.0015)
Zip code FE	Y	Y	Y	Y	Y	Y

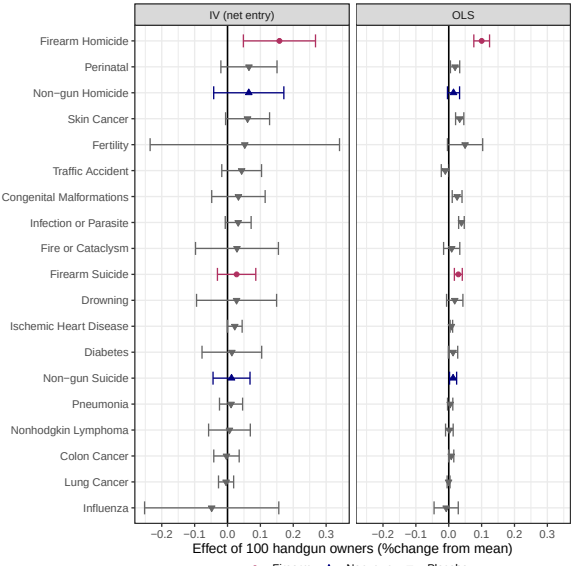
Similar first-stage and IV estimates with event-time instruments

back

	Owners	Homicide	Suicide
Panel A: IV = $\#\textbf{GunRetailers}_{z,t}$			
IV	0.003	0.0005	0.0002
	(0.0004)	(0.0001)	(0.0002)
IV + county-quarter FE	0.001	0.0005	0.00003
	(0.0003)	(0.0003)	(0.0004)
IV + county-quarter FE + zip-year controls	0.001	0.0005	-0.00003
	(0.0003)	(0.0003)	(0.0004)
IV + zip-trend	0.0003	0.004	-0.002
	(0.0002)	(0.003)	(0.003)
Panel B: IV = $\sum_{t'=1}^{t} \#\textbf{GunRetailers}_{z,t'} - \#\textbf{GunRetailers}_{z,1}$			
IV	0.0002	0.0004	0.0002
	(0.00004)	(0.0002)	(0.0002)
IV + county-quarter FE	0.0001	0.0005	0.0003
	(0.00003)	(0.0004)	(0.0004)
IV + county-quarter FE + zip-year controls	0.0001	0.0005	0.0002
	(0.00003)	(0.0004)	(0.0004)
IV + zip-trend	0.0002	0.0001	-0.001
	(0.00002)	(0.0004)	(0.0005)
Zip code FE	Y	Y	Y
Quarter FE	Y	Y	Y
Zip code clusters	1,304	1,304	1,304
Zip code-quarters	57,376	57,376	57,376

Handgun ownership does not cause most types of fatal injuries

back



Heterogeneous effects of handgun ownership

estimator back

- Augment regression with het. effects by zip-quarter μ_{zt}, microfounded by individuals i

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{E_{zt}\left[\text{externality}_i \,|\, \mathbf{1}(\text{GunOwner}_{it}) = 1\right]}^{\text{average externality of owners} \equiv \mu_{zt}} \times \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

Heterogeneous effects of handgun ownership

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- Individual externalities follow linear regression: $\text{externality}_i = \mu + \zeta^W W_i + \widetilde{\text{externality}}_i$
  - Time constant covariates W_i (age, gender, zip code income) $\rightarrow$ Composition of owners
  - Reduce dimension of effects μ_{zt}

Heterogeneous effects of handgun ownership

estimator back

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$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{E_{zt}\left[\text{externality}_i \,|\, \mathbf{1}(\text{GunOwner}_{it}) = 1\right]}^{\text{average externality of owners} \equiv \mu_{zt}} \times \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} + \text{FE}_z + \text{FE}_t + \omega_{zt}$$

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  - Time constant covariates W_i (age, gender, zip code income) $\rightarrow$ Composition of owners
  - Reduce dimension of effects μ_{zt}

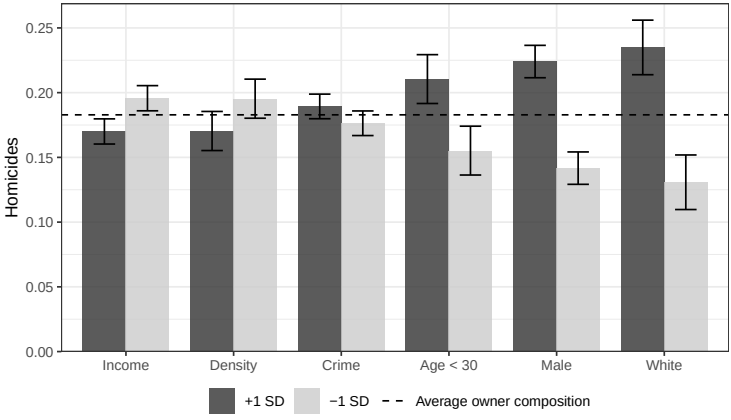
- Control function: Address corr of fatality shock ω_{zt} with effect μ_{zt} and GunOwners_{zt}

$$\omega_{zt} = \chi R_{zt} + \tilde{\omega}_{zt}$$

  - R_{zt}: Vector of resids from first-stage regressions of ownership level and composition
  - Isolate variation in ownership level and composition from retailer net entry

Heterogeneous externalities across marginal owners

back



- Geography: lower income, more rural, higher crime $\rightarrow$ More homicides
- Demographics: age $<$ 30, male, white $\rightarrow$ More homicides

Heterogeneous effects of handgun ownership: Estimator

back

- Regression: Combine model of effects μ_{zt} and control function for fatality shock ω_{zt}

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} \overbrace{\left(\mu + \zeta^W \sum_{i:z(i)=z} \frac{\mathbf{1}(\text{GunOwner}_{it})}{\text{GunOwners}_{zt}} W_{x(i)z} \right)}^{\text{average causal effect} \equiv \mu_{zt}} + \text{FE}_z + \text{FE}_t + \overbrace{\chi \hat{R}_{zt} + \tilde{\omega}_{zt}}^{\text{control function}}$$

  - $\chi = \vec{0}$: Neither ownership level nor composition correlates with fatality shock $\omega_{zt} \rightarrow$ OLS
  - $\zeta^W = \vec{0}$: Average effect $\hat{\mu}$ numerically equivalent to 2SLS

Heterogeneous effects of handgun ownership: Estimator

back

- Regression: Combine model of effects μ_{zt} and control function for fatality shock ω_{zt}

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \frac{\text{GunOwners}_{zt}}{\text{Pop}_z} \overbrace{\left(\mu + \zeta^W \sum_{i:z(i)=z} \frac{\mathbf{1}(\text{GunOwner}_{it})}{\text{GunOwners}_{zt}} W_{x(i)z} \right)}^{\text{average causal effect} \equiv \mu_{zt}} + \text{FE}_z + \text{FE}_t + \overbrace{\chi \hat{R}_{zt} + \tilde{\omega}_{zt}}^{\text{control function}}$$

  - $\chi = \vec{0}$: Neither ownership level nor composition correlates with fatality shock $\omega_{zt} \rightarrow$ OLS
  - $\zeta^W = \vec{0}$: Average effect $\hat{\mu}$ numerically equivalent to 2SLS

- Control function: Variation *not* explained by retailer entry

$$\frac{\text{GunOwners}_{zt}}{\text{Pop}_z} = \hat{\beta} \# \text{GunRetailers}_{zt} + \widehat{\text{FE}}_z^{\text{owners}} + \widehat{\text{FE}}_t^{\text{owners}} + \hat{R}_{zt}^{\text{owners}}$$

  - First step: Construct $\hat{R}_{zt}$ for each dimension of observable $W_i \rightarrow$ Bootstrap SEs

Inside nest: Retailer choice

estimate δ_j | distribution α_i | determinants α_i

- Indirect utility of consumer i choosing retailer j in quarter t

$$u_{ijt} = \delta_j - \alpha_i d_{ijt} + \varepsilon_{ijt}$$

  - Consumer trades off retailer quality δ_j and distance d_{ijt} at rate α_i
  - Distance disutility α_i log-linear in county FE, individual demo $x(i)$, and zip chars

Inside nest: Retailer choice

estimate δ_j | distribution α_i | determinants α_i

- Indirect utility of consumer i choosing retailer j in quarter t

$$u_{ijt} = \delta_j - \alpha_i d_{ijt} + \varepsilon_{ijt}$$

  - Consumer trades off retailer quality δ_j and distance d_{ijt} at rate α_i
  - Distance disutility α_i log-linear in county FE, individual demo $x(i)$, and zip chars
- MN logit choice probabilities across retailers

$$P_{ijt} = \exp(\delta_j - \alpha_i d_{ijt}) / \overbrace{\sum_{j'} \exp(\delta_{j'} - \alpha_i d_{ij't})}^{\equiv \exp(I_{it})}$$

  - Inclusive value I_{it} summarizes quality of retailer choice set
  - Basis for MLE of δ_j and parameters of α_i
  - Choice set variation: Market geography, retailer entry/exit

Outside nest: Extensive margin choice

parameters

- Indirect utility of not purchasing a gun

$$u_{i0t} = -\left(\overbrace{\gamma_x g_{i,t=0} + \tilde{\nu}_i + \psi_{xz}}^{\text{Persistent } \nu_i} + \overbrace{\phi_{xt} + \xi_{it}}^{\text{Shocks}_{xzt}} \right) + \varepsilon_{i0t}$$

  - Individual$_i$ heterogeneity by pre-2005 ownership γ_x and unobservable $\tilde{\nu}_i \sim N(0, \sigma_x)$
  - Aggregate$_{xzt}$ fixed effects and shocks

Outside nest: Extensive margin choice

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  - Aggregate_{xzt} fixed effects and shocks
- Binary logit choice probability accounting for quality of retailer choice set

$$\log P_{it}(j > 0) - \log P_{it}(j = 0) = \text{Individual}_i + \overbrace{\text{Aggregate}_{xzt} + \rho I_{it}}^{\eta_{xzt}}$$

Outside nest: Extensive margin choice

parameters

- Indirect utility of not purchasing a gun

$$u_{i0t} = -\left(\overbrace{\gamma_x g_{i,t=0} + \tilde{\nu}_i + \psi_{xz}}^{\text{Persistent } \nu_i} + \overbrace{\phi_{xt} + \xi_{it}}^{\text{Shocks}_{xzt}}\right) + \varepsilon_{i0t}$$

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$$\log P_{it}(j > 0) - \log P_{it}(j = 0) = \text{Individual}_i + \overbrace{\text{Aggregate}_{xzt} + \rho I_{it}}^{\eta_{xzt}}$$

- Estimation by demo using MLE with contraction for η_{xzt}
  - η_{xzt}: Align data Purchases_{xzt} with posterior predicted $\sum_{i \in x,z} E_{\tilde{\nu}}\left[\hat{P}_{it}(j > 0) \mid \text{buy}^T_{i,t=0}\right]$

Outside nest: Extensive margin choice

parameters

- Indirect utility of not purchasing a gun

$$u_{i0t} = -\left(\overbrace{\gamma_x g_{i,t=0} + \tilde{\nu}_i + \psi_{xz}}^{\text{Persistent } \nu_i} + \overbrace{\phi_{xt} + \xi_{it}}^{\text{Shocks}_{xzt}} \right) + \varepsilon_{i0t}$$

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  - $(\gamma, \sigma)_x$: Individual heterogeneity from panel data
    - Repeated choice: Consumer i purchases in many periods $\Leftrightarrow \nu_i \uparrow$
    - Shocks move along demand curve: i purchases at low $\eta_{xzt} \Leftrightarrow \nu_i \uparrow$

Nesting parameter and demand shocks back

- Estimate nesting parameter ρ via CMD
  - Event study: observe market expansion after 1 year, w/in zip and 0–5 miles away go
  - Model: choose ρ to match event-study effects, given inside/outside nest MLE
  - $\rho = 0.43$, s.e. $= 0.04$

Nesting parameter and demand shocks back

- Estimate nesting parameter ρ via CMD
  - Event study: observe market expansion after 1 year, w/in zip and 0–5 miles away go
  - Model: choose ρ to match event-study effects, given inside/outside nest MLE
  - $\rho = 0.43$, s.e. $= 0.04$
- Decompose contraction constants: Separate persistent preferences from shocks
  - FE regression, weight by population

$$\hat{\eta}_{xzt} - \hat{\rho} I_{it} = \underbrace{\psi_{xz}}_{\text{Persistent}} + \underbrace{\phi_{xt} + \xi_{it}}_{\text{Shocks}}$$

Intuition for identification from entry/exit

back

1. Entry/exit of firearm retailer
2. ΔPreferences for handgun purchase u_{ijt}
3. ΔHandgun purchase decision $\max_j\{u_{ijt} - u_{i0t}\} \geq 0$
4. ΔHandgun ownership: Level g_{zt} and Composition $E[(W, V)_i | g_{it} = 1]$
5. Identify externality intercept μ and slope ζ

Technical conditions for control function approach

back

- **Local shocks**: Time-varying utility in zip-quarter $zt \perp$ Fatality shocks in $z't'$

$$E[\tilde{\omega}_{zt} \,|\, \xi_{xzt} - \alpha^p_{xz} p_t,\, \xi_{xz't'} - \alpha^p_{xz'} p_{t'}] = E[\tilde{\omega}_{zt} \,|\, \xi_{xzt} - \alpha^p_{xz} p_t]$$

- **Ignorable retailers**: Unobservable preference ε_{ijt} for retailer $j \perp$ Consumers with higher externalities $\tilde{e}_i$ or purchasing in high-fatality zip-quarters ω_{zt}

$$E[\omega_{z(i)t} \,|\, \varepsilon_{ijt}] = E[\omega_{zt}] = E[\tilde{e}_i \,|\, \varepsilon_{ijt}] = E[\tilde{e}_i] = 0, \quad \text{all } i, j, t$$

- **Linear control function**: Expected fatalities y_{zt} linear in demand shock ξ_{xzt}

$$E\left[\chi_x \sum_{i:z(i)=z,x(i)=x} \frac{\xi_{xzt} - \alpha^p_{xz} p_t}{\text{Pop}_z} + \omega_{zt} + \sum_{i:z(i)=z} \frac{g_{it}\tilde{e}_i}{\text{GunOwners}_{zt}}\right] = \chi_x \sum_{i:z(i)=z,x(i)=x} \frac{\xi_{xzt} - \alpha^p_{xz} p_t}{\text{Pop}_z}$$

Regression specification

back

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{\frac{\text{GunOwners}_{zt}}{\text{Pop}_z}\left(\mu + (\zeta^W, \zeta^V)^\top \hat{E}_{zt}\left[(W,V)_i \mid g_{it}=1\right]\right)}^{\text{Expected externality}} + \overbrace{\kappa_z + \eta_t + \chi_x \frac{E_{zt}[\xi_{x(i)zt} - \alpha^p_{x(i)z} p_t]}{\text{Pop}_z}}^{\text{Expected base rate}} + \underbrace{\omega_{zt} + \sum_{i:z(i)=z} \frac{g_{it}\tilde{e}_i}{\text{Pop}_z}}_{\text{Residual}},$$

- Estimate via OLS, with inputs from demand model
  - Construct composition $\hat{E}_{zt}[(W,V)_i \mid g_{it}=1]$
  - Condition on demand shock $\hat{\xi}_{xzt} - \alpha^p_{xz} p_t$
- If ξ_{xzt} in residual $\rightarrow$ Correlates with GunOwners_{zt} and Composition $\hat{E}_{zt}[(W,V)_i \mid g_{it}=1]$

Effect of entry/exit and demand shock on handgun ownership

back

	Owners/Pop	×Inc	×Den	×Crime	×Male	×Young	×White	$\times g_{i0}$	$\times \psi_{xz}$	$\times E[\tilde{\nu}_i \mid g_{it} = 1]$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$E_{zt}[I_{xzt}]$	0.0185	0.0104	−0.0119	−0.0176	0.0146	0.0055	0.0162	0.0382	−0.1557	0.0236
	(0.0009)	(0.0013)	(0.0015)	(0.0027)	(0.0007)	(0.0003)	(0.0009)	(0.0018)	(0.0076)	(0.0011)
$E_{zt}[\xi_{xzt}]$	0.0055	0.0079	−0.0015	−0.0036	0.0045	0.0015	0.0049	0.0118	−0.0522	0.0072
	(0.0004)	(0.0005)	(0.0006)	(0.0007)	(0.0003)	(0.0001)	(0.0004)	(0.0008)	(0.0035)	(0.0005)
Zip code FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zip code clusters	1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304	1,304
Zip code-quarters	57,079	57,079	57,079	57,079	57,079	57,079	57,079	57,079	57,079	57,079

Estimate (SE)

- Entry/exit I_{xzt} drives handgun ownership and heterogeneity in owner characteristics
- So does demand shock ξ_{xzt}

Estimator satisfies roots back

$$(R1) \qquad 0 = \frac{\partial \mathcal{L}(\Theta)}{\partial \gamma_x} = \frac{\partial \mathcal{L}(\Theta)}{\partial \sigma_x}, \text{ all } x$$

$$(R2) \qquad 0 = \frac{\partial \mathcal{L}(\Theta)}{\partial \Theta_l^\delta} \text{ for } l = 1, \ldots, |\Theta^\delta|$$

$$(R3) \qquad 0 = \sum_{i:x(i)=x,\, z(i)=z} q_{it} - P_{it}\left(q = 1; \Theta\right), \text{ all } x, z, t$$

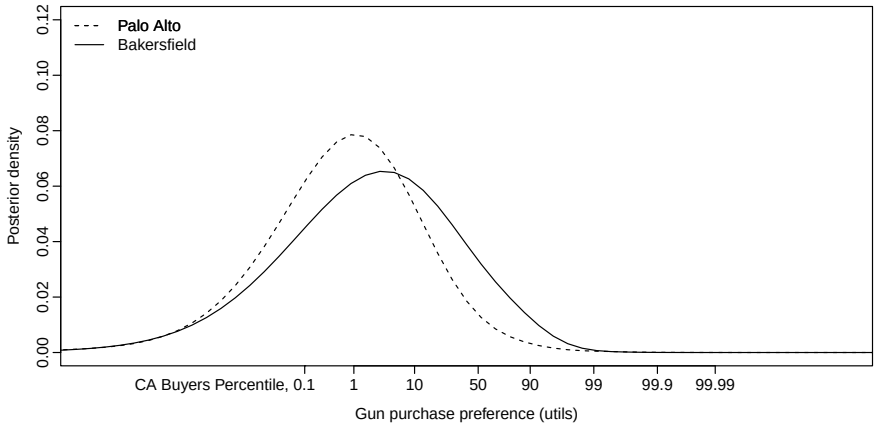
$$(R4) \qquad 0 = \sum_t \xi_{xzt} - \alpha^p (p_t - \overline{p}), \text{ all } x, z$$

$$(R5) \qquad \alpha^p = \frac{\alpha^d_{x(i)z(i)}}{\$\text{cost 1 mile}_{\text{cty}}}$$

$$(R6) \qquad \sum_{t'=5}^{8} \hat{\beta}_{t'} = \frac{1}{|\mathcal{N}|} \sum_{n \in \mathcal{N}} \sum_{t:5 \le t - t(n) \le 8} \frac{1}{M_{z(n)}} \left(q_{z(n)t} - \sum_{i:z(i)=z(n)} P_{it}\left(q = 1 | \mathcal{J}_{z(i)t} \setminus \{j(n)\}; \Theta\right) \right)$$

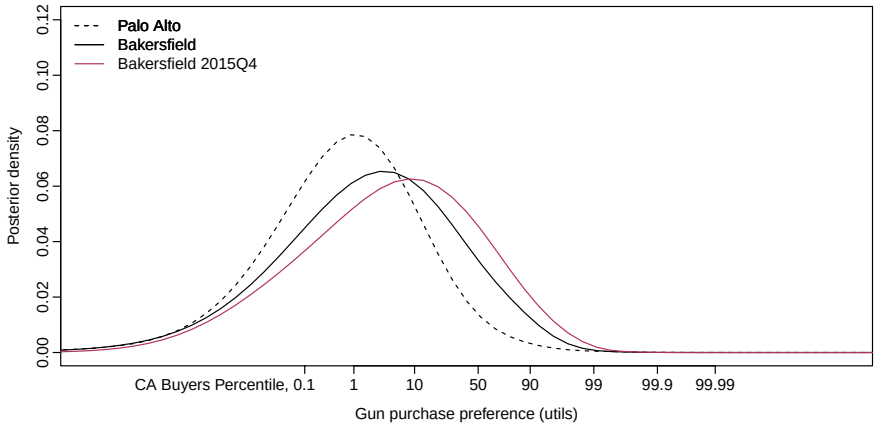
$$(R7) \qquad 0 = \frac{\partial \sum_z \sum_t \left(\omega_{zt} + \sum_{i:z(i)=z} g_{it} \tilde{e}_i / M_z \right)^2}{\partial \Theta_l^e} \text{ for } l = 1, \ldots, |\Theta^e|$$

Preferences for handgun purchase



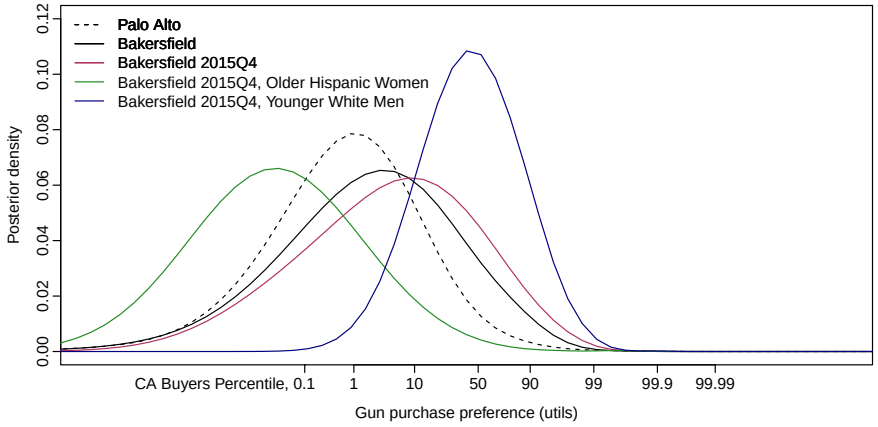
- Geographic variation: Higher preferences in Bakersfield than in Palo Alto

Preferences for handgun purchase



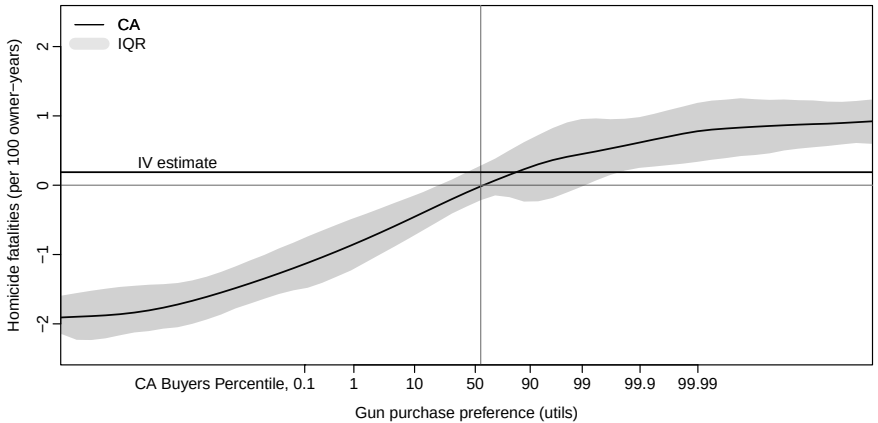
- Time series variation: Demand spikes from San Bernardino Shooting

Preferences for handgun purchase



- Demographic variation: Preference heterogeneity within zip-quarter-demo $\tilde{\nu}_i$

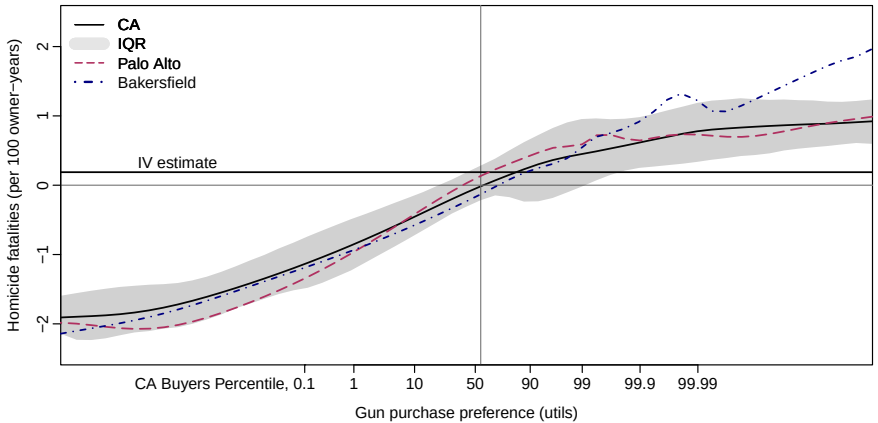
Homicide externalities from handgun ownership params back



- Adverse selection: Higher preference → More costly externality

Homicide externalities from handgun ownership

params back



- Adverse selection: Higher preference $\rightarrow$ More costly externality

Isolating variation from entry exit back

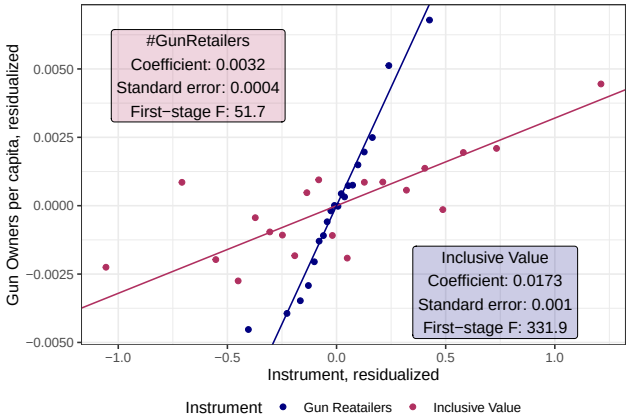
- Conditional on ξ_{xzt}, entry/exit from retailer choice set $\mathcal{J}_{zt}$ is only source of variation in expected handgun purchase within zip over time

$$\log \frac{P_{it}(q=1;\,\nu_i)}{1-P_{it}(q=1;\,\nu_i)} = \nu_i - \alpha^p p_t + \xi_{xzt} + \rho \overbrace{\log \sum_{j \in \mathcal{J}_{zt}} \exp\left(\delta_j - \alpha^d_{xz} d_{ij}\right)^{1/\rho}}^{\equiv I_{xzt}}$$

- Inclusive value of marginal retailer choice I_{xz}
  - Quality-weighted "mean" disutility from travel to purchase a firearm
  - Same IV estimate of handgun ownership g_{zt} on fatalities y_{zt} as $\#\text{GunRetailers}_{zt}$
  - Predicts handgun ownership g_{zt} better than $\#\text{GunRetailers}_{zt}$ (F-stat 300 v. 50)

Isolating variation from entry exit

back



Inclusive value captures same effect of marginal owners as net entry

back

	IV Net entry (1)	IV Model-based (2)	OLS (3)	Sample Mean (4)
Panel A: Homicides				
Firearm	0.159	0.137	0.101	1.120
	(0.056)	(0.031)	(0.012)	
Non-gun	0.029	0.026	0.007	0.431
	(0.025)	(0.012)	(0.004)	
All	0.188	0.164	0.107	1.551
	(0.059)	(0.036)	(0.013)	
Panel B: Suicides				
Firearm	0.042	0.050	0.044	1.090
	(0.045)	(0.016)	(0.009)	
Non-gun	0.023	0.041	0.025	1.692
	(0.054)	(0.024)	(0.010)	
All	0.065	0.091	0.069	2.782
	(0.072)	(0.029)	(0.015)	
Panel C: Handguns (Average year with +1 retailer)				
Owners (first-stage)			277.2	890
			(38.6)	
Purchases			60.6	283.8
			(6.3)	

Calibrate price coefficient back

$$\alpha^{p}_{xz} = \frac{\alpha^{d}_{x(i)z(i)}}{\$\text{cost 1 mile}_{cty}},$$

Where \$cost 1 mile $= \$6.5 =$

$$\underbrace{2}_{\text{Trips}} \times \underbrace{2}_{\text{There/back}} \times \left(\underbrace{\frac{11 \text{ minutes}}{5 \text{ miles}}}_{\text{Drive time}} \times \underbrace{\frac{24 \text{ dollars}}{60 \text{ minutes}}}_{\text{CA wage}} + \underbrace{\frac{8 \text{ driven miles}}{5 \text{ miles}}}_{\text{Drive distance}} \times \underbrace{\frac{0.53 \text{ dollars}}{1 \text{ driven mile}}}_{\substack{\text{CA travel} \\ \text{reimbursement}}} \right)$$

Likelihood and choice probabilities back

- Log-likelihood. Integrate over standard normal density $\varphi(\cdot)$ by quadrature

$$\log \mathcal{L} = \sum_i \log \int_v \prod_{t=1}^{T} \overbrace{P_{it}\left(q_{it}; \tilde{\nu}_i/\sigma_x = v\right)}^{\text{extensive margin}} \overbrace{P_{it}\left(j_{it}|q=1, j \in \mathcal{J}_{z(i)t}\right)^{q_{it}}}^{\text{retailer choice}} \varphi(v)dv$$

Likelihood and choice probabilities

back

- Log-likelihood. Integrate over standard normal density $\varphi(\cdot)$ by quadrature

$$\log \mathcal{L} = \sum_i \log \int_v \prod_{t=1}^{T} \overbrace{P_{it}\left(q_{it}; \tilde{\nu}_i/\sigma_x = v\right)}^{\text{extensive margin}} \overbrace{P_{it}\left(j_{it}|q=1, j \in \mathcal{J}_{z(i)t}\right)^{q_{it}}}^{\text{retailer choice}} \varphi(v)dv$$

- Retailer j choice probability

$$P_{it}\left(j|q=1, j \in \mathcal{J}_{z(i)t}\right) = \frac{\exp\left(\delta_j - \exp(\alpha_x + \alpha_z)d_{ijt}\right)^{1/\rho}}{\underbrace{\sum_{j' \in \mathcal{J}_{z(i)t}} \exp\left(\delta_{j'} - \exp(\alpha_x + \alpha_z)d_{ij't}\right)^{1/\rho}}_{\equiv \exp(I_{xzt})}}$$

Likelihood and choice probabilities back

- Log-likelihood. Integrate over standard normal density $\varphi(\cdot)$ by quadrature

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- Handgun purchase q choice probability

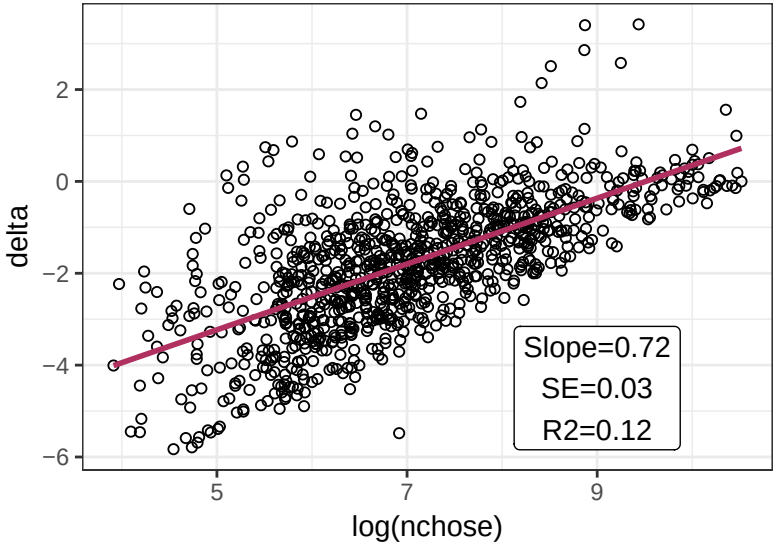
$$P_{it}\left(q|\tilde{\nu}_i, \mathcal{J}_{z(i)t}\right) = \left(1 + 1/\exp\left(\psi_{xz} + \gamma_x g_{i0} + \tilde{\nu}_i - \alpha^p p_t + \xi_{xzt} + \rho I_{xzt}\right)\right)^{-1}$$

Moment that identifies nesting parameter back

$$\sum_{t'=5}^{8} \hat{\beta}_{t'} = \frac{1}{|\mathcal{N}|} \sum_{n \in \mathcal{N}} \sum_{t:5 \leq t - t(n) \leq 8} \frac{1}{\text{Pop}_{z(n)}} \overbrace{\left(q_{z(n)t} - \sum_{i:z(i)=z(n)} \hat{P}_{it}\left(q = 1 | \mathcal{J}_{z(i)t} \setminus \{j(n)\}\right) \right)}^{\text{Drop in gun purchases w/o entrant } n \text{ in choice set}}$$

- Set of "clean" entries $\mathcal{N}$
- RHS: Remove entrant $n \rightarrow$ Average drop in purchases 5–8 quarters post entry, local to zip codes with "clean" entry

Estimating retailer quality δ_j back

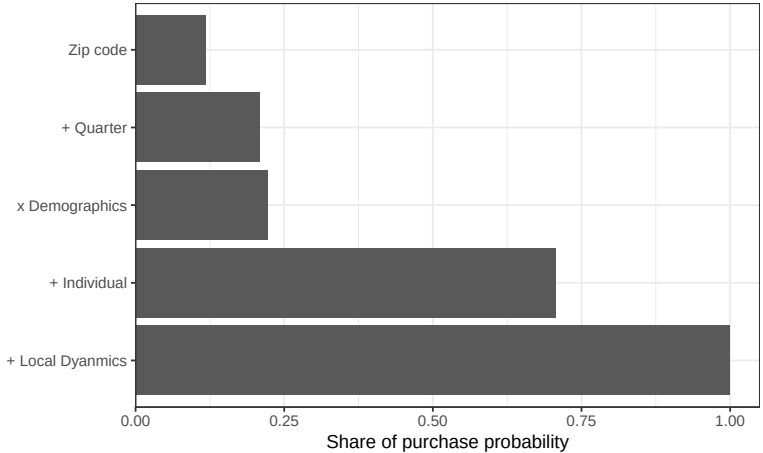


Extensive margin parameter estimates and standard errors back

Gender	Race	Age	Random effect variance $\sigma_\cdot$	Prior ownership $\gamma_\cdot$
Female	Asian	18-30	2.911	0.641
			(0.184)	(0.279)
Female	Asian	30-38	3.157	3.464
			(0.357)	(0.153)
Female	Asian	38-48	3.578	4.090
			(0.723)	(0.183)
Female	Asian	48-57	3.967	4.338
			(1.133)	(0.201)
Female	Asian	58-99	4.647	3.477
			(5.273)	(0.273)
Female	Black	18-30	2.354	0.621
			(0.196)	(0.278)
Female	Black	30-38	1.998	1.685
			(0.124)	(0.095)
Female	Black	38-48	2.138	1.959
			(0.154)	(0.095)
Female	Black	48-57	2.264	2.002
			(0.215)	(0.105)
Female	Black	58-99	2.493	1.821
			(0.359)	(0.172)
Female	Hispanic	18-30	2.614	1.908
			(0.133)	(0.201)
Female	Hispanic	30-38	2.578	3.555
			(0.153)	(0.090)
Female	Hispanic	38-48	2.891	4.076
			(0.261)	(0.106)
Female	Hispanic	48-57	2.989	3.735
			(0.386)	(0.137)
Female	Hispanic	58-99	4.040	5.447
			(1.779)	(0.257)
Female	Other	18-30	1.693	-3.064
			(0.154)	(0.279)
Female	Other	30-38	1.827	-1.938
			(0.212)	(0.154)
Female	Other	38-48	2.332	-1.543
			(0.292)	(0.163)
Female	Other	48-57	2.839	-1.639
			(0.806)	(0.222)
Female	Other	58-99	3.824	-2.039
			(1.668)	(0.324)
Female	White	18-30	1.959	1.343
			(0.042)	(0.095)
Female	White	30-38	2.053	1.815
			(0.049)	(0.040)
Female	White	38-48	2.171	1.935

- Separate estimates by 50 demo bins
- Top row: Youngest, Asian, Women
  - $\sigma_x = 2.9$, s.e.=0.2
- Bottom row: Oldest, White, Men
  - $\sigma_x = 2.3$, s.e.=0.02

Variance decomposition back



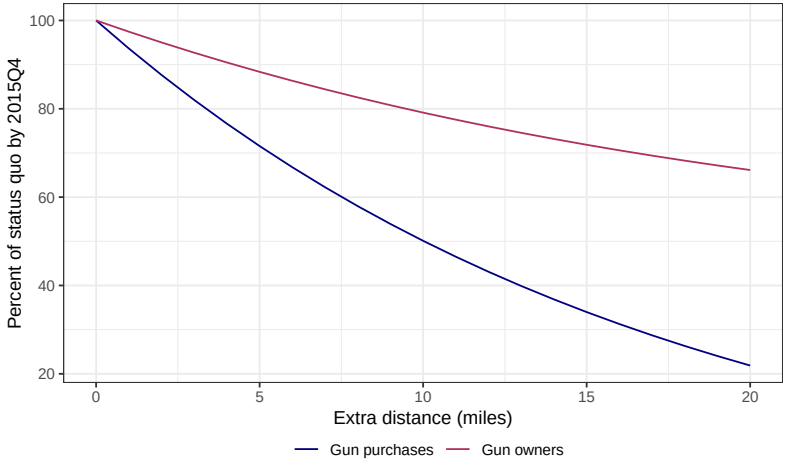
- Local shocks and market structure explain 30% of gun purchasing

Preference parameters back

	Mean	SD	P10	P90	#Values
	(1)	(2)	(3)	(4)	(5)
Panel A: Handgun purchase Θ^{ν}					
σ_{κ}	2.46	0.71	1.71	3.26	50
	(0.06)		(0.01)	(0.22)	
γ_{κ}	1.82	2.02	-1.61	4.00	50
	(0.17)		(0.06)	(0.04)	
$\psi_{xz} - \alpha^{p}\overline{p}$	-8.48	2.07	-10.89	-5.89	51,813
$\xi_{xzt} - \alpha^{p}(p_t - \overline{p})$		0.54	-0.64	0.71	692,467
α^{p}_{xz}	0.02	0.004	0.01	0.02	32,711
Consumer observations					28,683,439
Panel B: Retailer choice Θ^{δ}					
δ_j	-1.14	0.91	-2.34	-0.03	992
α^{d}_{xz}	0.11	0.02	0.08	0.14	32,711
Purchase observations					2,765,428
Panel C: Nesting parameter ρ					
ρ	0.64				1
	(0.06)				
Entry observations					183

Value, (SE)

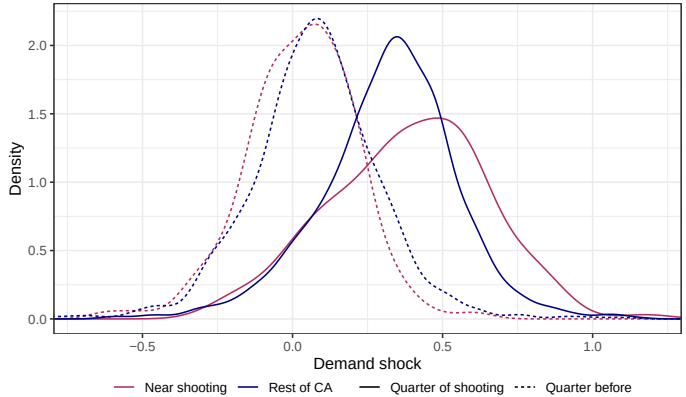
The role of travel distance back



- All store in CA 10mi miles further → Gun sales fall 50% → Ownership falls 20%

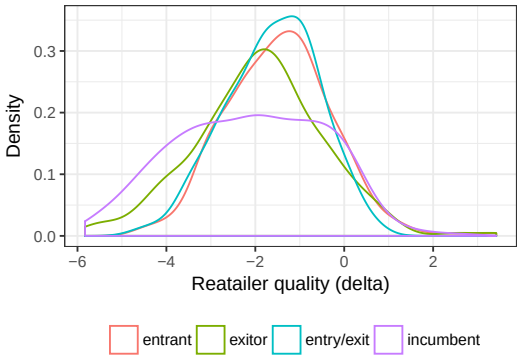
Demand shocks ξ_{xzt} around San Bernardino Shooting

back



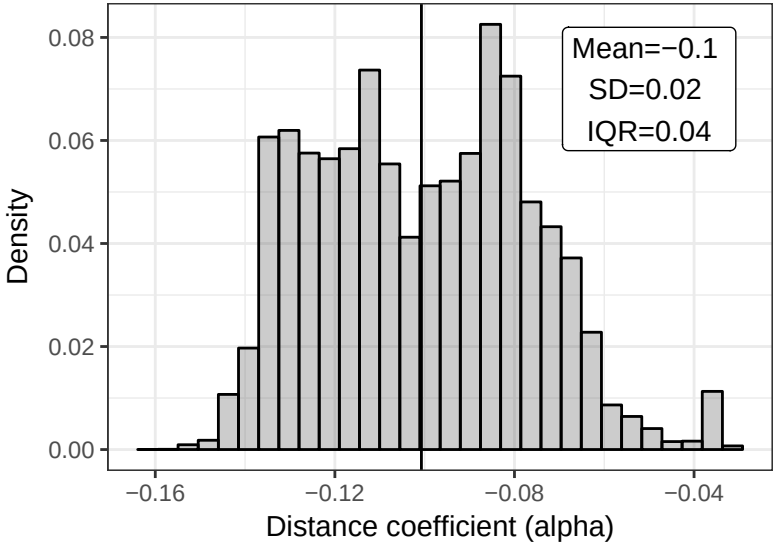
- Capture timing and geographic heterogeneity
- Observe higher purchasing $\rightarrow$ Estimate higher preferences

Retailer quality δ_j by entry/exit decisions back



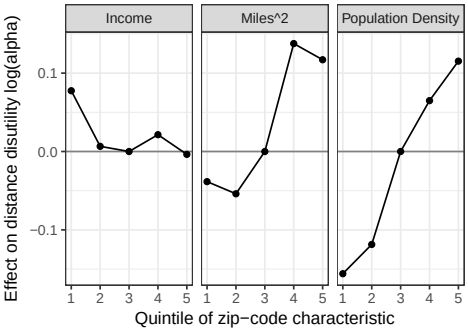
- Entrant $\succ$ Entrant/Exitor $\succ$ Exitor
- Pure incumbents are most diffuse $\rightarrow$ Good and bad retailers stay in

Distribution of distance disutility α_i back

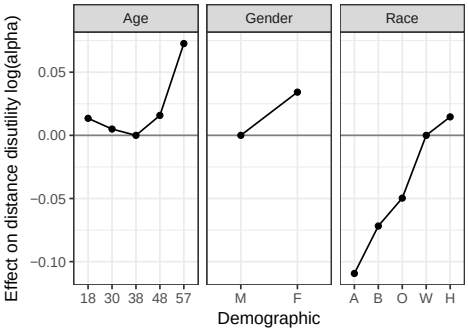


Determinants of distance disutility α_{xz}^{p} back

Zip code characteristics α_z



Demographics α_x



$$\log(\alpha_{xz}^{d}) = \alpha_{\text{county}(i)} + \alpha_{z(i)} + \alpha_{x(i)}$$

Externality parameters back

	Homicide			Suicide		
	Control function		2SLS	Control function		2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
μ	−0.3415	−0.1347	−0.3677	−0.0386	0.0301	−0.2195
	(0.0542)	(0.0251)	(0.1564)	(0.0611)	(0.0329)	(0.1212)
ζ^{inc}	−0.0024			0.0027		
	(0.0021)			(0.0033)		
ζ^{den}	−0.0040			−0.0039		
	(0.0025)			(0.0033)		
ζ^{crime}	0.0016			0.0005		
	(0.0012)			(0.0018)		
ζ^{male}	0.1417			0.0516		
	(0.0391)			(0.0493)		
$\zeta^{<30}$	0.0662			0.0416		
	(0.0216)			(0.0310)		
ζ^{white}	0.0673			0.0116		
	(0.0123)			(0.0121)		
ζ^{ds}	−0.1186			0.2870		
	(0.0612)			(0.0895)		
ζ^{o}	−0.00003			0.0005		
	(0.0020)			(0.0034)		
ζ^{v}	0.1436	0.1314	0.3198	−0.0074	−0.0104	0.1928
	(0.0232)	(0.0218)	(0.1281)	(0.0276)	(0.0260)	(0.0986)
χ	0.0001	0.0001		0.00001	0.00003	
	(0.0001)	(0.0001)		(0.0001)	(0.0001)	
Zip code FE	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y

Nonparametric identification under demand model back

- High-level assumption: linear conditional expectation function $E[e|\nu] = \vec{\tau} \cdot \vec{h}(\nu)$

$$\overbrace{E[\text{Fatalities}_{zt}] + \text{Error}_{zt}}^{\text{Data}} = \sum_{i \in z} \text{GunOwner}_{it} \times e_i + \text{Error}_{zt} \qquad \text{(Model)}$$

$$= \sum_{i \in z} \text{GunOwner}_{it} \times E[e|\nu_i] + \text{Error}_{zt} \qquad \text{(LOIE)}$$

$$= \vec{\tau} \cdot \sum_{i \in z} \underbrace{\text{GunOwner}_{it} \times \vec{h}(\nu_i)}_{\text{Data}} + \text{Error}_{zt} \qquad \text{(Linearity)}$$

- More flexible $\vec{h}(\cdot) \rightarrow$ Non-parametric approximation

Nonparametric identification under demand model back

- High-level assumption: linear conditional expectation function $E[e|\nu] = \vec{\tau} \cdot \vec{h}(\nu)$

$$\overbrace{E[\text{Fatalities}_{zt}] + \text{Error}_{zt}}^{\text{Data}} = \sum_{i \in z} \text{GunOwner}_{it} \times e_i + \text{Error}_{zt} \qquad \text{(Model)}$$

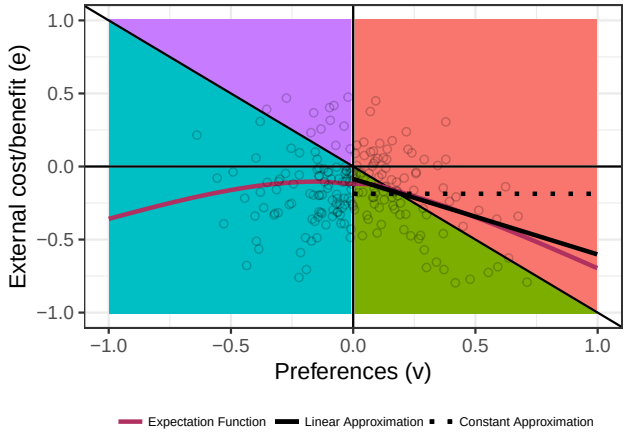
$$= \sum_{i \in z} \text{GunOwner}_{it} \times E[e|\nu_i] + \text{Error}_{zt} \qquad \text{(LOIE)}$$

$$= \vec{\tau} \cdot \sum_{i \in z} \underbrace{\text{GunOwner}_{it} \times \vec{h}(\nu_i)}_{\text{Data}} + \text{Error}_{zt} \qquad \text{(Linearity)}$$

  - More flexible $\vec{h}(\cdot) \rightarrow$ Non-parametric approximation

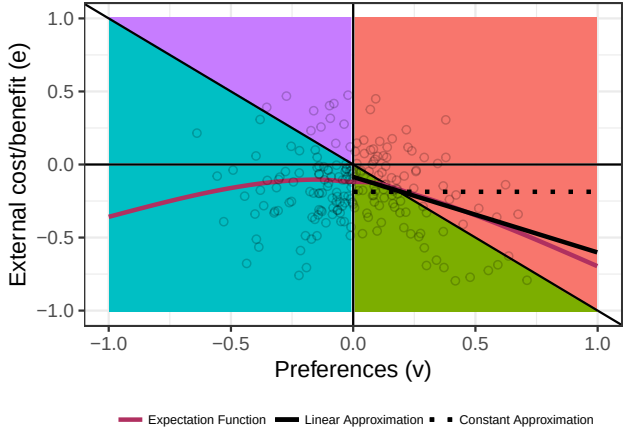
- Parametric implementation
  - First-order approximation: $h(\nu_i) \equiv (1, \nu_i)$
  - Fixed effects: $\text{Error}_{zt} = \text{FE}_z + \text{FE}_t + \omega_{zt}$

Implied geometry of public health curve $E[e|\nu]$ back



- Expectation function: Collapse $f_{e|\nu}$ to $E[e|\nu]$

Implied geometry of public health curve $E[e|\nu]$ back

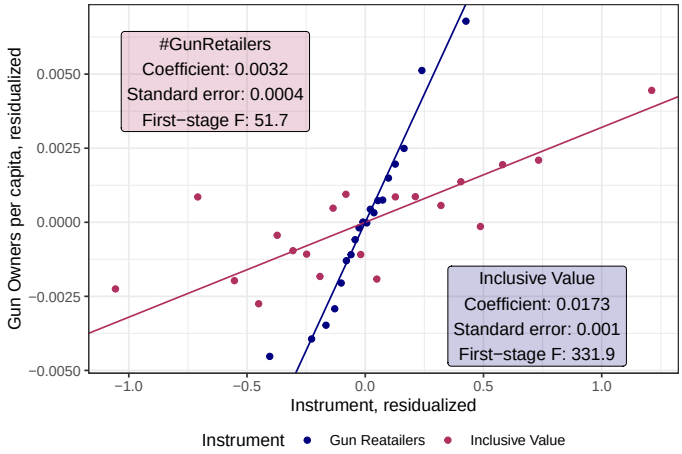


- Expectation function: Collapse $f_{e|\nu}$ to $E[e|\nu]$
- First-order approximation to $E[e|\nu] = \mu + \lambda\nu$
- Approximation local to gun buyers $\nu > 0$

$$\begin{cases} \lambda = 0 & \text{Constant } \mu = \text{LATE} \\ \lambda \neq 0 & \text{exact if } (u, e) \sim N(\mu, \Sigma) \end{cases}$$

Powering up the net entry instrument

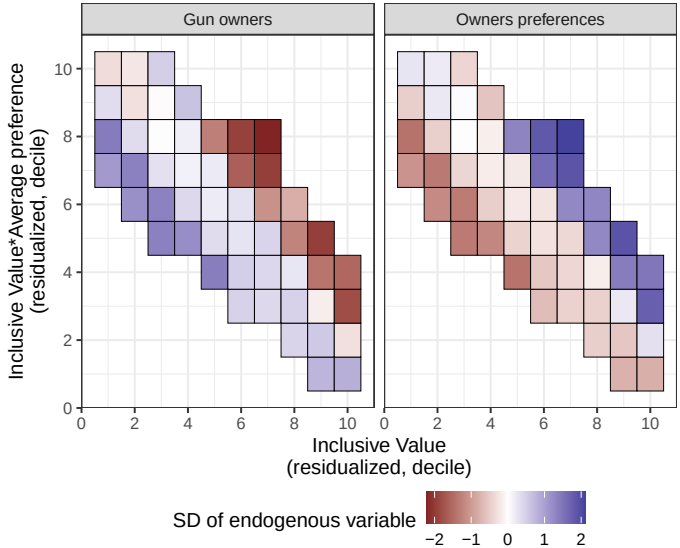
back



- Use $E_{zt}[I_{it}]$ as instrument for gun ownership
- Allows heterogeneity in effect of net entry by local characteristics

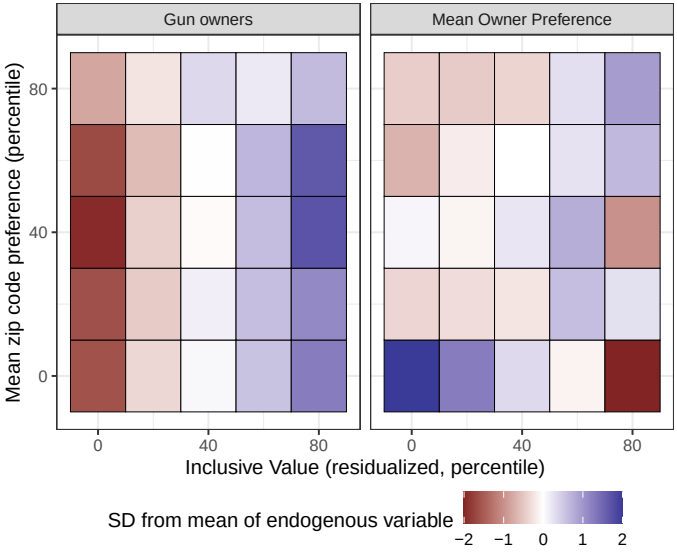
Effects of instruments on level and composition of gun owners

back



Effect of net entry varies by average preference in zip code

back



Intuition for identification of $E[e|\nu] = \mu + \lambda\nu$ back

- Summarize each entry n by 3 pre-post comparisons

Reduced form	Ownership first-stage	Composition first-stage
ΔFatalities	ΔGunOwners	$\Delta E[\nu_i|\text{Own}]$

Intuition for identification of $E[e|\nu] = \mu + \lambda\nu$ back

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- Intercept μ: Average increase in fatalities per increase in gun owners, across entries

$$\text{First-derivative: } E_n\left(\frac{\Delta\text{Fatalities}}{\Delta\text{GunOwners}}\right)$$

Intuition for identification of $E[e|\nu] = \mu + \lambda\nu$ back

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- Intercept μ: Average increase in fatalities per increase in gun owners, across entries

$$\text{First-derivative: } E_n\left(\frac{\Delta\text{Fatalities}}{\Delta\text{GunOwners}}\right)$$

- Slope λ: Its cross-entry correlation with change in composition

$$\text{Cross-partial: } \text{Corr}_n\left(\frac{\Delta\text{Fatalities}}{\Delta\text{GunOwners}}, \Delta E[\nu_i|\text{Own}]\right)$$

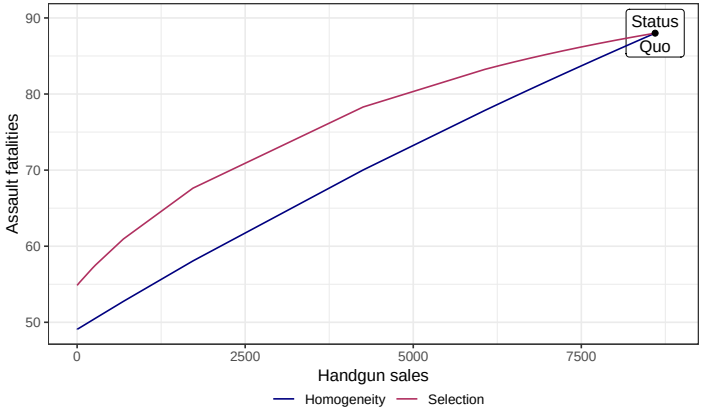
  - "How much does a change in composition systematically raise/lower the change in fatalities per gun owner"

Effects of instruments on level and composition of gun owners

back

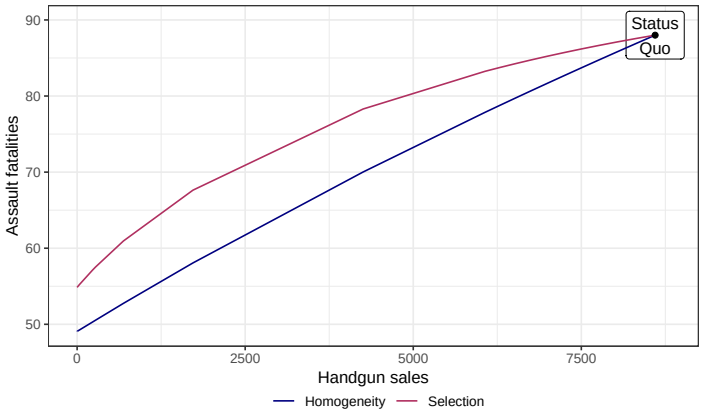
	Endogenous variable	
	Gun owners	Owners preferences
	(1)	(2)
Inclusive Value	0.50707	−0.45310
	(0.04471)	(0.04068)
×Average Preference	−0.12976	0.15716
	(0.03142)	(0.02830)
Zip code FE	Y	Y
Period FE	Y	Y
Clusters	1304	1304
Observations	57376	57376
F	64.86	62.18
R^2	0.94836	0.95789

Marginal fatalities from gun tax in Palo Alto CA back



- ↑Tax rate → Move left along curve → Marginal owner has higher preference

Marginal fatalities from gun tax in Palo Alto CA back

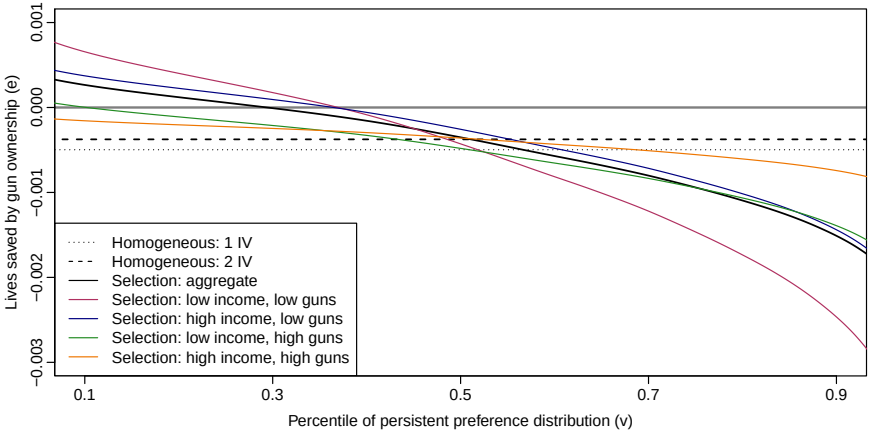


- ↑Tax rate → Move left along curve → Marginal owner has higher preference
- Lower slope: Many one-time buyers with small externalities
- Higher curvature: Ardent buyers have larger externalities → Adverse selection

Control function estimates $E[e|\nu]$ back

	Endogenous variable		
	Gun owners	Gun owners	Owners preferences
	(1)	(2)	(3)
Inclusive Value I_{zq}	454.96	436.40	−2,020.75
		(44.66)	(212.82)
×Average preferences $I_{zq} \times E_z[\nu_i]$		−178.89	1,217.35
		(39.75)	(209.64)
Zip code FE	Y	Y	Y
Period FE	Y	Y	Y
Clusters	1304	1304	1304
Observations	57376	57376	57376
F	119.64	64.86	62.18
R^2	0.95	0.95	0.96

Public health estimates for assault fatalities $E[e|\nu]$ back



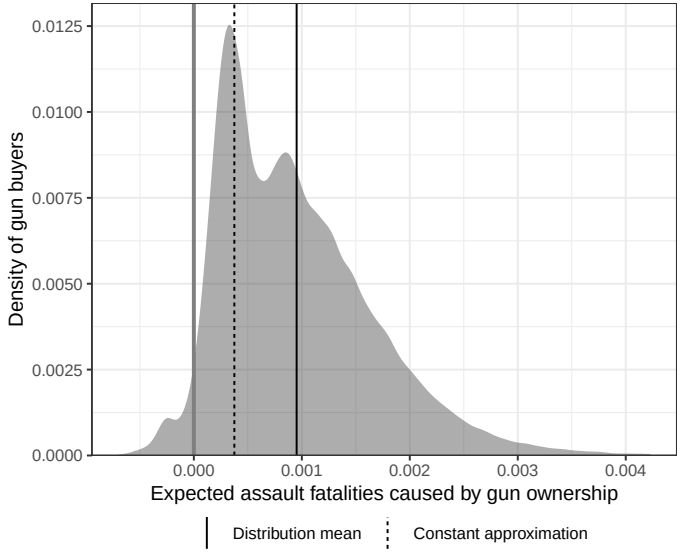
- Heterogeneity: Higher zip income, owners/pop at $t{=}0 \rightarrow$ Flatter profile

Parameter estimates $E[e|\nu] = \mu_z + \lambda_z \nu$ back

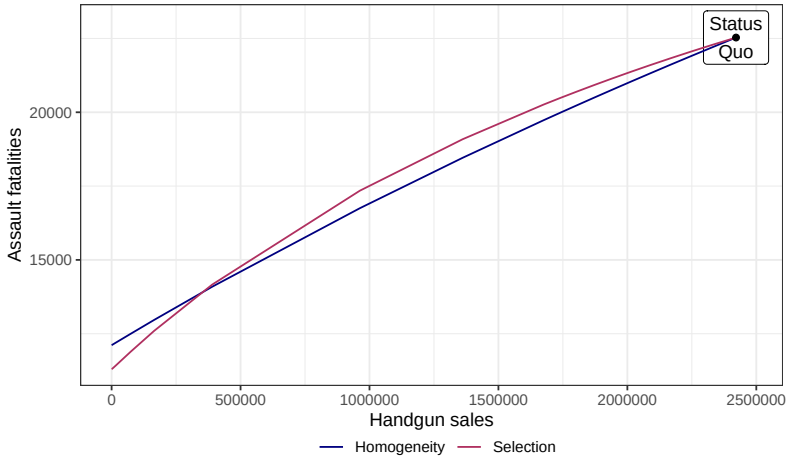
	Assault fatalities			
	(1)	(2)	(3)	(4)
μ: Gun owners g_{zt}	0.00050	0.00038	0.00308	0.00522
	(0.00014)	(0.00016)	(0.00060)	(0.00121)
+ High income, only				−0.00218
				(0.00119)
+ High initial guns, only				−0.00260
				(0.00108)
+ High both				−0.00396
				(0.00117)
λ: Owner preferences $g_{zt} \times E_{zt}[\nu_i \mid g_{it} = 1]$			0.00055	0.00096
			(0.00014)	(0.00026)
+ High income, only				−0.00040
				(0.00025)
+ High initial guns, only				−0.00053
				(0.00023)
+ High both				−0.00078
				(0.00024)
Control function, 1 IV	−0.00046			
	(0.00013)			
Control function, Gun owners		0.00011	−0.00259	−0.00140
		(0.00027)	(0.00075)	(0.00073)
Control function, Owner preferences		0.00009	−0.00046	−0.00023
		(0.00006)	(0.00017)	(0.00017)

Distribution of fatality effect among buyers

back

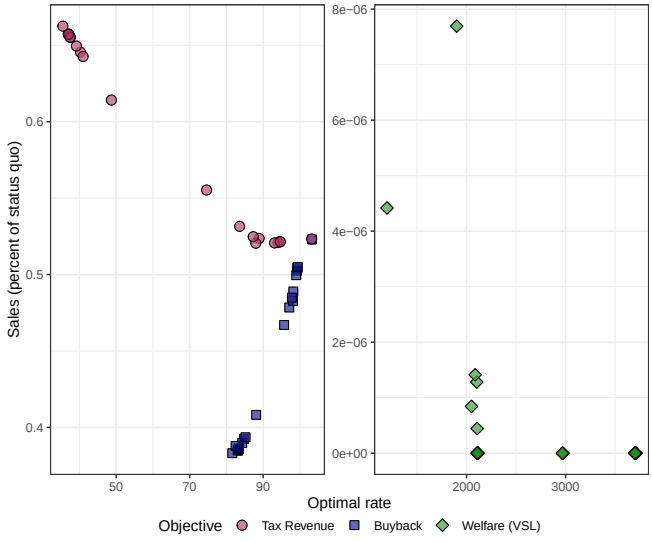


Public health heterogeneity in California back

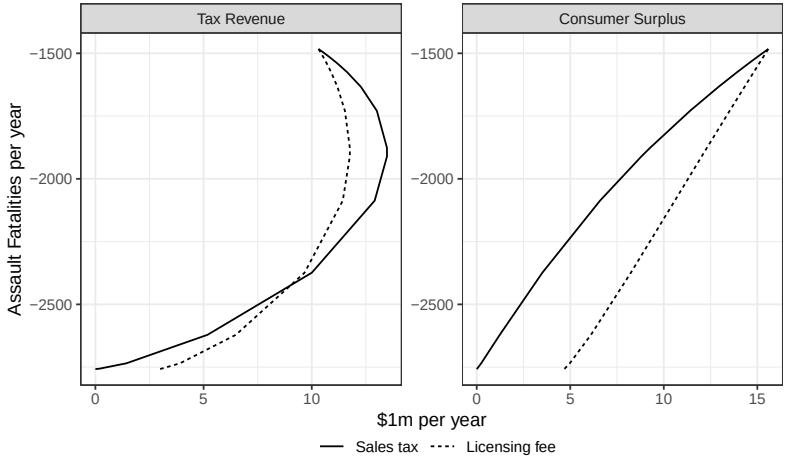


Sales quantities at optimal gun taxes in California

back

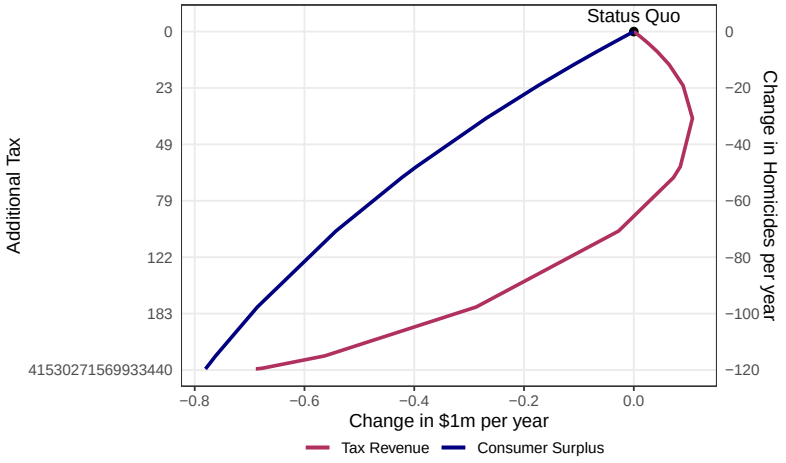


Alternative policies in CA back



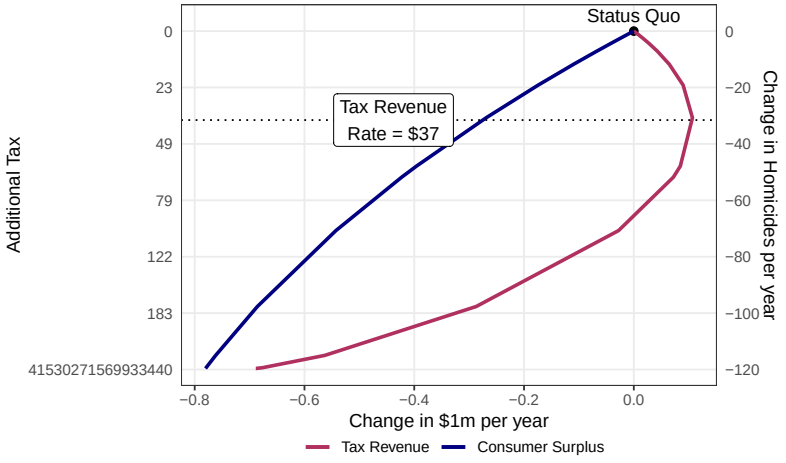
Effect of sales tax in LA

back alternative instruments



Effect of sales tax in LA

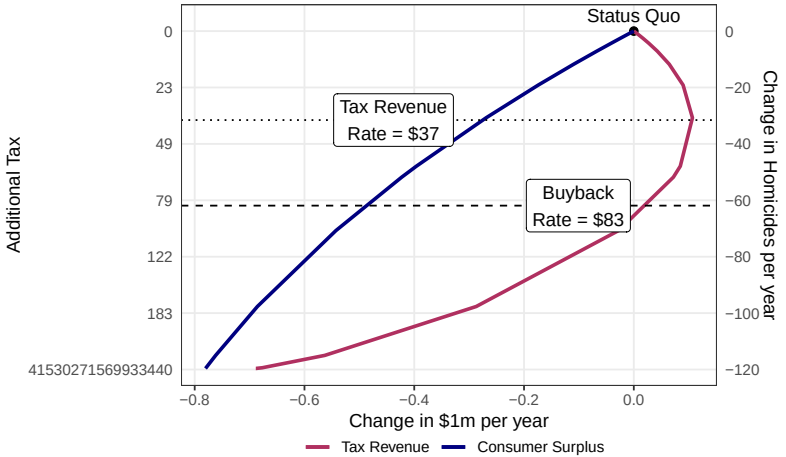
back alternative instruments



- Max revenue → +$150k Revenue, -$300k CS, -14 Fatalities → Sound fiscal policy

Effect of sales tax in LA

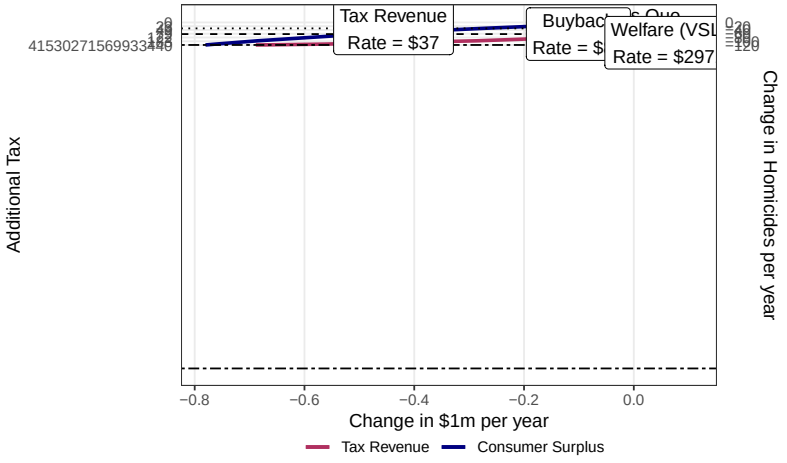
back alternative instruments



- Value gun sales at buyback WTP → Higher optimal rates, lower sales

Effect of sales tax in LA

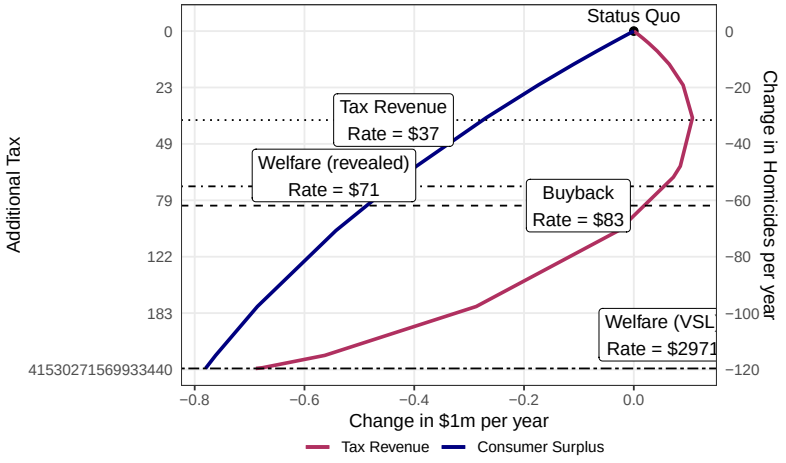
back alternative instruments



- Directly value fiscal cost of fatalities → Shut down market

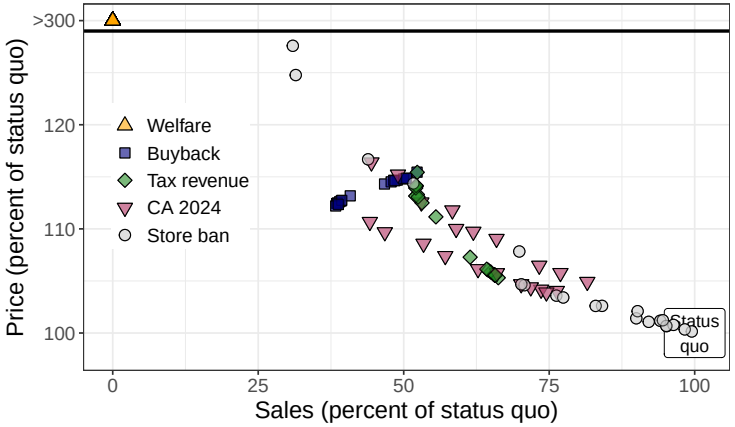
Effect of sales tax in LA

back alternative instruments



- Value fatalities using CA policymakers' revealed preference → Milder taxation

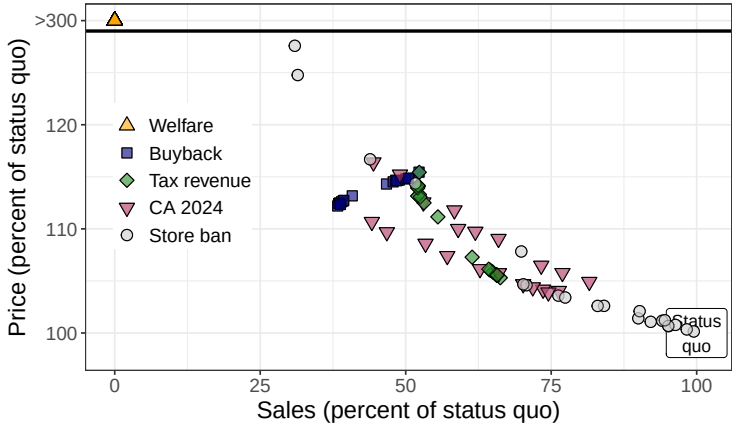
Optimal sales taxes and quantities in Palo Alto back



- Optimal policy varies by objective and geography
- Retailer ban is coarsest → Shrink market 1–70% targeting

Optimal sales taxes and quantities in Palo Alto and 20 largest CA cities

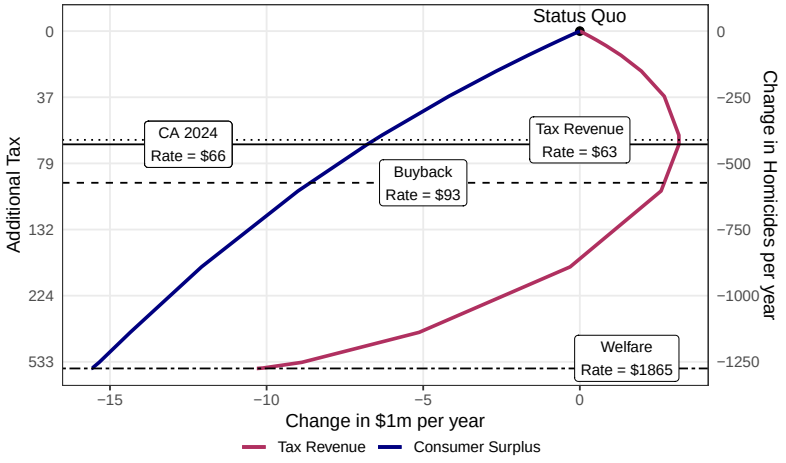
back



- Optimal policy varies by objective and geography
- Retailer ban is coarsest → Shrink market 1–70%

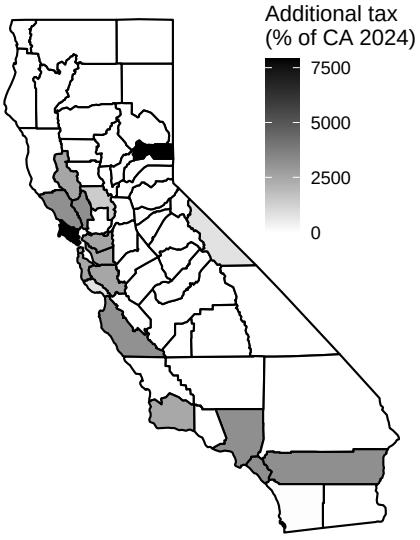
targeting

Effect of handgun sales tax in CA back



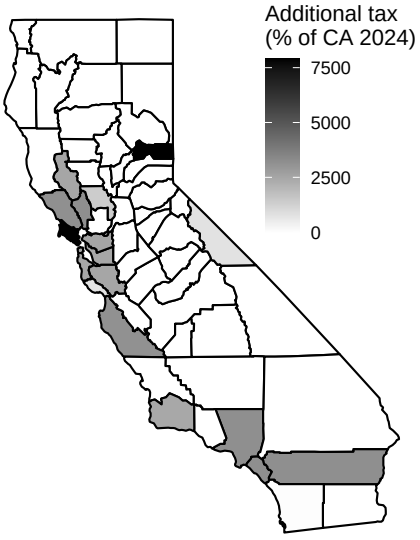
- Value gun sales at buyback WTP → Lower rates → Buybacks under-priced

Gun regulation is a local issue back



- Set rates optimally by county, matching CS drop from CA 2024 tax
  - High rates around Bay Area and LA
    (Low wtp, dense population, high crime)
  - Status quo for rest of CA
    (High wtp, sparse population)
- Optimal rates align with political preferences for firearm regulation

Gun regulation is local issue back



- High rates around Bay Area and LA
  - Low wtp, dense population, high crime
- Status quo for rest of CA
  - High wtp, sparse population
- Optimal rates align with political preferences for firearm regulation
  - Achieve efficiency gain from targeting by returning jurisdiction to local level

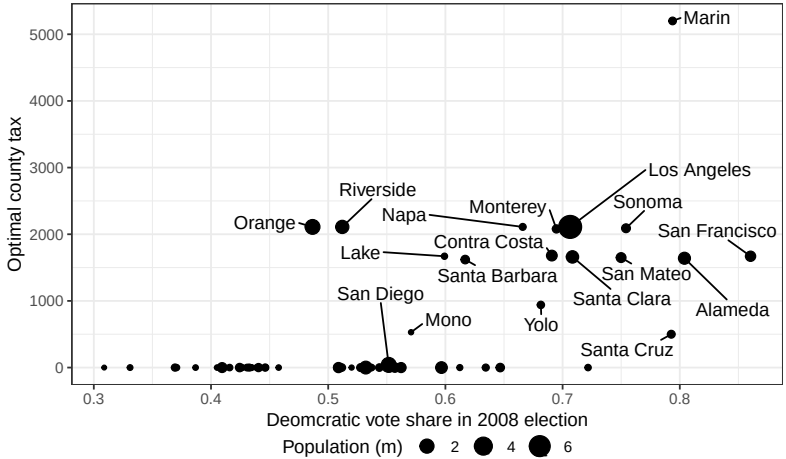
City-wide bans on firearm retailers are mis-targeted

back



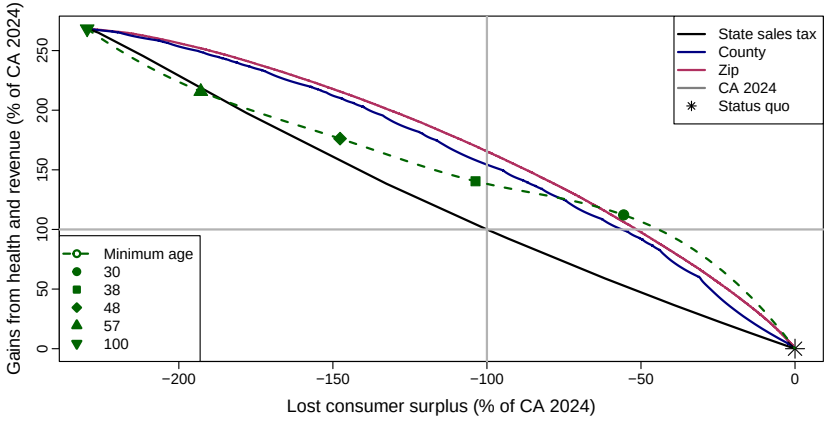
- Bans have larger effects in cities with lower optimal taxes
- Better "targeting" via single state-wide rate

Geographic firearm taxes may be politically feasible back



- Locations with higher optimal taxes have higher Democratic vote share

Gains from making handgun purchasers "age out of crime"



- Gains from other targeted bans on firearm purchase (e.g., background checks)
- Market regulation scales better than targeted bans