

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
 - Key: Effect on marginal gun purchases → Ambiguity in magnitude and characteristics

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Entry → Gun sales up 30% & Gun owners up 12% → Homicides up 13%
Marginal purchases Marginal owners Negative externalities

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

Heterogeneity → Higher willingness to pay $\Leftrightarrow$ Costlier externality → Adverse selection

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- Analyze counterfactual taxes and regulations for CA handgun market
 - Today: CA 2024 tax maximizes revenue. Too low accounting for CS and public health
 - In paper: Targeted policy proposals

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

CA licit handgun market

- Price $\approx$ \$600. Quantity $\approx$ 300k/year
 - 1/3 buyers are first-time owners
- Regulations on each sale
 - Implemented by licensed, brick-and-mortar retailer (1k in data, 500 entries)
 - Reported to CA DOJ
- Transaction-level data 2005–2015
 - Observe: Consumer and Retailer ID + Location + Characteristics (demo, own pre-2005)
 - No price $\rightarrow$ Use distance as metric
- Public health. 9k shootings/year
 - Data from morgue records
 - In paper: Shootings tied to licit market operations, nearby and short-term

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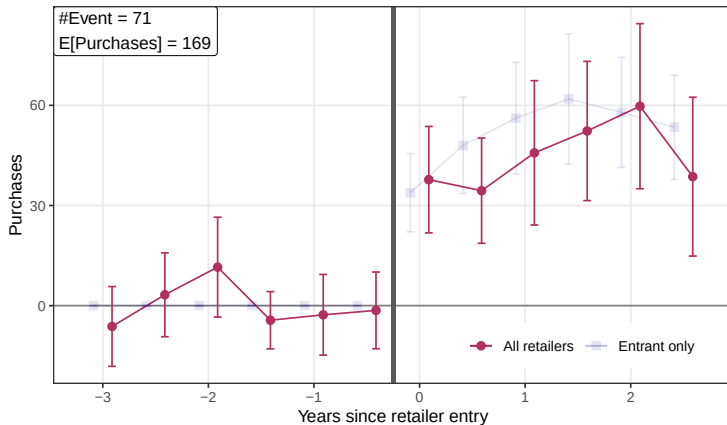
Many gun purchases on margin: Method

- Estimate event study around “clean” first entries of firearm retailers ($0 \rightarrow 1$)

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

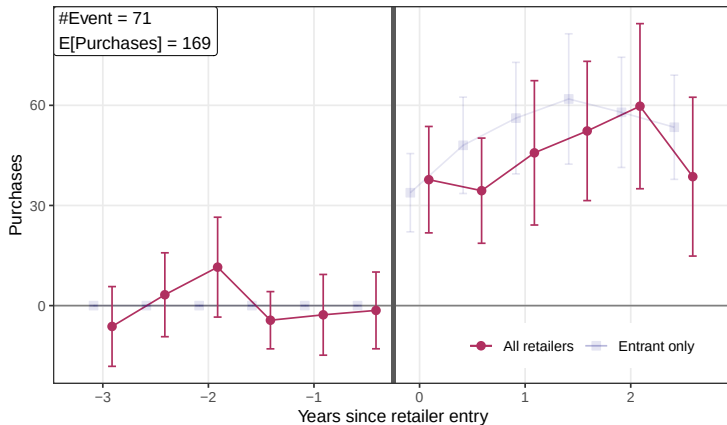
- Zip code z , half-year t , event time t'
- Compare zip-period post entry to others not-yet or never entered (Borusyak et al. 2024)

Many gun purchases on margin



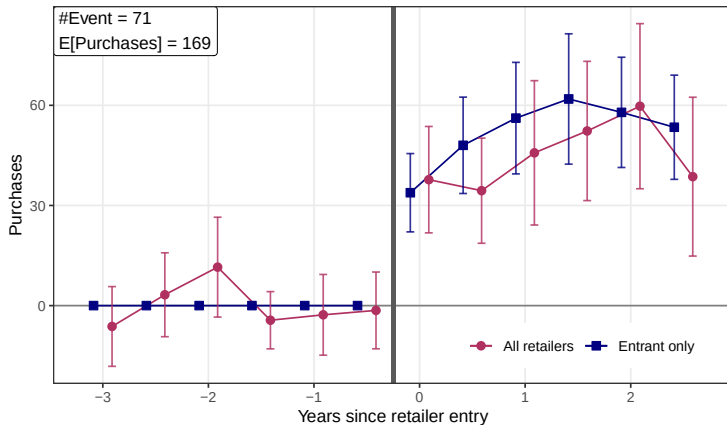
- Outcome: Purchases by consumers in entered zip at any retailer → **Mkt Expansion**
- Assume: Retailers do not time or position operations on dmd shock ξ_{zt} (Support in paper)

Many gun purchases on margin



- Year 1: $\overbrace{\text{Mkt Expansion}}^{100}$
- In paper: Travel distance, Heterogeneity by more-distant zips, incumbents, exit

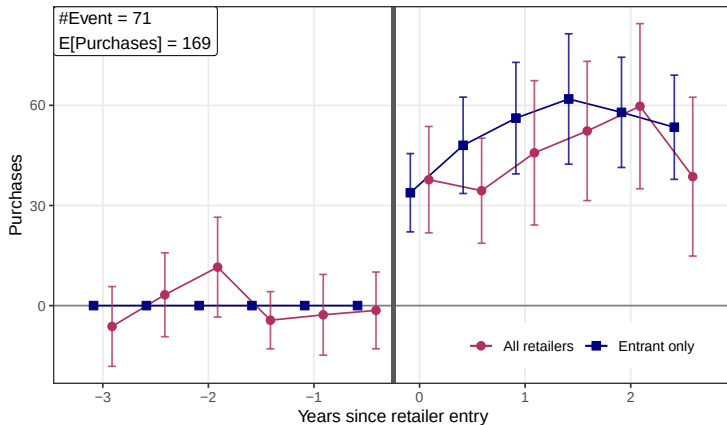
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- Year 1: $\text{Mkt Expansion} = \text{Entrant Only} - \text{Biz stealing}$

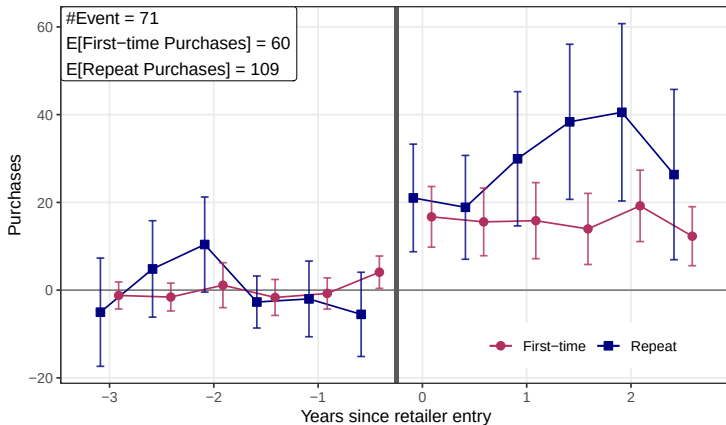
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Many gun purchases on margin



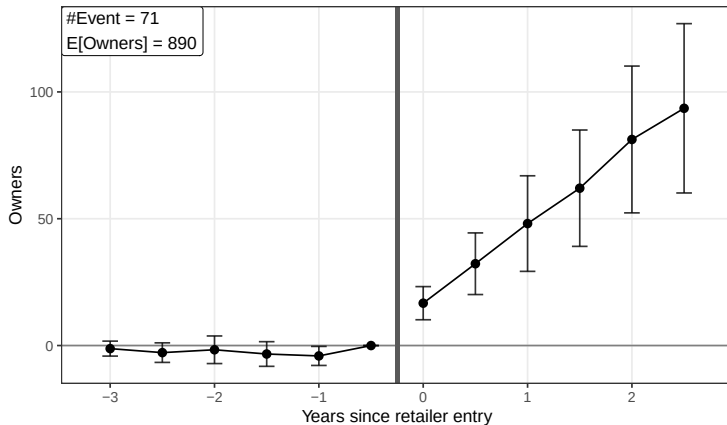
- Year 1: $\overbrace{\text{Mkt Expansion}}^{100} = \overbrace{\text{Entrant Only}}^{120} - \overbrace{\text{Biz stealing}}^{20} \rightarrow \uparrow \text{Purchases } 30\% \rightarrow \text{Large margin}$
- In paper: Travel distance, Heterogeneity by more-distant zips, incumbents, exit

Proportional change in composition of handgun purchases



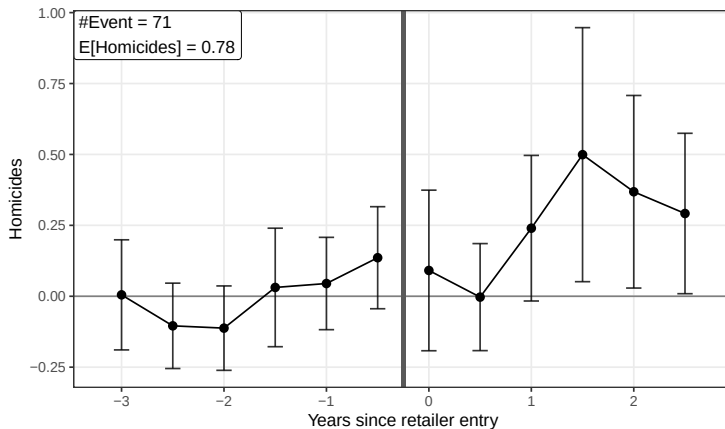
- $\uparrow$ Purchases 30% for repeat and first-time buyers $\rightarrow$ Change in ownership

Handgun ownership grows post-entry



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

Retailer entry causes homicide fatalities



- Kink in ownership stock $\rightarrow$ Kink in homicide flow $\rightarrow$ Owning gun causes homicide
- In paper: Higher-power 2SLS, Heterogeneity by fatality and owner characteristics

Roadmap

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

Preferences, purchases, and handgun ownership

- Purchase by consumer i in zip z , quarter t . Nested logit over stores j , no-buy $j=0$

$$u_{ijt} = \overbrace{\nu_i - \alpha_i^p \cdot \text{price}_t + \xi_{zt}}^{\text{extensive margin}} + \overbrace{\delta_j - \alpha_i^d \cdot \text{distance}_{ij} + \varepsilon_{ijt}}^{\text{retailer choice}}$$
$$u_{i0t} = \varepsilon_{i0t}$$

- ν_i : Individual demand, partially unobservable
- ξ_{zt} : Zip-quarter demand shock (i.e., local crime wave)
- Choice set $_{it}$: Retailers j within 200 miles, operating during t . Handguns undifferentiated

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 - Choice set $_{it}$: Retailers j within 200 miles, operating during t . Handguns undifferentiated
- Gun ownership $g_{it} \in \{0, 1\}$ is durable + Repeated static choice $\rightarrow$ Law of motion

$$g_{it}(\nu_i, \xi_{zt}) = g_{i,t-1} + (1 - g_{i,t-1}) \times \mathbf{1}\left(\max_{j \in \text{choice set}_{it}} u_{ijt}(\nu_i, \xi_{zt}) > u_{i0t}\right)$$

Handgun ownership and public health

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

$$\frac{\text{Fatalities}_{zt}}{\text{Pop}_z} = \overbrace{\sum_{i|z} \frac{g_{it}(\nu_i, \xi_{zt})}{\text{Pop}_z}}^{\text{gun owner count}} \times \overbrace{E_{zt}[e_i(\nu_i) | g_{it}(\nu_i, \xi_{zt}) = 1]}^{\text{avg owner's externality}}$$

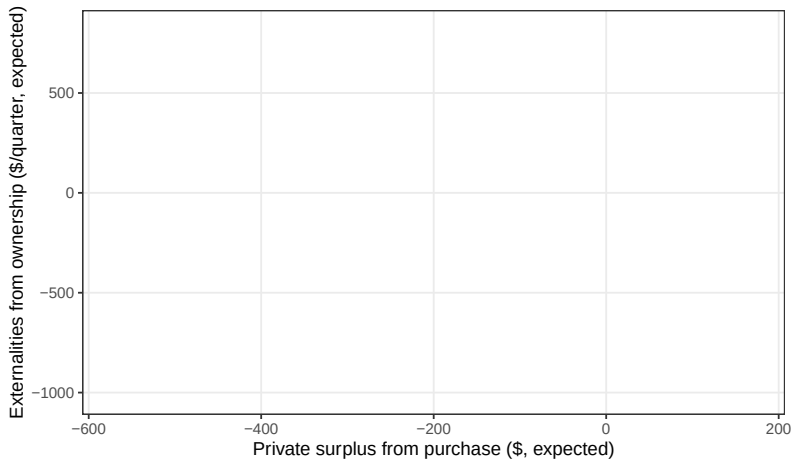
$$+ \underbrace{\kappa_z + \eta_t}_{\text{fixed effects}} + \underbrace{\chi \xi_{zt}}_{\text{endogeneity}} + \underbrace{\omega_{zt}}_{\text{shocks}}$$

- Selection: Individual demand $\nu_i \rightarrow$ ownership g_{it} and externality e_i (Heckman 1979)
- Endogeneity: Demand shock $\xi_{zt} \rightarrow$ ownership g_{it} , externality $E[e_i | g_{it}]$, and fatality χ

Empirical implementation

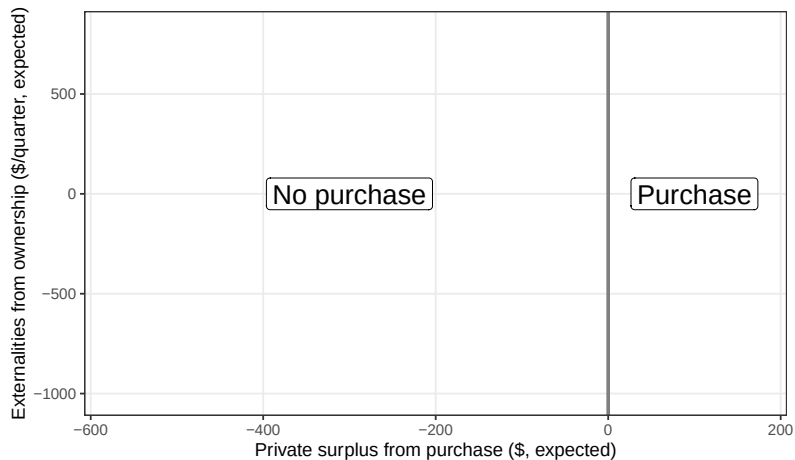
- Estimation via exactly-identified minimum distance. Moments from
 - Panel data
 - Effects of entry/exit
 - Calibrate price coefficient: $\alpha_i^P = \hat{\alpha}_i^d / \cost 1 mile_z (Dolfen et al. 2023)
- Valuing welfare components
 - Consumer surplus = $E[\max_{j \in \{\text{choice set}_{it} \cup 0\}} u_{ijt}] / \alpha_i^P$
 - Gun fatality: fiscal cost (homicide = \$170k)
 - Tax: \$1 revenue = \$1 welfare, account for status-quo sales tax

Preferences and externalities in California's average quarter



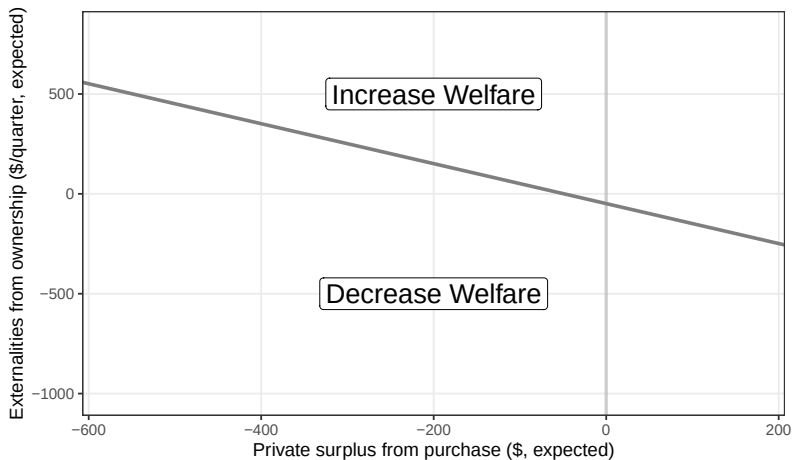
- Preferences and externalities

Preferences and externalities in California's average quarter



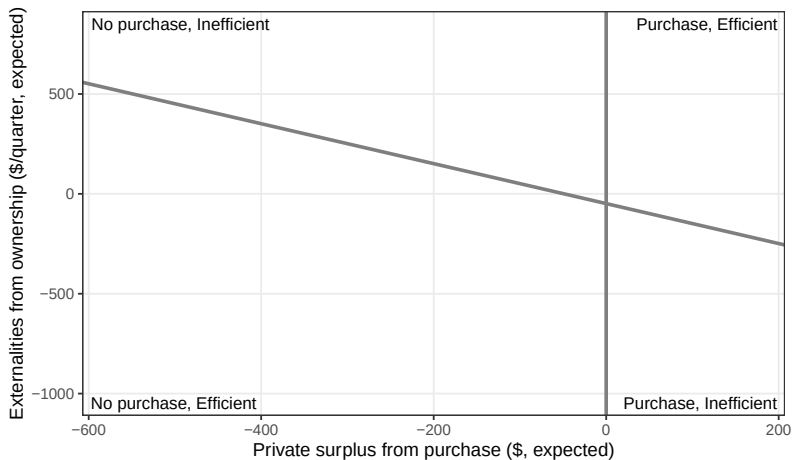
- Preferences → Gun purchase

Preferences and externalities in California's average quarter



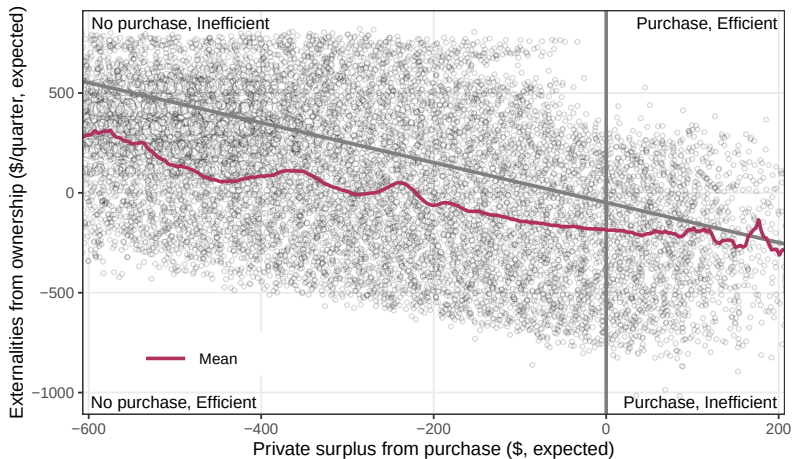
- Preferences, externalities, tax revenue → Welfare

Preferences and externalities in California's average quarter



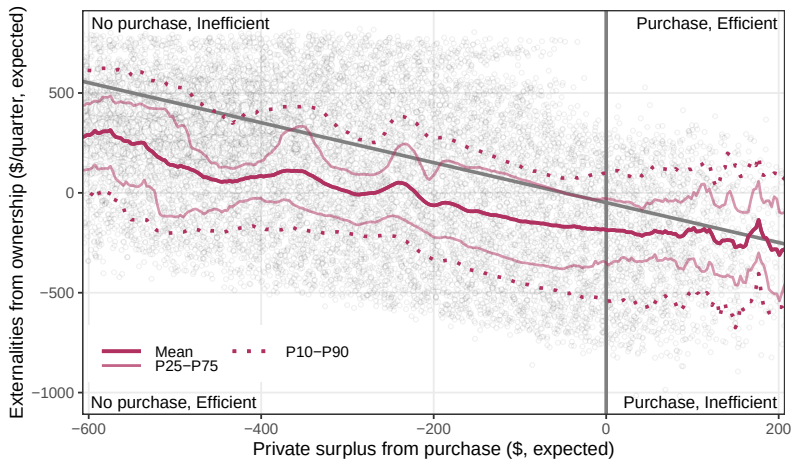
- Gun purchase → Allocative (in)efficiency

Preferences and externalities in California's average quarter



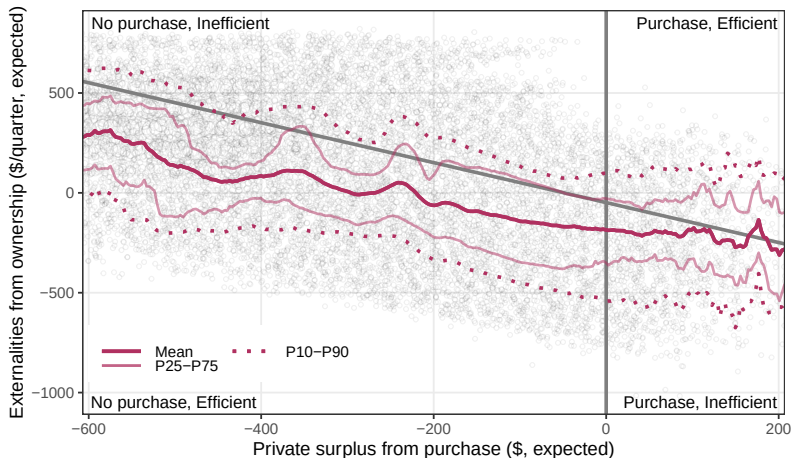
- Fitted model → Consumer distribution

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Preferences and externalities in California's average quarter

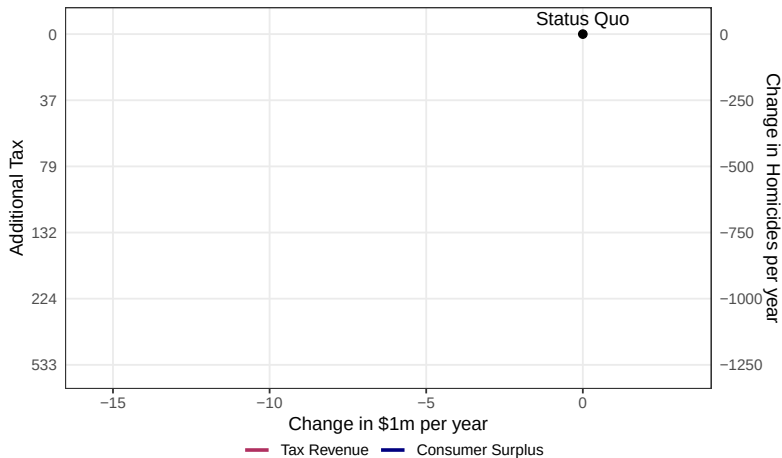


- Fitted model → Consumer distribution
- Downward slope → Adverse selection → Allocative inefficiency

Roadmap

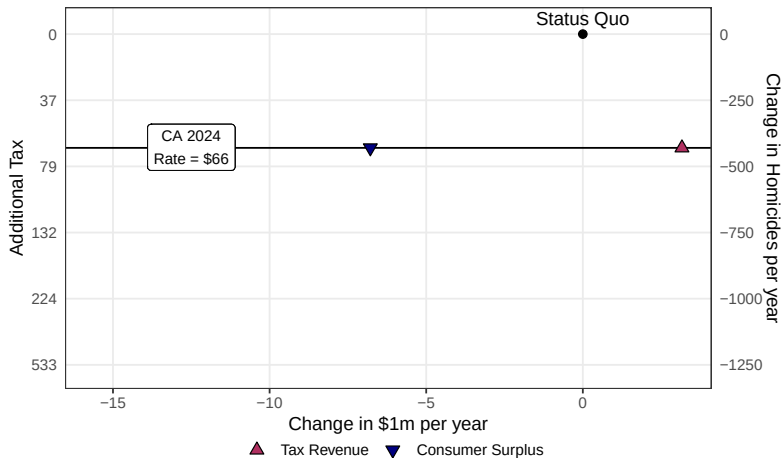
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Effect of handgun sales tax in CA



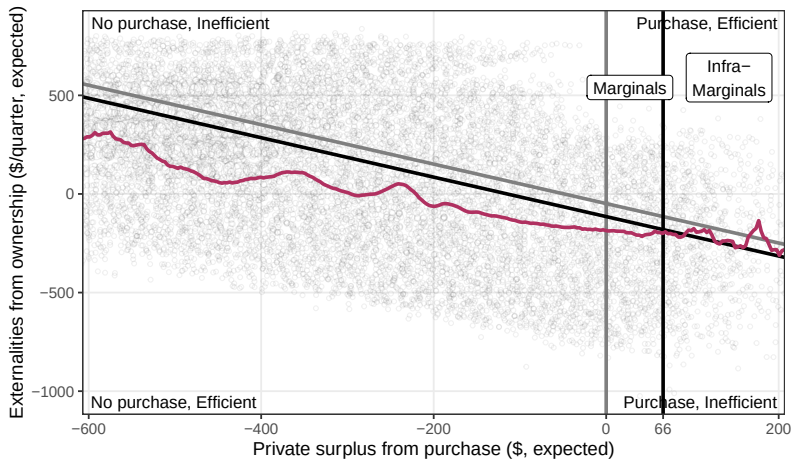
- Use tax to trace out frontier of CS, revenue, and homicides

Effect of handgun sales tax in CA



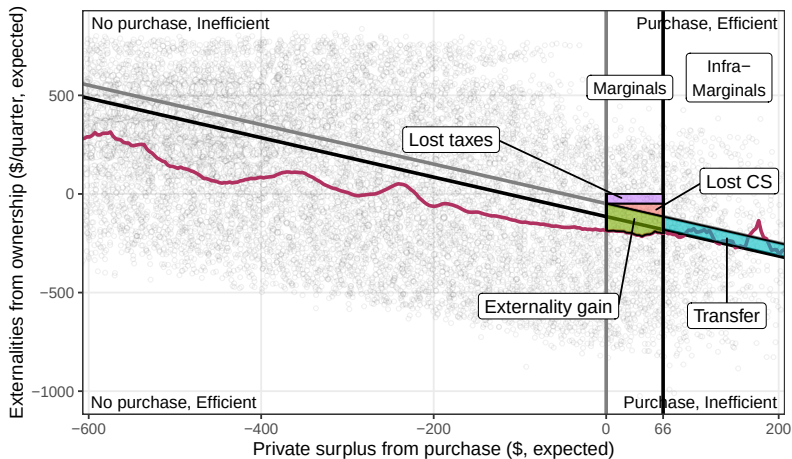
- Use tax to trace out frontier of CS, revenue, and homicides
- Raise tax \$66 → -\$7m CS, +\$1m Revenue, -400 Homicides → Sound policy (CA 2024)

Effect of handgun sales tax in CA



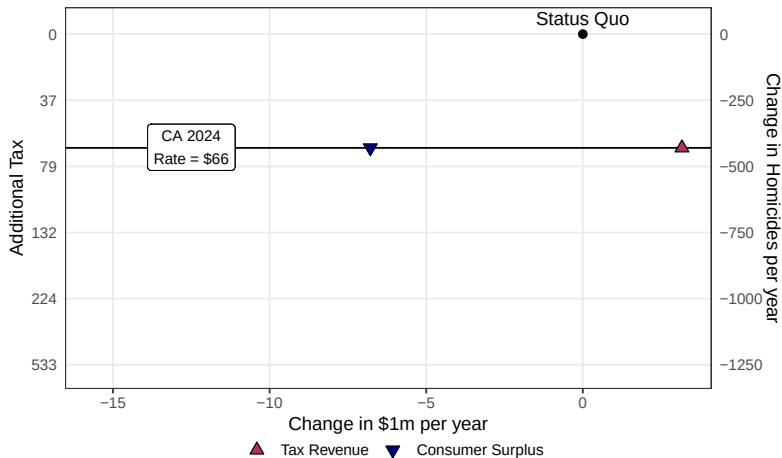
- Counterfactual tax partitions consumers at $WTP = \$66$

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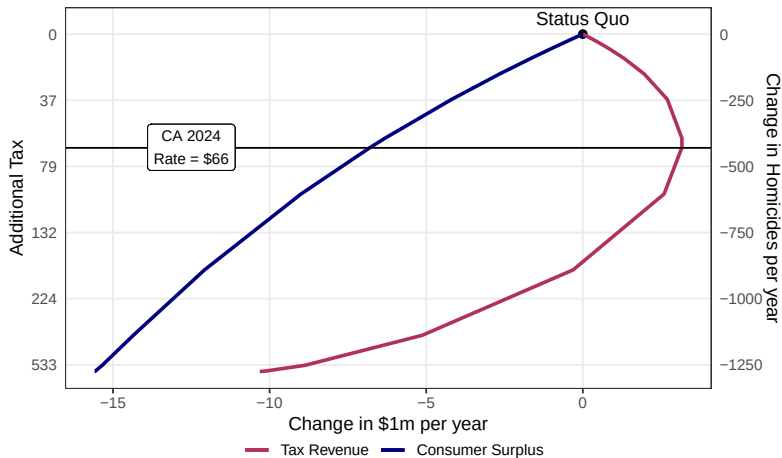
- Counterfactual tax partitions consumers at $WTP = \$66$
- Measure ΔCS , Δ Tax revenue, Δ Homicides in average quarter

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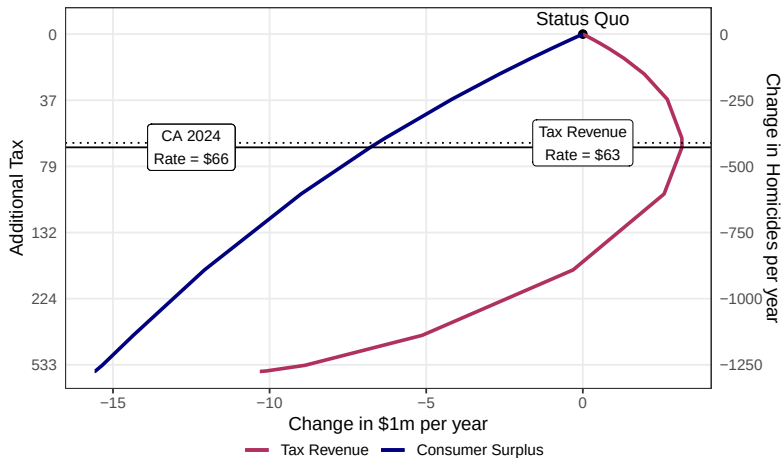
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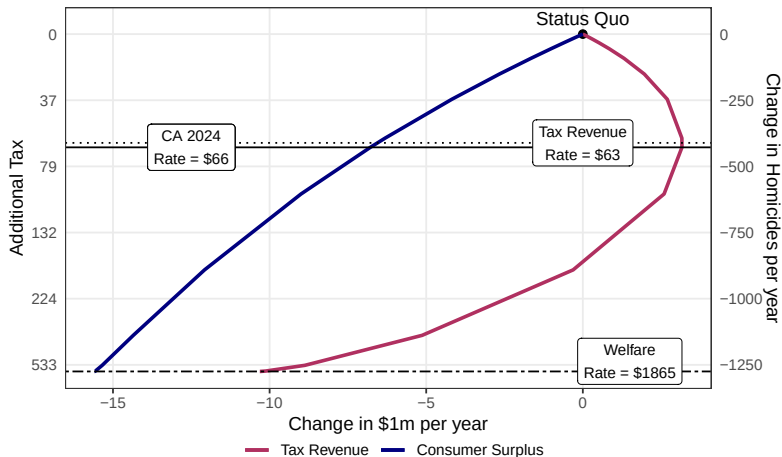
- Use tax to trace out frontier of CS, revenue, and homicides
- Solve at many counterfactual taxes

Effect of handgun sales tax in CA



- CA 2024 rate approximately maximizes tax revenue

Effect of handgun sales tax in CA



- CA 2024 rate approximately maximizes tax revenue
- Directly value CS and homicides → Adverse selection → Shut down market

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
 - Today: CA 2024 tax maximizes revenue. Too low accounting for CS and public health
 - More in paper: local taxes, store bans, min age restrictions, buybacks

Thank you!

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