Estimating Officer Risk Factors for Police Shootings

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Police Use of Lethal Force Sparks Unrest

- 2001 Cincinnati PD shooting of Timothy Thomas resulted in 4 days of riots and $3.6M in damage

- 2006 NYPD shooting of Sean Bell, 50 shots fired. Officers found not guilty at trial, but fired or resigned

- 2014 Ferguson PD shooting of Michael Brown. Numerous questions about what happened

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Outline

- Existing research on police shootings
- Analysis of NYPD police shootings
- Robustness of the findings
- Conclusions

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Researchers Have Tried to Make Sense of Police Shootings

- Sorensen (1993) analyzed Supplemental Homicide Reports 1976-1988 period
  - Most police killings were of "necessity," the officer was attacked or attempting to stop a crime
  - These necessary police shootings made up 65 to 75 percent of all police shooting deaths
  - Most killed were black, but as likely as whites to be killed in nonelective shootings
  - Black police officers killed black felons at a much higher rate than did white police officers

Note: Tennessee v. Garner ruling was in 1985

Police Likely Are Responding to Perceived Danger

- Police shootings are best explained by officers' exposure to dangerous places and persons (MacDonald et al, 1999)
  - Justifiable homicides by citizen's strongly related to police shootings
  - Robbery-related homicides also strongly related
  - Domestic-incident homicides unrelated

Geller & Karales (1981) Dissect Chicago PD Shootings

- Explore offender features
  - 65% because of threat to police
  - 17% flight without resistance
  - 13% accidental
  - No racial difference in rate of shooting per arrest
  - No racial difference in fatality rates

Geller & Karales Also Examine Officer Features

- Black officers more likely to shoot
  - 9.2 black shooting victims per 1,000 black officers
  - 3.8 black shooting victims per 1,000 white officers
  - Black officers produce 45% of off-duty shootings

This research does not address that these officers work in different contexts

McElvain and Kposowa (2008) Compared Shooters to Non-Shooters

- Riverside County Sheriff Department
  - 186 shooting incidents involving 314 deputies
  - Control group consisted of 334 deputies with no involvement in shooting incidents
  - Data for shooters collected at time of shooting, controls collected in 2004
- Shooters were more likely to be male, Hispanic, no college, younger, and in lower ranks
- Unmeasured confounding is a major concern in such a study design

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NYPD Sought a Comprehensive Review of Firearm Practices

- Prompted by controversy surrounding an officer-involved shooting, NYPD Police Commissioner sought a review of:
  - Initial firearms training provided to new recruits
  - In-service firearms training
  - Firearms Discharge Review Board functions and processes
  - The phenomenon of reflexive shooting

"The characteristics of officers involved in discharge incidents will be examined for patterns in training, experience, supervision, and other factors that may help predict, and thus reduce, firearms discharges generally and inappropriate discharges in particular"

Assessing Officer Risk Factors Requires Controlled Comparison

- Officers that discharge their weapons often look different from other officers in obvious ways, such as
  - In the field
  - In particular neighborhoods
  - Conducting higher risk operations
  - Not at a desk
- Idea: Compare shooting officer to other non-shooting officers on the scene
  - Does not judge shooting justification
  - But if there is a consistent pattern it could inform training or assignments

Fyfe (1989) states that "there is virtually no empirical support for assertions that individual officer characteristics are measurably related to any type of performance in office"

Each Shooting Is an Experiment

1. Multiple officers on the scene
2. Each officer has a latent risk of shooting
3. Before the shooting, each officer on the scene could have been the shooter
   - Shooter could run out the back door instead of the front
   - One officer could be the first through the door
   - One pair of officers arrives first
4. Test whether there are officer features that affect the risk of shooting

Utilized Data on a Review of Three Years of OIS Records

- Gathered data on all shooting incidents adjudicated in 2004, 2005, and 2006
- For each shooting I recorded
  - department ID numbers for shooters in the incident
  - department ID numbers for non-shooting officers that were witnesses or in the immediate vicinity of the shooting
- 106 incidents involving 150 shooting officers and 141 non-shooting officers
- Collected data on age, experience, education, training, and past performance

Learn the Factors Affecting the Probability of Shooting

$$\log \frac{P(S=1|\mathbf{x},\mathbf{z})}{1-P(S=1|\mathbf{x},\mathbf{z})} = h(\mathrm{z}) + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_d x_d$$

- S is 1 if the officer shoots
- x are the officer's features
- z are the features of a particular scenario (kinds of suspects involved, location, and lighting)

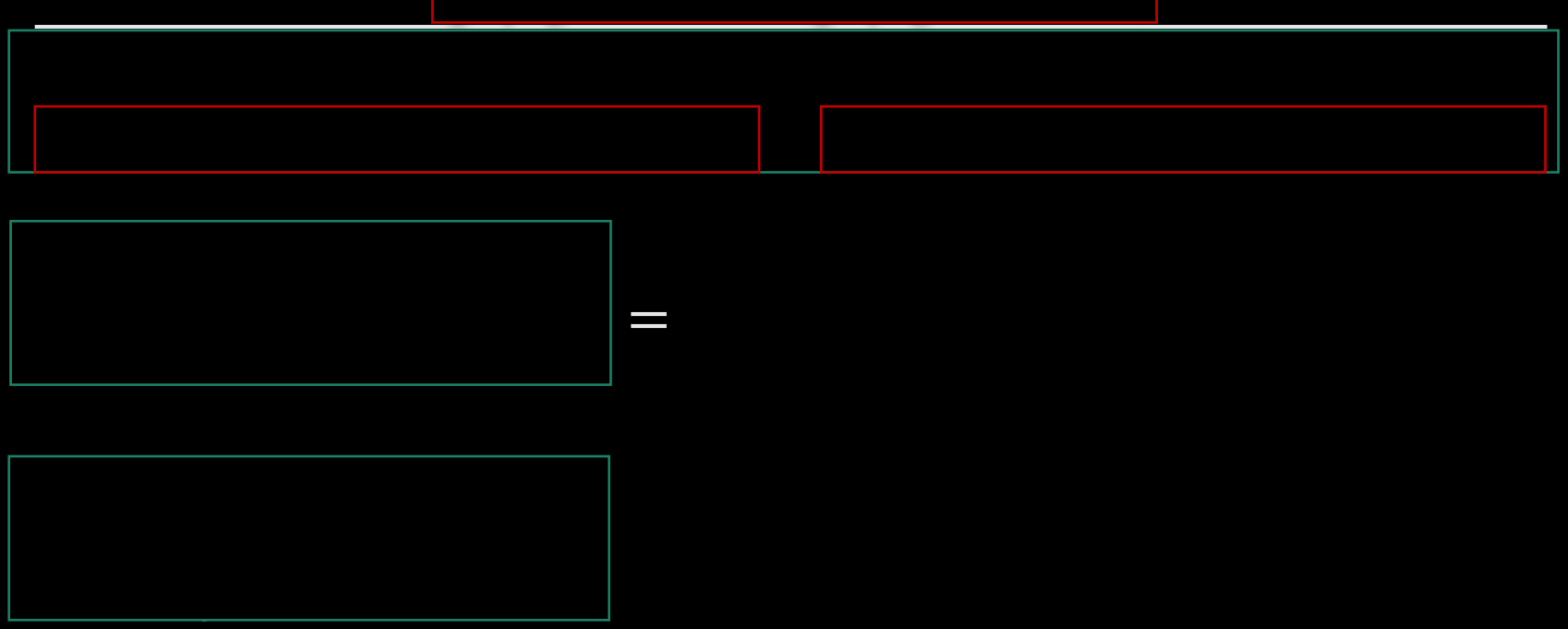
Collected data do not quite match this framework

Consider the Likelihood of a Shooting Involving Two Officers

$$P(S_A = 1, S_B = 0 | S_A + S_B = 1, \mathbf{x}_A, \mathbf{x}_B, \mathbf{z}) =$$

Substituting Simplifies the Model

$P(S_A = 1|\mathbf{x}_A, \mathbf{z})$ $P(S_B = 1|\mathbf{x}_B, \mathbf{z})$



Who Is More Likely to Shoot?

Variable	Risk difference
Rank	
Police officer (reference)	
Detective	
Sergeant	
Lieutenant	
Captain	

- If an OIS occurs and an officer at each of these ranks is on the scene, who is most likely to be the shooter?

Supervisors and Management Ranks Are Less Likely to Shoot

Variable	Risk difference
Rank	
Police officer (reference)	
Detective	No difference
Sergeant	-74%
Lieutenant	-95%
Captain	-96%

Who Is More Likely to Shoot?

Variable	Risk difference
Rank	
Police officer (reference)	
Detective	No difference
Sergeant	-74%
Lieutenant	-95%
Captain	-96%
Male	
Race	
White (reference)	
Black	
Hispanic	

Black Officers More Likely to Shoot

Variable	Risk difference
Rank	
Police officer (reference)	
Detective	No difference
Sergeant	-74%
Lieutenant	-95%
Captain	-96%
Male	No difference
Race	
White (reference)	
Black	+126%
Hispanic	No difference

Each Year Decreases Risk by 11%

Variable	Risk difference
Rank	
Police officer (reference)	
Detective	No difference
Sergeant	-74%
Lieutenant	-95%
Captain	-96%
Male	No difference
Race	
White (reference)	
Black	+126%
Hispanic	No difference
Years at NYPD	No difference
Age	-11%
Education	No difference
Special assignment	No difference

Tracked Annual Activity

Variable	Risk difference
Average annual	
Evaluation score < 3.5	
Range score < 86	
Complaints > 0.6	
Medal count > 3.8	
CPI points > 3.1	
Gun arrests > 2.4	
Felony arrests > 9.3	
Misdemeanor arrests > 10.0	
Days of leave	

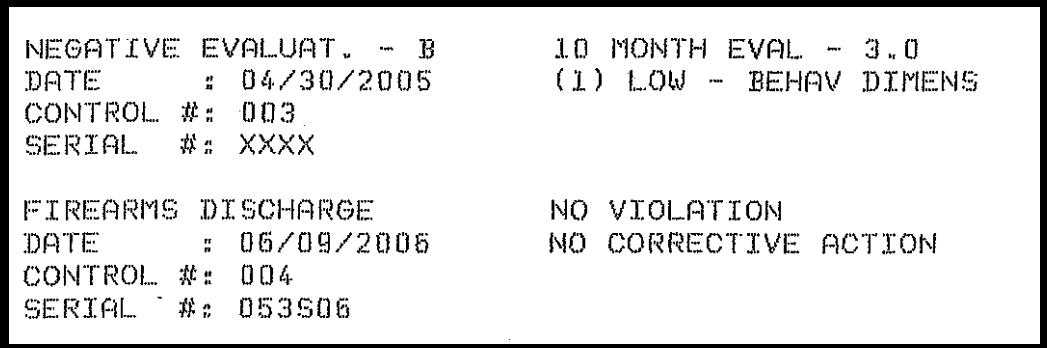
Rapid Accumulation of Negative Marks Signals Elevated Shooting Risk

Variable	Risk difference
Average annual	
Evaluation score < 3.5	
Range score < 86	
Complaints > 0.6	
Medal count > 3.8	
CPI points > 3.1	+212%
Gun arrests > 2.4	
Felony arrests > 9.3	
Misdemeanor arrests > 10.0	-80%
Days of leave	

8% of NYPD officers
15% of shooting scene officers

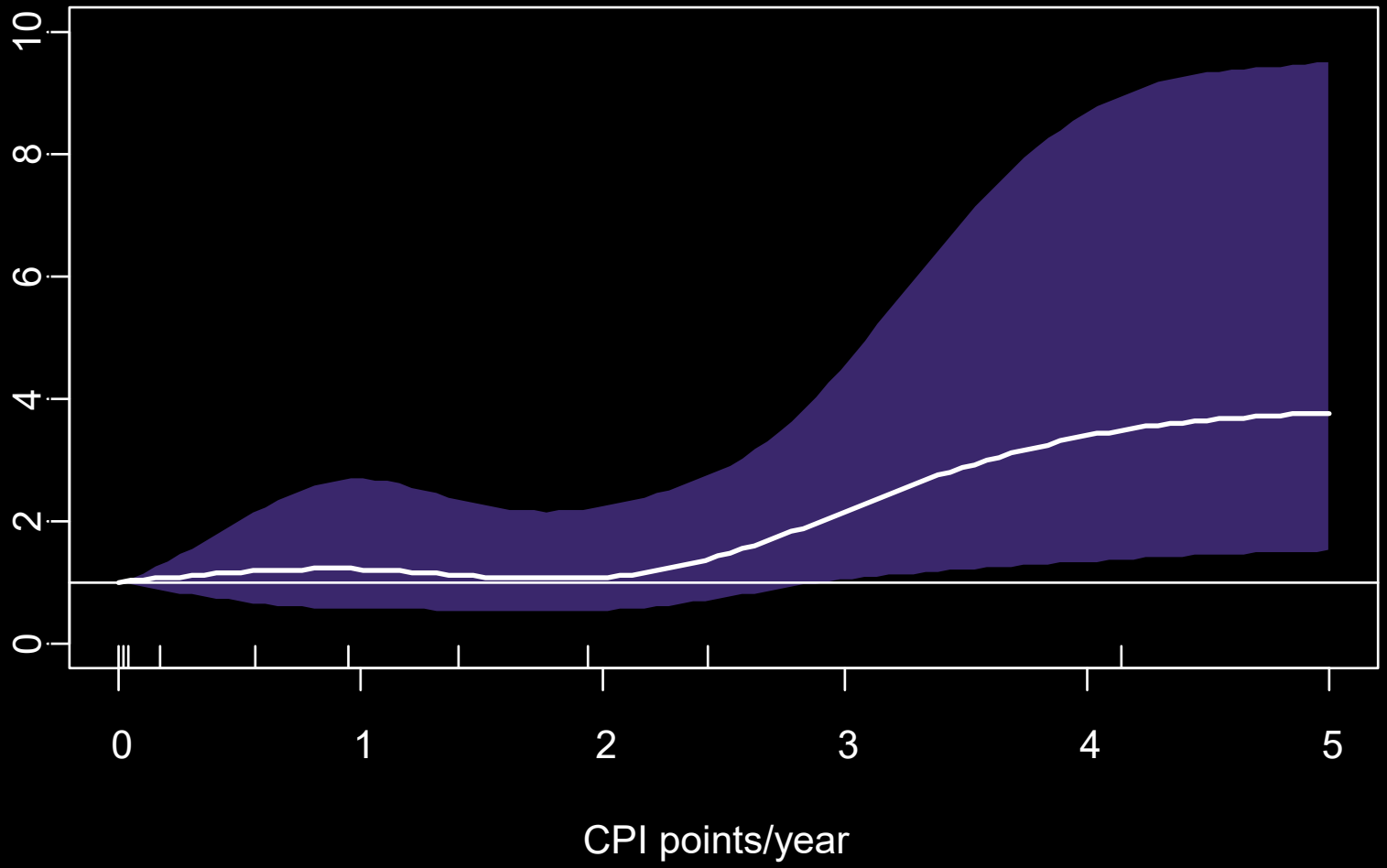
Central Personnel Index Assign Points to Problematic Incidents

Event	Point value
Suspension	8
Loss of firearm	6
Negative evaluation - A	5
Fail to safeguard weapon	5
Chronic sick – B	4
Loss of shield	4
Negative evaluation – B	3
Chronic sick – A	2
Firearm discharge	1
Dept. auto accident	1



Exceeding 3.1 CPI/year Strongly Associated with Shooting Risk

Odds of being a shooting officer relative to officers with zero CPI points



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“Active” Officer May Be Key Factor

Variable	Risk difference
Average annual	
Evaluation score < 3.5	No difference
Range score < 86	No difference
Complaints > 0.6	+107%
Medal count > 3.8	+128%
CPI points > 3.1	+212%
Gun arrests > 2.4	No difference
Felony arrests > 9.3	+115%
Misdemeanor arrests > 10.0	-80%
Days of leave	No difference

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Results Are Insensitive to Independence Assumption

- If a coefficient is 0, even if officers are dependent, test will still be consistent
  - Will still have some officers shoot and some who do not
  - If a coefficient is 0 in truth, then the model will find no differences between the shooters and non-shooters

Results Are Insensitive to Independence Assumption

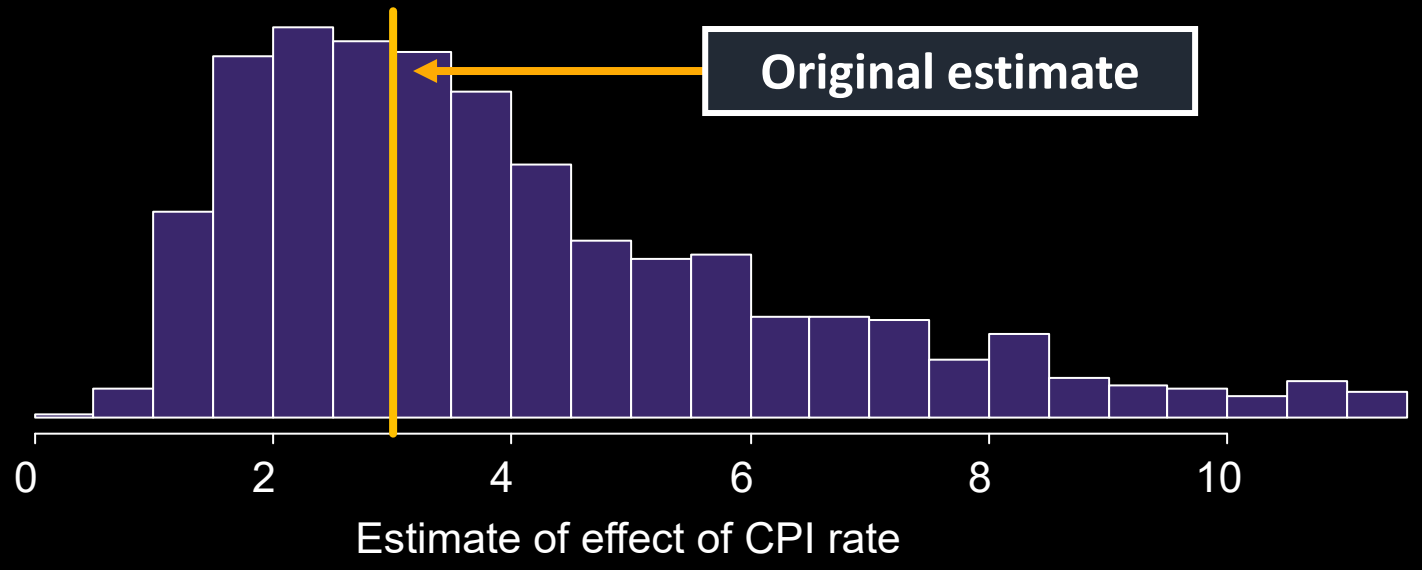
- Dependence parameter, α, is weakly identifiable, dependence term is near 1 for
  - Large values of $|h(\mathbf{z})|$
  - For βs near 0
  - For x_A near x_B

α is a "contagion" parameter

$$\frac{e^{\beta' x_A}}{e^{\beta' x_A} + \frac{1 + e^{\alpha + h(\mathrm{z}) + \beta' x_B}}{1 + e^{h(\mathrm{z}) + \beta' x_B}} \frac{1 + e^{h(\mathrm{z}) + \beta' x_A}}{1 + e^{\alpha + h(\mathrm{z}) + \beta' x_A}} e^{\beta' x_B}}$$

Results Are Insensitive to Independence Assumption

- Simulating dependence leaves results unchanged
  - simulate same distribution of officer features and number of shooters involved in an incident
  - first shot doubles others' risk of shooting



Results Are Insensitive to Missing Data

- 17 percent of the officers involved in shootings during the study were no longer part of the NYPD when I extracted the data
  - 27 shooting officers and 39 non-shooting officers
  - Those who left the NYPD were about 50 percent less likely to have been shooters (95% CI: -82%, 18%)
- Imputed values for all missing covariates using the NYPD officer with complete data with the most similar employee ID number
  - I manipulated the values of the CPI rate among those officers who had left the NYPD to vary the correlation between shooting and CPI rate
  - Correlation at 0.16, as in the complete data, then findings unchanged
  - Reductions in the correlation have minimal impact on the lower bound of the 95% confidence interval

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Conclusions

- Case-control model for use-of-force incidents can tease out factors contributing to risk
  - NYPD analysis suggests personnel file has signals
- Effect of contagious shooting is not likely to change findings
- More powerful analyses would be possible with a larger class of use-of-force incidents

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CPI Rate Predicts Shooter Status

- Use leave-one-shooting-out cross-validation to assess prediction of shooting status for each officer
  - Guessing correctly classifies 55% of officers
  - Model correctly classifies 57% of officers
- Focusing exclusively on shootings involving officers with high CPI rates
  - Guessing correctly classifies 56% of officers
  - Model correctly classifies 65% of officers