Speed, Surveillance, and Safety:
an Econometric Analysis of Traffic Fatality Reduction in New York

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Background

Traffic accidents are the eighth most common cause of death worldwide, and the leading cause of death in Americans under 30

The probability of an accident resulting in death increases exponentially with speed

Speed camera programs have been staples of other nations for years

- Wilson, Willis, Hendrikz, Le Brocque, & Bellamy (2010) conducted a meta-analysis on the efficacy of speed control cameras, concluding they did lower driver speeds
- Li, Zhu, Graham, & Zhang (2020) showed, within England, the presence of speed cameras reduced the number of accidents

Automated speed camera programs have struggled to gain traction in America, with the general public or mainstream politicians

The New York boroughs rolled out the program in 2014 in high risk areas, such as in school zones and highly traffic areas, and continued to expand the program.

Deterrence theory dictates that introducing automated speed enforcement systems should reduce speeding by increasing the perceived likelihood of punishment.

- However this is predicated on rational choice theory, and speeding may be considered an irrational decision to begin with

Data

The primary data needed to conduct this analysis was the number of fatalities in each U.S. county by year.

- The fatality rate of car crashes was initially considered to be the variable of study, however the number of fatalities was chosen to more consistent and comprehensive reporting across U.S. counties

The report of individual fatal car crashes was sourced from the United States Department of Transportation, spanning from 2009 to 2019.

- This contained additional information about the circumstances surrounding the crash

Two supplemental data sets were used

- The official set of geographical locator codes, from the U.S. General Service Administration to identify states and counties.

The largest U.S. counties according to the U.S. census, web scraped from Wikipedia, and validated through the official census results

- The U.S government does not approve of web scraping census data
- This was used to select the set counties similar in population to the boroughs

Did the introduction of speed cameras into the boroughs of New York Reduce the Number of Traffic Fatalities?

Model

$$Fatalities_{it} = \beta_1 * Treated_i + \sum \beta_t * Year_t + \sum \delta_n * (Year_t * Treated_i) + County\ Fixed\ Effects_i$$

$Fatalities_{it}$	$Treated_i$	$Year_t$	$Year_t * Treated_i$	$County\ Fixed\ Effects_i$
The number of fatalities in county i and year t	An indicator variable for the treated boroughs	An indicator variable for each year 2009-2019	Event time variable created though the interaction of indicator variables	adjustments for unique characteristics of each county

Methodology

Model Choice

- An event study model was well suited for the research question
  - The model highlights the effects for each year after the programs introduction
  - The model explicitly highlights the difference between the boroughs and the control counties
  - There is a large amount of data to support the relatively complex model.

Model Structure

- There are no explicit control variables outside the fixed effects
  - Control variables such as vehicle type, weather, and accident were considered, but were heavily correlated with the county
- Year fixed effects were explicitly defined to provide more context for the δ coefficients.

Control Group

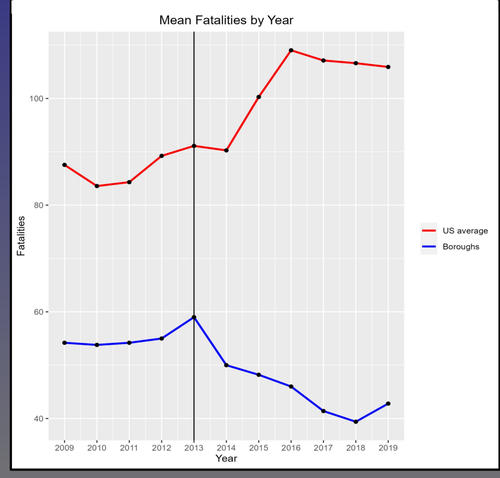
- The control group was defined the 100 largest U.S. counties, less the boroughs and Los Angeles
  - Staten Island is not one of the largest counties, however it is as densely populated as the other boroughs so it was not excluded
  - Los Angeles was excluded from the control group as it was an extremely high outlier that dictated the trend of the entire control group.

The model was calculated using the R command: feols(finalData, fatalities~treated + YEAR_2009 + YEAR_2010 + YEAR_2011 + YEAR_2012 + YEAR_2014 + YEAR_2015 + YEAR_2016 + YEAR_2017 +YEAR_2018 + YEAR_2019 + YEAR_2009*treated + YEAR_2010*treated + YEAR_2011*treated + YEAR_2012*treated + YEAR_2014*treated + YEAR_2015*treated + YEAR_2016*treated + YEAR_2017*treated + YEAR_2018*treated + YEAR_2019*treated | COUNTY)

Regression Results

YEAR_2009	-3.559*	YEAR_2009 × treated	-1.241
	(1.842)		(4.491)
YEAR_2010	-7.527***	YEAR_2010 × treated	2.327
	(1.824)		(6.235)
YEAR_2011	-6.796***	YEAR_2011 × treated	1.996
	(1.835)		(6.821)
YEAR_2012	-1.871	YEAR_2012 × treated	-2.129
	(1.427)		(4.011)
YEAR_2014	-0.839	YEAR_2014 × treated	-8.161***
	(1.518)		(2.847)
YEAR_2015	9.172***	YEAR_2015 × treated	-19.972***
	(1.956)		(5.893)
YEAR_2016	17.925***	YEAR_2016 × treated	-30.925***
	(2.159)		(8.905)
YEAR_2017	16.011***	YEAR_2017 × treated	-33.611***
	(2.350)		(7.092)
YEAR_2018	15.505***	YEAR_2018 × treated	-35.105***
	(2.246)		(4.698)
YEAR_2019	14.796***	YEAR_2019 × treated	-30.996***
	(2.296)		(4.883)
treated	-0.608		
	(21.598)	Signif. codes: *** 0.01 ** 0.05 * 0.1	

Validation of Parallel Trends Assumption



Results

The Regression table shows there was a significant reduction in the number of traffic fatalities in the boroughs after the introduction of speed cameras

The magnitude of the of the decrease in fatalities continued to grow in the years after program's rollout

In 2014 the expected number of traffic fatalities was lower than that of the control counties by 8.161 after controlling for the underlying differences in the counties

The difference is at its greatest in 2018 where the boroughs averaged 35.105 less traffic fatalities than the control counties.

The plot of average fatalities by year shows the approximately parallel trend required for the results of the event study model to be valid.

Biases

The primary source of bias that could affect the papers results are contemporaneous effects

- New York pushed road safety education programs around the same time as speed cameras launched.
- The control group was too large to examine all policy decisions made over the ten year period

Drivers may have avoided driving through the boroughs after the program launched, causing fatalities to occur in surrounding counties

There could have been omitted control variables that may have impacted the estimated number of fatalities

- A general preference shift to safer or more unsafe vehicles
- A shift in economic conditions in a region could increase or decrease the amount people drive
- A shift in demographics, a large number of teenage drivers could cause more accidents

Conclusions

The decrease in traffic fatalities attributed to New York's automated speed camera network presents a compelling case for other cities to evaluate speed cameras as an effective traffic safety measure

Crash Statistics by Year

YEAR	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mean	85.84	82.06	82.77	87.49	89.46	88.21	97.62	105.81	103.76	103.18	102.68
Standard Deviation	64.25	61.39	62.59	65.45	69.73	73.57	77.51	86.17	86.79	85.33	83.70