The Ban on Handheld Device on Traffic Fatalities

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Abstract

Handheld device use while driving has been studied to be one of the highest related causes of traffic incidents within the U.S. This poster presents an empirical analysis of the ban on handheld device policy towards the different types of traffic fatalities across the 50 states and the District of Columbia. Aside from the policy reform's effect, this study's objective is to analyze the effect of other contributing factors that drive traffic fatalities, such as the state's speed limit and fuel tax. Speed limit and fuel tax are included in this analysis model because it is hypothesized that a higher speed limit will incur higher rates of traffic fatalities. In contrast, higher fuel tax rates will produce lower commuters on the road, which correlates to lower traffic fatalities. Moreover, a decomposition of the types of road environment: rural and urban, will show if the effect of the policy is more effective in reducing traffic fatalities towards one or the other types of road environments.

Traffic Fatality Data Preview

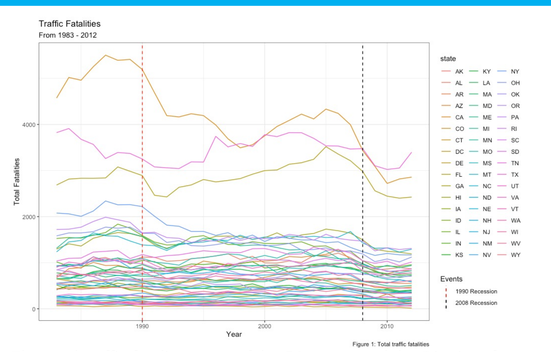


Figure 1: Total traffic fatalities

The total traffic fatality count of the 50 states and the District of Columbia have different levels of seasonality and time trend. California, Texas, and Florida are the three top states which produce the most amount of total traffic fatality across the 30-year timeframe.

Methodology

Two-Way Fixed Effect Regression:

- Two-way fixed effect regression controls for the state-level variables, which are constant across the timeframe and the time trend of the traffic fatalities—by controlling for the state-level variables, we can analyze the within-level trends on the effects of the policy reform.
- The model will use control variables such as average age, total population, per capita income, and a dummy variable on a higher speed limit level.

Sun and Abraham (SA) difference-in-difference:

- Using Sun and Abraham's (SA) difference-in-difference analysis to decompose the effect of the policy reform on traffic fatalities over time.
- This analysis is performed by regression on the relative time the policy reform is initially instilled and using the same control variables per the Two-way fixed effect model.

The fixed effect regressions will provide information on the effects of the policy between pre- and post-policy reform, whereas the SA Difference-in-Difference will visualize the effects of policy reforms on the relative time of the first policy enacted.

Effect of Policy | Pre- and Post-

Table 0.1: Effects of Handheld Device Ban

Dependent Variables:	Total Fatalities	Occupant Fatalities	Nonoccupant Fatalities
Model:	(1)	(2)	(3)
Variables			
Handheld Device Ban	-155.6**	-129.0**	-26.53
	(73.87)	(60.07)	(17.76)
Total Population	-6.42×10^{-5}	-4.88×10^{-5}	-1.53×10^{-5}***
	(4.42×10^{-5})	(4.11×10^{-5})	(3.21×10^{-6})
Average Age	-9.049	-13.18	4.129
	(22.98)	(19.80)	(3.961)
Per-Capita Personal Income	0.0048	0.0043	0.0005
	(0.0039)	(0.0032)	(0.0008)
70MPH or Greater Speed Limit	100.6***	82.54***	18.08**
	(32.29)	(25.60)	(8.242)
Fuel Tax, Cents per Gallon	-13.86**	-12.45**	-1.408
	(5.972)	(5.302)	(0.9453)
Fixed-effects			
State	Yes	Yes	Yes
Year	Yes	Yes	Yes
Fit statistics			
Observations	1,530	1,530	1,530
R^2	0.97801	0.97358	0.98108
Within R^2	0.23876	0.20842	0.26281

Clustered (State) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

The ban on handheld devices has a negative relationship with the three types of traffic fatalities compared to states without a ban on handheld devices. The policy reform has the highest effect on total fatalities compared to occupant and nonoccupant fatalities. Though states with the policy reforms reduce total fatalities and occupant fatalities by approximately 155.6 and 129 fatalities, respectively, other supplementary inferences increase or decrease traffic fatalities.

Other Highlights of Table-0.1:

- States with a speed limit of 70MPH or more have, on average higher traffic fatalities than states with lower speed limits.
- A one-unit increase in fuel tax has, on average, produced lower traffic fatalities rates compared to states with a lower speed limit.
- This realization reinforces the hypothesis on the effect of the higher-level speed limit and fuel tax as per the 'abstract' section.

Table 0.2: Effects of Handheld Device Ban on Types of roads with CV

Dependent Variables:	Total Fatalities	Occupant Fatalities	Nonoccupant Fatalities
Model:	(1)	(2)	(3)
Variables			
Handheld Device Ban	-110.1	-82.45	-27.61
	(73.10)	(56.32)	(17.90)
Total length of rural roads (miles)	-0.0012	-0.0007	-0.0005*
	(0.0010)	(0.0008)	(0.0003)
Density of cars in rural roads (VMT / Total Length)	369.1	287.3	81.85**
	(243.2)	(210.4)	(38.59)
Total length of urban roads (miles)	0.0141*	0.0120	0.0020
	(0.0082)	(0.0075)	(0.0013)
Density of cars in urban roads (VMT / Total Length)	126.6	98.58	27.98**
	(90.59)	(82.15)	(12.24)
Total length of rural roads (miles) × Density of cars in rural roads (VMT / Total Length)	0.0152**	0.0163***	-0.0012
	(0.0063)	(0.0057)	(0.0008)
Total length of urban roads (miles) × Density of cars in urban roads (VMT / Total Length)	-0.0092*	-0.0061	-0.0031***
	(0.0054)	(0.0046)	(0.0011)
Fixed-effects			
State	Yes	Yes	Yes
Year	Yes	Yes	Yes
Fit statistics			
Observations	1,500	1,500	1,500
R^2	0.98037	0.97673	0.98400
Within R^2	0.32921	0.31317	0.37777

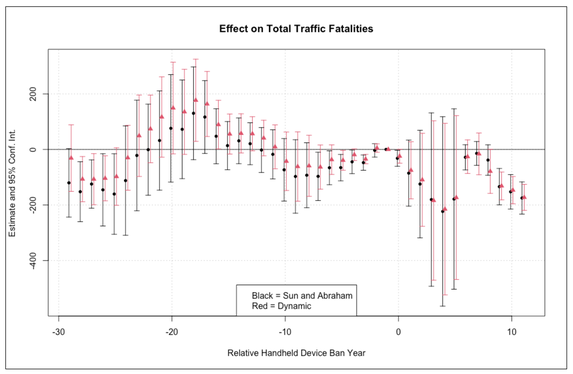
Clustered (State) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

When regressing the different types of the road environment on top of the control variable, as in table-0.1, the statistical significance of the relationship of the policy reform on traffic fatalities becomes inconsequential—the interaction between the length and density of the types of road environment becomes significant. Howbeit, the different types of road environments appear to have a relatively more minor effect on traffic fatalities. Therefore, it might be concluded that there are no discrepancies in traffic fatalities between the types of road environments.

Other Highlights of Table-0.2:

- A one VMT/ Length unit increase in the density of both types of road environment has, on average, increased nonoccupant fatalities.

Effect of Policy | Relative to the Years



OLS estimation, Dep. Var.: Total Fatalities
Observations: 1,530
Fixed-effects: state: 51, year: 30
Standard-errors: Clustered (State)

	Estimate	Std. Error	t value	Pr(>|t|)
cohort::2001	-45.53333	14.49385	-3.141563	2.8224e-03 **
cohort::2004	36.50556	24.91281	1.465333	1.4909e-01
cohort::2005	86.62187	16.53951	5.237271	3.2597e-06 ***
cohort::2007	-482.75833	371.39975	-1.299835	1.9962e-01
cohort::2009	3.22500	18.15638	0.177624	8.5974e-01
cohort::2010	-20.86667	18.28231	-1.141359	2.5916e-01
cohort::2011	-3.75000	7.55229	-0.496538	6.2169e-01
cohort::2012	-24.90000	10.27755	-2.422756	1.9068e-02 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 110.6 Adj. R2: 0.977752
Within R2: 0.386569

The effect of the policy reform appears to decrease total traffic fatalities on average in the subsequent years after the policy was first enacted—the more robust SA model indicates that the effect is more negative in all leads and lag compared to the dynamic model. However, from the table above, the average negative effect within the first five years does not appear to have a relatively accurate estimate. Therefore, it is difficult to suggest that the policy continuously negatively affects total traffic fatality in the early years after implementation.

Robustness Check Analysis

Leads and Lags

Dependent Var.:	Total Fatalities
tau = -10	-21.04 (91.05)
tau = -9	-35.62 (95.50)
tau = -8	-32.79 (88.43)
tau = -7	-40.99 (66.60)
tau = -6	-23.27 (48.36)
tau = -5	-22.98 (36.77)
tau = -4	-3.963 (31.41)
tau = -3	-31.22 (24.55)
tau = -2	6.224 (16.78)
tau = 0	-24.61 (21.46)
tau = 1	-91.28 (65.81)
tau = 2	-135.9 (99.42)
tau = 3	-201.7 (123.8)
tau = 4	-252.1* (117.2)
tau = 5	-206.1. (116.5)
tau = 6	-190.3* (92.06)
tau = 7	-188.3. (101.4)
tau = 8	-248.0* (105.6)
tau = 9	-405.8*** (43.54)
tau = 10	-423.7*** (45.65)
tau = 11	-443.2*** (49.38)
Fixed-Effects:	----------
state	Yes
year	Yes
S.E.: Clustered	by: State
Observations	1,530
R2	0.97941
Within R2	0.28740

The leads and lag of the SA difference-in-difference demonstrate that the model produces little statistical power for the first few leads period after the policy is reformed. The furthest last three lead periods are the only statistically significant up to 99% confidence interval for estimating the effects of the policy reform.

- The dynamic model exhibits similar results, albeit on a lesser negative relationship.
- Due to the lack of statistical strength in the first few lead periods, it is ambiguous to acknowledge that the policy reform's effect continuously produced a negative relationship.

Conclusion

- Similar forms of the model that include the number of the labor force, employment, and unemployment rates of different states could pose a more accurate estimation of the effects of the policy reforms compared to the model of this study. However, the variables have far fewer observations within the given dataset, which would reduce the statistical power of the analysis more.
- Unless more data points of the census are observed in future data frames, including the variables would decrease the statistical power of the analysis.
- Nonetheless, although the result of this study is entangled with omitted variable bias, which might not represent accurate estimates of the effects of the policy reform, in general terms, the ban on handheld devices on drivers poses a negative relationship towards total traffic fatalities—the effect of the ban on handheld device relative to the policy reform year is ambiguous.