Regulation, Information, and Crime

Ye Hong and Lia Yin*

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Abstract

When a law is passed in a state, the information does not immediately disseminate to the entire population of the state. This paper uses Google Trends data to compile a measure for public awareness of the Stand-your-ground law over the years 2005 - 2014, and examines its impact over time on crime rate in the state of Michigan. Crime data are obtained from the National Incident-Based Reporting System, and aggregated by the week to match with the frequency of the awareness data. Regression kink results show that there is more impact on less serious crimes such as larceny, but less impact on more serious crimes such as homicide.

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*Hong: University of North Carolina at Greensboro (email: y_hong@uncg.edu); Yin: Boston College (email: yinlb@bc.edu).

1 Introduction

The "Stand Your Ground" (SYG) law is a law allowing individuals to defend themselves when they think they face danger of great bodily harm or death in public. It was first passed in Florida in 2005, and now versions of it have been passed in 30 states. More states have had proposals of it in the legislation, even though they have not passed. Despite its popularity, studies have consistently found it to not decrease violent crime, but increase certain types of crime. These studies include those that are on the national level (Cheng and Hoekstra, 2013; McClellan and Tekin, 2017; Gius, 2016; Guettabi and Munasib, 2018; Hong and Nielson, forthcoming), those that are on the state level (Chamlin and Krajewski, 2016; Chamlin, 2014; Humphreys, Gasparrini and Wiebe, 2017), and those that are at the city level (Ren, Zhang and Zhao, 2015). However, none of the papers looked at the effect of the law on crime on the aggregate, and none of them study the state of Michigan.

This study looks at the aggregate crime incidents in the state of Michigan, and found that there is a considerate drop in crime around the time when the law was passed (Oct 2006). The results might be different than the rest of the studies, but we believe they are consistent. When the law passes, some criminals are deterred, while others are provoked. Among crimes, non-violent crimes are deterred more, whereas violent crimes are provoked more. To add to the effects, some non-violent crimes can convert to violent crimes if offenders are provoked, causing us to observe a significant increase in certain types of violent crimes.

Therefore, although total number of cases drops, the conversion from nonviolent to violent crimes is a cause of great concern. It might hurt the welfare of the general public, burden the criminal justice system, and overcrowd the prison system.

2 Background on Stand-Your-Ground Law in the U.S.

3 Studies on the SYG Law at the State Level

Many papers have been written on the effect of the SYG law on crimes in individual states. Effects can be regional, they can convert from one category to another, and vary from state to state.

Ren, Zhang and Zhao (2015) has found that after the SYG law passed, a highly-publicized shooting incidence in Houston has reduced both residential and business burglaries in Houston, but not in Dallas. Chamlin and Krajewski (2016) found the same effect for residential areas in the state of Oklahoma, not businesses. They attributed it to the limited version of the law in Oklahoma that only covers residential areas, but not businesses. Further, Chamlin (2014) found an increase in

robberies and suicides in the state of Arizona. However, Humphreys, Gasparrini and Wiebe (2017) did not find the same level of significant effect on suicide in Florida. They did find an increase in homicide and homicide by firearms.

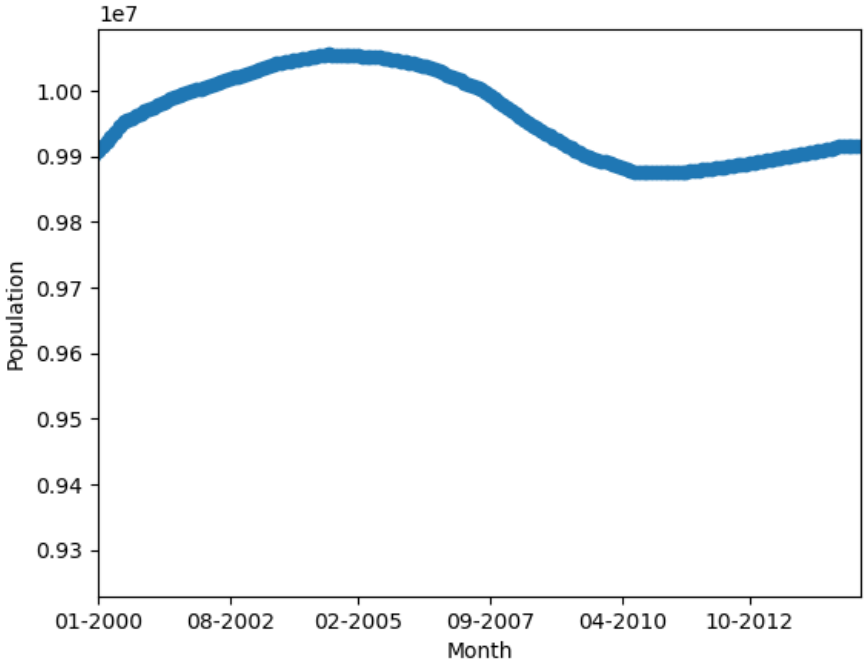
4 Data

4.1 Population Data

In order to find out the effect of the law on crime, we used several different dependent variables. They include crime incidences, log crime incidences, crime incidences per 100,000 population, and log crime incidences per 100,000 population. Population data comes from the Census Bureau at the county level (Census Bureau, 2000-2010, 2010-2017) , and they are extrapolated to monthly frequency based on annual data.

As opposed to common belief, the population of Michigan did not steadily increase over the years. Between Jan 2000 and Dec 2014, it grew to a high point of 10.1 million by Jul 2004 (101.5% of Jan 2000 level), but started dropping after that. By Jul 2011, the population of Michigan has dropped to 9.88 million (99.1% of Jan 2000 level). However, it has climbed back up to its January 2000 level by the end of 2014. See Figure 1 and Table 1 for more details.

Figure 1: Population in Michigan (2000-2014)



In Jan 2000, the population was around 9.91 million. It grew to more than 10 million in July 2004, which was 101% of that in Jan 2000, but subsequently dropped to around 9.88 million by July 2011 (99.7% of Jan 2000 level), and has been steadily climbing back up since then.

Table 1: Summary Statistics of Michigan Population (2000-2014)

Month	Population	Percent of Jan 2000 Population
Jan 2000	9,908,113	100%
Jul 2004	10,055,315	101.5%
Jul 2011	9,876,199	99.7%
Dec 2014	9,916,131	100%

Population in Michigan is rather consistent over the years 2000-2014. It grew by 1.5% to reach over 10 million by July 2004, but subsequently fell to 99.7% of January 2000 level by July 2011. By December 2014, it has climbed back up to its January 2000 level.

4.2 Crime Data

Crime data come from the National Incident Based Reporting System (NIBRS) (Federal Bureau of Investigation, n.d.*a*). Unlike the more popular dataset of the FBI's Uniform Crime Report

(UCR), which is available annually, the NIBRS is available by the crime. It has the date on which each of the crime has happened.

Data is available by the year. We download each year's data and keep them for the state of Michigan. Compared to the UCR, the shortcoming of this dataset is that, since it is a newer project and it is voluntary, data consistency is not very good. However, for the state of Michigan, and for the time period that we care about (2000 - 2014), the number of reporting agencies that report to the NIBRS is rather consistent.

In total, there are 877 reporting agencies in Michigan. They are represented by their Originating Agency Identifiers (ORI) (NACJD, n.d.*b*). Shown in Table 2, 632 of them start reporting before 2000 (Federal Bureau of Investigation, n.d.*b*).

Table 2: Number of Agencies Reporting to the NIBRS

Year	No. of Reporting Agencies	% Popl Covered
2000	632	77%
2005	667	97%
2010	683	97%
2015	711	98%
2019	719	98%

Out of 877 reporting agencies in Michigan, 632 are submitting to the NIBRS by 1-1-2000, covering 77% of the 2000 population. Only 35 more are submitting by 1-1-2005, but the percentage of the 2005 population covered has risen to 97%, because the Detroit Police Department started reporting on 1-1-2005.

Since we would like to see changes between Jan 2000 and Oct 2006 (the month when the law was passed), we include all reporting agencies that have started reporting by 1-1-2000. We may examine Detroit data more closely in a separate analysis.

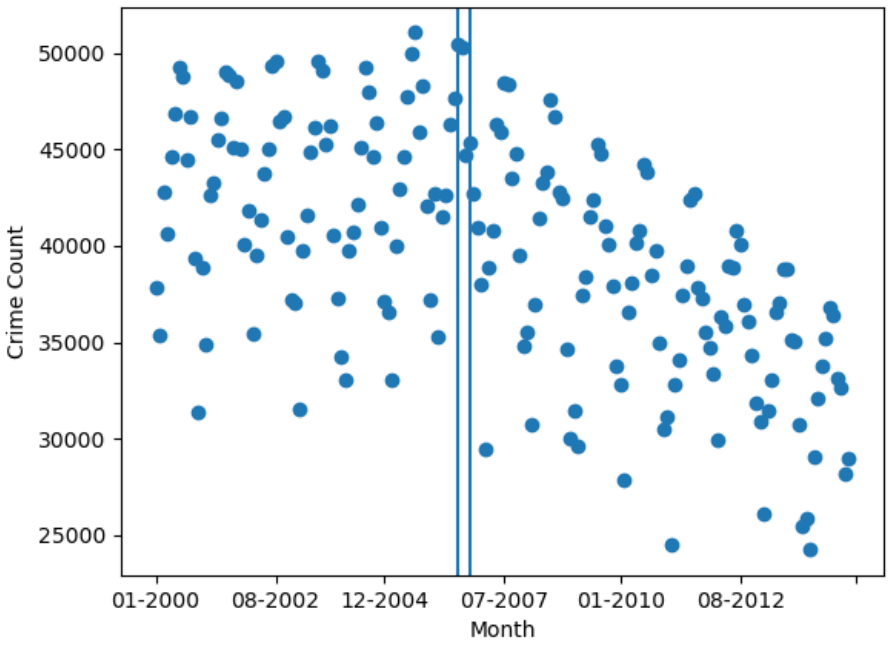
Also, there are three agencies that each had a dormant year (see Figure 3). Of the three, Pontiac Police Department's jurisdiction has the highest population of 66,337 in 2011, which makes up .6% of the total population of Michigan. Even after summing the population of these agencies, they make up a small percentage of the Michigan population. Data from these agencies have been dropped.

Table 3: Agencies with Dormant Years

Agency Name	Dormant Year	Population	Percent of State Population
Clarkston Police Department	2010	962	.009%
Pontiac Police Department	2011	66337	.6%
Oakley Police Department	2007	2344	.02%

Three reporting agencies in Michigan have gaps in reporting. Clarkston Police Department's jurisdiction makes up .009% of the population of Michigan in 2010, Pontiac Police Department's jurisdiction makes up .6% of the population of Michigan in 2011, and Oakley Police Department's jurisdiction makes up .02% of the population of Michigan in 2007. Data from these three reporting agencies are dropped from the analysis.

Figure 2: Number of Crime Incidences in Parts of Michigan

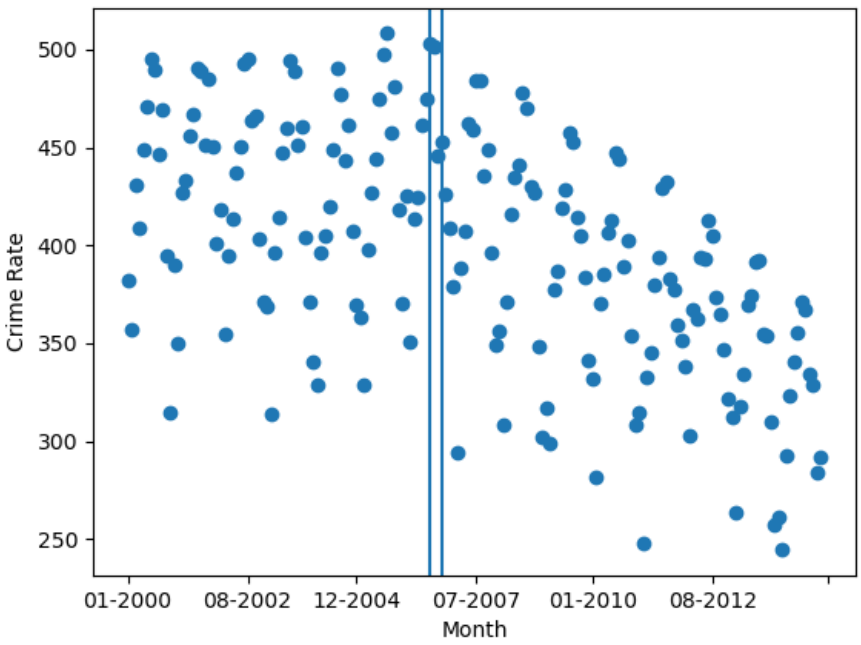


We can see clear seasonality in the data. There are more crime incidences each summer than the same year in the winter. During the years 2000 to 2014, the highest number of crimes is 51,070 in August 2005, and the lowest is 24,221 in February 2014. There is a visible slope change for crime incidences in the state of Michigan, in the jurisdictions of the 632 reporting agencies that are covered in our data. Vertical lines denote July 2006, when the SYG law was passed in the state of Michigan, and October 2006, when the law was enacted.

The next step is to aggregate the data into monthly frequency, which is described in Figure 2. The data displays strong seasonality, and they are quite stable until around 2006, when they start to trend down. Vertical lines are July 2006, when the SYG law was passed in the state, and October 2006, when the law was enacted (H.B.5153, 93rd Legislature; H.B.5153 Enrolled Analysis, 2006).

In addition to examining the crime count data, due to fluctuations in the state population over the years, we also examined the crime rate data after dividing monthly crime count data by monthly population data. Figure 3 illustrates that the highest crime rate between the years 2000 and 2014 happened in August 2005 (508 incidents per 100,000 population), and the lowest crime rate happened in February 2014 (244 incidents per 100,000 population). Vertical lines denote July 2006 and October 2006, months when the SYG law was passed in Michigan and when it was enacted, respectively.

Figure 3: Crime Rate for Part of Michigan (2000-2014)



The change for the crime rate over the years is quite similar to the pattern for the crime count due to low fluctuations of the Michigan population between the years 2000 and 2014. The highest crime rate was 508 per 100,000 population in August 2005, and the lowest was 244 per 100,000 population in February 2014. The two vertical lines are for July 2006, when the SYG law was passed in Michigan, and October 2006, when the law was enacted. An interactive version of this figure can be found here.

According to Figure 4, examining year-on-year data by the month, we can see that crime rate increased a bit in fall 2001, fell back down in 2002 - 2004, and increased again in summer 2005. They started a long downward trend from summer 2006 to winter 2014, with a brief rebound in winter 2011 that did not disturb the long-term trend overall.

Figure 4: Year-on-Year Changes in Crime Rate for Parts of Michigan (2000-2014)

Crime rate in Michigan started increasing in the fall of 2001, and started decreasing in the spring of 2002. A new wave of increases started in summer 2005, and decreases started in summer 2006. There was a rebound around winter 2011, but overall, crimes trend down ever since the peak. An interactive version of the figure can be found here.

Finally, we would like to plot changes at the ORI level. However, location data is only available at the Census of State and Local Law Enforcement Agencies (CSLLEA) level (Bureau of Justice Statistics, n.d.). In January 2000, 551 reporting agencies reported crimes to the NIBRS, 451 of which are in the CSLLEA. This is because there could be multiple additional ORIs under a specific CSLLEA, but their locations are not captured in the CSLLEA. For example, MICHIGAN STATE POLICE would have one CSLLEA number, which corresponds to an ORI number, but every state police post will have their own separate ORI code (NACJD, n.d.*a*). These 441 ORIs reported 33,386 crimes in January 2000 out of 37,876 total reported crimes in the data, which makes up 88.15% of the total.

4.3

5 Preliminary Data Analysis

From Figures 2, 3, and 4, we can see that the decrease in crime rate corresponds to the passing and enactment of the SYG law in Michigan. Data visibly shows a trend change around summer and fall 2006. Therefore, we conduct a Chow test to check if there is structural break in October 2006 (Chow, 1960; Luitel and Mahar, 2015). The independent variable is the crime rate, and the dependent variable is months. The specification is as follows:

$$Y_t = \beta_0 + \beta_1 X_t + u_{1t} \tag{1}$$

where Y_t represents crime rate, X_t is the time variable that varies from January 2000 to December 2014, and u_{1t} is the error term.

Our hypothesis is that the regression coefficient β_0 and β_1 will change over the time period. In order to address this question, we divided the data into two time periods, January 2000-September 2006 and October 2006-December 2014. The two specifications for the two time periods are as follows:

$$\textbf{January 2000-September 2006: } Y_t = \alpha_0 + \alpha_1 X_t + u_{2t} \tag{2}$$

$$\textbf{October 2006-December 2014: } Y_t = \delta_0 + \delta_1 X_t + u_{3t} \tag{3}$$

where u_{2t} and u_{3t} are assumed iid.

If the trend for crime rate is the same before and after the SYG law was passed, then we would expect $\beta_0 = \alpha_0 = \delta_0$ and $\beta_1 = \alpha_1 = \delta_1$. In other words, the intercept coefficients and the slope coefficients are not statistically different from each other. To evaluate whether we could reject the hypothesis above, we estimated all three of the regressions above, i.e., equations 1, 2, and 3. The regression results and corresponding residuals sums of squares are reported in Table 4.

Table 4: Tests for Structural Break

Regression for 2000-2014	Regressions for 2000-2006 and 2006-2014	
$Y_t = \beta_0 + \beta_1 X_t + u_{1t}$	$Y_t = \alpha_0 + \alpha_1 X_t + u_{2t}$	$Y_t = \delta_0 + \delta_1 X_t + u_{3t}$
$\hat{Y}_t = 455.263 - .634 X_t$	$\hat{Y}_t = 423.634 + .145 X_t$	$\hat{Y}_t = 504.584 - 1.015 X_t$
(7.661) (.073)	(10.966) (.227)	(23.948) (.177)
$n = n_1 + n_2 = 180$	$n_1 = 82$	$n_2 = 98$
$R^2 = .295$	$R^2 = .005$	$R^2 = .256$
$RSSR = 466178.616$	$SSR_1 = 198500.072$	$SSR_2 = 227553.955$
df = 178	df = 80	df = 96

Standard errors in parentheses.

The restricted residual sum of squares (RSSR) is obtained directly, while the unrestricted residual sum of squares (USSR) is obtained from adding the residual sum of squares from equation 2 and equation 3. If there is no structural break, RSSR would not statistically differ from USSR. On the contrary, it would be. The Chow test statistic has an F-distribution:

$$F = \frac{(RSSR - SSR_1 - SSR_2)/k}{(SSR_1 + SSR_2)/(n-2k)} \sim F_{[k,(n-2k)]} \tag{4}$$

Inserting the values of $RSSR$, SSR_1 and SSR_2 obtained from equations 1, 2, and 3, we obtain:

$$\frac{(RSSR - SSR_1 - SSR_2)/k}{(SSR_1 + SSR_2)/(n-2k)} = \frac{(466178.616 - 198500.072 - 227553.955)/2}{(198500.072 + 227553.955)/(180 - 2*2)} = 8.288 \tag{5}$$

The F statistic follows the F distribution with 2 and 176 degrees of freedom in the numerator and denominator. The 1% critical value is close to 4.728, which is much smaller than the F statistic, indicating that the trends in crime rate before and after the SYG law was passed in Michigan are statistically significantly different.

6 Empirical Strategy

6.1 OLS Regressions

The specification we used is as below:

$$crime = \beta_0 + \beta_1 * syg + \beta_2 * time + \beta_3 * syg\_time + \beta_4 * monthly\_dummies + u \tag{6}$$

We have four different dependent variables: crime incidences, log incidences, number of crimes per 100,000 population (IPP), and log IPP.

We are predicting that for nonviolent crimes, since the offense is not severe, criminals are deterred by the law.

7 Results

According to the regressions, the SYG law increased crime right after it passed. However, it decreased crime over time.

Table 5: Effect of SYG Law on Crime

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ins	Ins	Log Ins	Log Ins	IPP	IPP	Log IPP	Log IPP
Law	6206.420***	6662.374***	0.226***	0.241***	57.247***	61.844***	0.211***	0.226***
	(1887.880)	(691.175)	(0.061)	(0.023)	(18.975)	(6.907)	(0.061)	(0.023)
Time	-3.550	-10.255**	-0.000	-0.000**	-0.124	-0.192***	-0.000	-0.001***
	(12.769)	(4.680)	(0.000)	(0.000)	(0.128)	(0.047)	(0.000)	(0.000)
Law * Time	-75.136***	-72.978***	-0.003***	-0.003***	-0.653***	-0.631***	-0.002***	-0.002***
	(16.262)	(5.952)	(0.001)	(0.000)	(0.163)	(0.059)	(0.001)	(0.000)
Monthly Dummies		Yes		Yes		Yes		Yes
N	228	228	228	228	228	228	228	228
F	75.01	224.2	75.59	219.6	71.74	221.7	72.14	215.1
r2	0.501	0.936	0.503	0.935	0.490	0.936	0.491	0.934

Ins is the number of instances of crime, *Log Ins* is the natural log of crime instances. *IPP* is the number of crime instances per 100,000 population, and *Log IPP* is the natural log of crime instances per 100,000 population.

8 Model

9 Policy Implications

10 Conclusion

11 Appendix

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