Self-defense Regulations and Crime

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Abstract

This paper provides a theoretical model and an empirical analysis of Stand Your Ground (SYG) laws, which permit greater use of force in self-defense. We built a game theoretical model based on Becker [1968], showing that SYG laws can increase arming of both victims and perpetrators, which deters some violent crimes but encourages others. In particular, the model suggests that SYG laws 1. can increase murder success rates, because they encourage criminals to prepare for a stronger defense, and 2. can increase unplanned murders more than planned murders, by increasing the frequency with which lesser crimes escalate into more violent ones. We then use a difference-in-difference empirical analysis to test these implications. We find that, consistent with the model, SYG laws in the US increased planned murder rate by 7.6% and unplanned murders by 10.4%, on average.

1 Introduction

This paper conducts theoretical and empirical analyses of the impact of the stand your ground (SYG) law on planned and unplanned murders.

What is the SYG law? Ever since the introduction of the English common-law "duty to retreat", individuals were required by law to back away when they feel endangered in public. They were allowed to defend themselves only when they were cornered (Kaplan et al. [2014]).

In 2005, however, Florida became the first state to pass the SYG law, which allows individuals to take defense actions when they have reasonable belief that they are facing great bodily harm or death. Ever since 2005, 30 states have passed similar versions of the same law.

One of the arguments for passing the law is to offer civilians the right to protect themselves (Bush [2016]). The hope is that giving civilians the opportunity to defend themselves will decrease the probability of success for perpetrators and in turn discourage them. As a result, we should expect neighborhoods to be safer. However, studies have found that SYG laws aren't able to reduce violent crime (Gius [2016]; Chamlin [2014]). On the contrary, multiple studies have found that the laws have increased murder rates (Cheng and Hoekstra [2013]; McClellan and Tekin [2017]; Humphreys et al. [2017a]; Humphreys et al. [2017b]). Previous studies attribute the increase in murder rates to the escalation of violence.

Escalation of violence can happen more often in unplanned murders than in planned murders. However, previous papers have not been able to distinguish the SYG law's impact on the two types of murder, so they could not tell apart the different implications. If the increase in murder rates is primarily driven by planned murders, then it implies that offenders have become more successful. This is because when the law passes, offenders know that victims would be more prepared, so they also make more preparations. Since planned murder offenders are usually more experienced than victims, their preparations are usually more effective. If this were the case, we need to reconsider the law.

If increases in murder rates are primarily driven by unplanned murders, then we see more evidence of the escalation of violence. When victim defense triggers perpetrators to become more aggressive, lesser crimes are likely to precipitate into murder, and people who were not planning to commit murders are now committing murders. In this case, we might want to increase social interventions such as directed patrol policing strategies (Weisburd et al. [2017], Makarios and Pratt [2012]).

Our theoretical model is able to stylize the two mechanisms above that characterize murders. One is that decisions of the offender and victim are made sequentially in the planned (first-degree) murder but simultaneously in the unplanned (second-degree) murder. Sequential decision making starts from the victim, when they decide on their level of self-defense. Victims are able to select a best course of action based on their predictions of the offender's response. However, they are

likely to over estimate their ability to succeed in self-defense, especially when they increase their self-defense after the law passes. Offenders are able to observe the increase in self-defense of the victims, and they are able to increase their effort accordingly. Their effort is usually more effective, because they are generally more experienced in crime than victims are.

If the offender and the victim make decisions simultaneously, the victim will not be able to trigger the offender to make more preparations beforehand, so the offender will not have as much of an upper hand during their encounters. As a result, victims will have more opportunities for self-defense, causing escalation of violence to happen.

Another important condition for escalation of violence to happen, is that some offenders are provoked by victims (Smith and Bouffard [2014]). The negative emotions generated by these offenders will reduce their time discount factor, making them more impulsive and discount the future more heavily (Liu et al. [2013]). Our model suggests that the targeted victim will spend more effort on defense when they are punished less for it. The victim also levels up defense effort, such as turning to lethal forces, in unplanned murder if the offender can be easily provoked by the victim's self-defense. There is likely to be an escalation of violence that ensues.

The model predicts that first degree murder cases increase after the law passes, because victims are often less experienced than offenders. If both parties are more prepared after the law, the offenders' preparations are likely to be more effective. Second degree murder cases also increase after the law, if offenders are easily provoked by victim self-defense. The more likely the offenders are to be provoked, the more likely that second degree murders increase more than first degree murders.

Our dataset for murder rate is the FBI's Uniform Crime Report's Supplementary Homicide Report (SHR). We distinguish between first-degree and second-degree murders through the "Murder Cases in 33 Large Urban Counties in the United States, 1988" dataset.

Our empirical analyses show that the rates of both first-degree murder and second-degree murder increase after the law passes. Second-degree murder increases more than first-degree murder, and the results for second-degree murder are more robust.

These increases are estimates on the lower bound. Out of 100 SYG cases collected by the Tampa Bay Times, 46 of them have a police record that shows dispute about who instigated the altercation. Out of these 46, 8 were pending, 5 were found guilty, and 7 were pleas. The rest of the 26 were not charged, dismissed, acquitted, or granted immunity. When it is difficult to find out who is the aggressor, it is difficult to charge them.

Our results also shed lights on the expressive power of law. We find that the SYG law does not entail a significant change to the self-defense law for the majority of states. The increase of unplanned murder and planned murder after the enact of the SYG law could be due to victim's misunderstanding of the law that results in over defense. They may falsely believe that the stand-your-ground law eliminates the limitation on the self defense against a charge of murder and grants

the right to meet force with force (McAdams [2015]). Although both people who commit planned murder and people who commit unplanned murder believe they could use stand your ground to shield themselves, people who actually became irrational and over-react could be the reason for the additional increase of the unplanned murder over the planned murder. Our model captures such false belief and irrational behaviors.

The breakdown of this paper is as follows: Section 2 gives a detailed introduction of the stand-your-ground law. Section 3 gives a review of the literature of related topics. Section 5 covers data. Section 6 talks about identification methods. Section 7 covers results. Section 4 talks about model. Section 8 discusses policy implications. Section 9 concludes.

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

What is the legal liability if a victim, in a public place, shoots an attempted robber that threatened her with bodily harm? Under the Stand Your Ground law, your action is justifiable by just presuming rather than proving the reasonable fear of death or serious bodily harm.

Stand You Ground law exempts a person's duty to retreat from the situation before turning to a lethal weapon. It can be viewed as an extension to castle doctrine in terms of the place that the situation occurs — expanding the location from home, yard, in some states also workplace and occupied vehicle to public area that one is legally allowed to be. Under the Stand Your Ground law killing is justifiable when a person reasonably believes the use of deadly force is necessary for self-defense against death, great bodily injury, or forcible felony including kidnapping, sexual assault, robbery and so on. In Florida, it was even permitted for a person who was engaging in unlawful activity.

On one side, the Stand Your Ground law gives the victim permissions to immediately use lethal weapon against armed offenders or certain types of crime. On the other side, the same permission can also encourage the victim to fight back with deadly weapon even if he/she can retreat with perfect safety or stop the crime with other forces. In appearance, the law entitles the victim excessive self-defense rights in public place. However, we shall not simply judge a law without referring to its historical roots.

The English Common law principles are the foundation to the United States legal system. It originally held a "duty to retreat" which means the victim must make an attempt to avoid the violence before using lethal forces[1]. However, in late nineteenth century the majority of states of America abandoned the duty to retreat in public places[2].

[1] https://criminal.findlaw.com/criminal-law-basics/self-defense-overview.html

[2] Any which way but loose, interpretative strategies and attitudes toward violence in the evolution of the Anglo-American "retreat rule." (1992)

Before the spate of "stand your ground" laws, the Florida Supreme Court noted that, while it required retreat,

For example, in 1876, a decision made by the Ohio Supreme Court became the leading American case on the right to stand one's ground. The ruling mentioned :" The question, then, is simply this: Does the law hold a man who is violently and feloniously assaulted responsible for having brought such necessity upon himself, on the sole ground that he failed to fly from his assailant when he might have safely done so? The law, out of tenderness for human life and the frailties of human nature, will not permit the taking of it to repel a mere trespass, or even to save life, where the assault is provoked; but a true man, who is without fault, is not obliged to fly from an assailant, who, by violence or surprise, maliciously seeks to take his life or do him enormous bodily harm."

In 1877, the Supreme Court of Indiana asserted:"[t]he tendency of the American mind seems to be very strongly against the enforcement of any rule which requires a person to flee when assailed,to avoid chastisement or even to save human life, and that tendency is well illustrated by the recent decisions of our courts, bearing on the general subject of the right of self-defence. The weight of modern authority, in our judgment, establishes the doctrine, that, when a person, being without fault and in a place where he has a right to be, is violently assaulted, he may, without retreating, repel force by force, and if, in the reasonable exercise of his right of self-defence, his assailant is killed, he is justifiable."

Although enacting the stand-your-ground law does not entail a significant change to self defense rules for the majority of states, the law has had a profound impact on public opinion towards self-defense and victim behavior. We illustrate this impact in section 4.2.

3 Studies on the SYG Law

Multiple papers have illuminated the reasons for why escalation of violence happened. First of all, studies have found that criminals are more impulsive than the general public (Åkerlund et al. [2016], Nagin and Pogarsky [2004], Loeber et al. [2012]). Also, victims are likely to have an unclear understanding of self-defense. Robinson and Darley [2004] point out that people often mis-perceive law based on gossip that passes from one person to another. Therefore, victims might think that they are carrying out proper self-defense, while sometimes they are actually over defending. The line is blurry sometimes between these two cases.

Anderson [2002] has found that 35% of offenders did not think about punishment when they committed the crime.

"a majority of jurisdictions do not impose a duty to retreat before a defendant may resort to deadly force when threatened with death or great bodily harm." Weiand v. State, 732 So.2d 1044, 1049 (Fla.1999) (citing Wayne R. LaFave and Austin W. Scott, Jr., Substantive Criminal Law § 5.7(f) (West, 2d ed.1986)). See also Gillis v. United States, 400 A.2d 311, 312 (D.C. 1979)("[P]robably the majority [of states] have adopted the rule that one is not required to retreat but may stand his ground and defend himself. This has been called the American rule and in at least two cases the Supreme Court has indicated approval of it."

see *Beard v United States*, 158 US550 (1985) and *Rowe v United States*, 164 US 546 (1896)

Literature has uncovered many reasons why a person could be underestimating punishment. Nagin and Pogarsky [2004] and Loeber et al. [2012] found that poor impulse control predicts violent offending among respondents. This means that during the offense, the offender has become irrational, which, in turn, means that sometimes it is not beneficial to the victim to choose self-defense even if they are offered the opportunity to. Since they might over-estimate the situation, it is more beneficial to take a step back. Liu et al. [2013] and Lake [2016] have found that negative emotions prime individuals to have lower time discount factor for the future. Fields et al. [2014] has found that impulsivity is positively correlated with stress. Novaco [2016] has found that anger impels aggressive behavior. Anderson [2002] even found that violent criminals ignore punishment when they commit crimes. They found that the majority of criminals are not deterred by stricter sanctions.

Another irrationality could come from people's tendency to be over-optimistic about themselves, which was noted in the findings of Weinstein [1980]. Both the offenders could be over-optimistic about their punishments and the victims could be over-optimistic about their ability to defend themselves. Supporting evidence for offenders being over-optimistic comes from Kleck et al. [2005]. They have found that even among those who are already in jail, it is difficult to correctly perceive the punishment for their crime. Anderson [2002] found that "83% of the criminals thought it was not very likely that they would be caught." Lerner and Keltner [2000] and Lerner and Keltner [2001] have found that anger can make people more optimistic towards risk.

Anderson [2002] also pointed out that while some criminals are deterred by existing punishments, additional punishments aren't likely to deter those who are already determined to offend.

3.1 Modeling Crime

Ever since Becker [1968], economists have started systematically analyzing crime. It illustrates how criminals weigh their gains and losses before they make a decision on committing a crime, which provides a foundation for both theoretical and empirical exploration of the issue. Like ours, studies have extended Becker's work by allowing victims to play a role in self-protection (e.g. Skogh [1973], Shavell [1991], Ben-Shahar and Harel [1995], Ben-Shahar and Harel [1996], Lee and Pinto [2009], Guha and Guha [2012], Baumann et al. [2019]). But our paper is the first to focus on the the relaxation of the regulation on over-defense and to analyze the behavior change of perpetrators and victims in first- and second-degree murder.

We model the interaction between the offender and the victim as a contest, in which the potential victim can exert defense effort to prevent herself from the attack while the offender's effort increase the probability of a successful attack. Some studies in the Economics of Crime model the probability of a successful attack in the form of a Tullock contest, in which the offender can put effort to raise and the victim can reduce such probability. For example, Goyal and Vigier [2014] model a contest between attackers and a central planner and analyze the optimal resource allocation for the central planner to defend attackers in a network. Hong and Neilson (2020) treat the

interaction between a cybercriminal and a victim as a contest and examine the optimal punishment for cybercrimes. Ours compares the offender and the victim's interaction in a unplanned murder (simultaneous game) with a planned murder (sequential game).

More closely related, a group of paper compares the effort levels of the Cournot–Nash play (simultaneous game) with those of the Stackelberg plays (sequential game)(Dixit [1987], Baik and Shogren [1992], Leininger [1993], Yildirim [2005]). The seminal paper, Dixit [1987], constructs an asymmetric contest that contains a favorite player who is more likely to win in a one-shot Cournot–Nash game and a underdog player. Dixit finds that given the chance to move first, the favorite player overcommits to his effort with respect to his Cournot–Nash amount, while the underdog undercommits. Unlike this seminal work, our result does not depends on the fact that the favorite player has a higher marginal probability of success, but rather on how easily the offender can be provoked by the victim's self-defense. When the offender can be easily provoked, both the offender and the victim overcommit to their effort in the simultaneous game comparing to the sequential game.

Related studies support the idea that the victim's defense effort can provoke the offender, making him discount the future punishment and become more violent. For example, Liu et al. [2013] and Lake [2016] have found that negative emotions prime individuals to have lower time discount factor for the future. Fields et al. [2014] has found that impulsivity is positively correlated with stress. Novaco [2016] has found that anger impels aggressive behavior. Lerner and Keltner [2000] and Lerner and Keltner [2001] have found that anger can make people more optimistic towards risk.

3.2 Empirical Studies

In order to test the model, we use the stand-your-ground law and crime data. Work has been done in this area both on the national level and on regional level.

3.2.1 At the National Level

Cheng and Hoekstra [2013] is the first work that touches upon this realm. They use the Uniform Crime Report (UCR) dataset for crime data. They found that murder has increased after the law passes.

McClellan and Tekin [2017] uses a slightly different crime data set to arrive at the same conclusion. They claim that the UCR data only records crime that has been reported, but a large amount of crime is not reported. Their data set is from the health records, so they don't have missing data problem.

Gius [2016] uses a two stage fixed effects model to address endogeneity issues and come to the same conclusion. The endogeneity issue that they address is that states with higher crime rates

may be more likely to enact the SYG law, resulting in a reverse causality problem. The instrument they use is the percent of the population that voted Republican in the last presidential election.

3.2.2 On the State Level

Guettabi and Munasib [2018] looks at heterogeneous effects between states using a synthetic control method. The found that Alabama, Florida and Michigan's gun death rate increased significantly after the law was passed.

3.2.3 On the City Level

Ren et al. [2015] evaluates the deterrent effect of the Texas castle doctrine law and the subsequent Horn shooting on burglary in the two largest cities in Texas, Houston and Dallas. Interrupted time-series designs (ARIMA) were employed in the study to analyze the intervention effects. Their finding is after a very publicized incident in Houston, burglaries were reduced in Houston but not in Dallas.

3.2.4 Our Study

Our study differs to the existing studies in two ways. First, it uses more recent data. Second, it considers the difference between different time periods before and after the law passes. Third, it considers the difference between planned and unplanned murder cases.

Since we are exploring the behavioral aspects of the response to the law, we are only doing the exploration on the aggregate level instead of on a state level.

4 Model

We model the planned murder as a sequential game and the unplanned murder as a simultaneous game between an offender and a victim. The victim moves first in the planned murder, choosing the costly defense effort s to exert. The offender in this type of murder observes the victim's defense effort before deciding whether to commit a crime and, if so, how much costly effort x to exert to improve the chances of success. However, in unplanned murder, the victim and the offender make decisions simultaneously — neither of them observes the other player's effort before making their own decision.

The probability that the murder is successful (the targeted victim is killed) is determined by the relative effort of the offender and the victim and governed by the function $p : \mathbb{R}^2_+ \to [0, 1]$ given by $p(x, s)$ with $p_x > 0$ and $p_s < 0$. The probability of success is a function of the offender's and the victim's effort. Increases in the offender's effort x make success more likely while increases in the

victim's defense effort s make it less likely. Also, the success function is concave in x and convex in s, with $p_{xx} < 0$, $p_{ss} > 0$, and $p_{xs} = p_{sx} < 0$.

4.1 Offender

The offender is risk neutral and chooses both whether to commit a murder and how much effort to provide if he does. His expected utility from attempting the murder is given by

$$O(x) = p(x,s)(B - \delta(s)F) - \frac{1}{\beta}x - (1 - p(x,s))D \tag{1}$$

where B is the benefit he receives and $\delta(s)F$ is the expected fine he pays conditional on the murder being successful. $\delta(s)$, the offender's discount factor, distinguishes offenders holding different time preferences. δ is a function of the victim's defense effort s and decreases in s for the reason that more violent defenses from the victim can provoke the offender and make him discount more heavily about the future. F captures the probability of prosecution and conviction together with the actual fine imposed by law and enforcement. The cost of effort is x/β in which the size of β determines the offender's marginal cost (relative to the victim) of attempting the murder. If the murder is not successful, the offender may be hurt or killed by the victim reducing his expected payoff by D.

The offender maximizes $O(x)$ subject to the constraint $x > 0$. Thus, B must be greater than $\delta(s)F - D$. The necessary and sufficient condition for an interior solution to this problem is simply

$$p_x(x^{br}(s), s)(B - \delta(s)F + D) = \frac{1}{\beta} \tag{2}$$

We use implicit function theorem to obtain the following

$$\frac{dx^{br}(s)}{ds} = -\frac{p_{xs}(B - \delta(s)F + D) - p_x\delta_s F}{p_{xx}(B - \delta(s)F + D)} = -\frac{p_{xs}}{p_{xx}} + \frac{p_x\delta_s F}{p_{xx}(B - \delta(s)F + D)} \tag{3}$$

Note that $\frac{dx^{br}(s)}{ds} > 0$ if $|\delta_s| > |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$. Which means if the offender can be easily provoked by the victim's self-defense (δ being very responsive to s), the inequality $\frac{dx^{br}(s)}{ds} > 0$ is likely to hold, so the offender exerts more effort as the victim fights harder in defense. In addition, the magnitude of the right hand side of the inequality $|\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$ tends to be small because the punishment F for murder is large, partial effect p_x is usually greater than the magnitude of the cross effect p_{xs}, and $0 \leq \delta(s) \leq 1$.

4.2 Victim

The victim suffers a loss L if the murder succeeds, but she can reduce the probability of death by taking a certain amount of costly defense effort, s. If the victim stops the murder, she may be fined for over-defense. The victim's expected loss is given by

$$V(s) = p(x,s)L + s + (1 - p(x,s))\gamma K(s)$$

The victim must pay for the cost of defense effort, s, but doing so reduces the probability of suffering the loss, L. The marginal cost of the victim's defense effort is normalized to 1. If the victim stops the murder, she is subject to a expected fine $K(s) \in [0, L)$ which is determined by the degree of over defense. Thus, K is a function of the victim's defense effort s with $K_s > 0$ and $K_{ss} = 0$.

$\gamma \in [0, 1]$ reflects the SYG law's impact on K. The SYG law can reduce the expected fine the victim perceives through γ for the following reasons. First, the law allows the victim to defend herself without retreat. There is a reduced burden of proof for the victim and the victim is less likely to be penalized by over-defense law. Second, the SYG law's information effects change the public view on over-defense (McAdams [2015]). Audience may falsely believe that the SYG statute eliminates the limitation on the self-defense defense against a charge of murder and grants the right to meet force with force. The legislature also reinforced such belief by stating "[T]he Legislature finds that it is proper for law-abiding people to protect themselves, their families, and others from intruders and attackers . . . and . . . [that] no person or victim of crime should . . . be required to needlessly retreat in the face of intrusion or attack." in the preamble to the SYG bill. Additionally, jury verdicts of acquittal on murder cases like "Zimmerman and Martin" may lead to a greater willingness to use deadly defensive force in cases where there is an alternative.

The other conditions for an expressive influence are satisfied. Media attention to the passage of the new law and then to various killings, prosecutions, and acquittals, most prominently the Zimmerman trial, gave intense publicity to these legal expressions. The legislature has expertise over public attitudes and jury verdicts of acquittal may be thought to aggregate evidence of those attitudes.

4.2.1 Unplanned Murder

An unplanned murder is an intentional killing done without advance planning. We model this type of murder with a simultaneous game in which neither the offender and the victim observes the opposition's effort choice.

The victim chooses s to minimize $V(s)$. Letting $s^{br}(x)$ denote the victim's best-response function, the first order condition is

$$p_s(x, s^{br}(x))(L - \gamma K) + 1 + (1 - p(x, s^{br}(x)))\gamma K_s = 0 \tag{4}$$

Differentiating (4) we obtain the comparative static derivatives

$$\frac{ds^{br}(x)}{dx} = -\frac{p_{sx}(L - \gamma K) - p_x \gamma K_s}{p_{ss}(L - \gamma K) - p_s \gamma K_s} > 0 \tag{5}$$

$$\frac{\partial s^{br}(x)}{\partial \gamma} = -\frac{(1-p)K_s}{p_{ss}(L-\gamma K) - p_s \gamma K_s} < 0 \tag{6}$$

The victim's best response to an increase in the offender's effort is to also increase her defense effort. The pass of the SYG law reduces γ and therefore lower the victim perceived punishment for over defense. As a result, the victim responds with more defense effort.

Using $x^{br}(s)$ from the expression (2) and $s^{br}(x)$ from the expression (4) to solve for x^* and s^*. We denote the equilibria x^* and s^* in the simultaneous game as x_u and s_u for the next section.

4.2.2 Planned Murder

For planned murder, the offender plans it in advance, so we assume he observes the victim's defense effort before attempting the murder. The victim takes account the offender's best response when choosing s. The timing of the game prescribes that the victim moves before the offender in planned murder. The necessary and sufficient condition for an interior solution to this problem is

$$[p_x(x^{br}(s^*), s^*)\frac{\partial x^{br}(s^*)}{\partial s} + p_s(x^{br}(s^*), s^*)](L - \gamma K(s^*)) + 1 + (1 - p(x^{br}(s^*), s^*))\gamma K_s(s^*) = 0 \tag{7}$$

To guarantee an interior solution for equation (7), we assume the victim's expect loss funtion V is strictly convex in s and $p_s(x, 0) = -\infty$. Differentiating (7) we obtain the comparative static derivatives[3]

$$\frac{\partial s^*}{\partial \gamma} = -\frac{-[p_x(x^{br}(s^*), s^*)\frac{\partial x^{br}(s^*)}{\partial s} + p_s(x^{br}(s^*), s^*)]K + (1-p)K_s}{[p_{xx}(\frac{\partial x^*}{\partial s})^2 + p_x\frac{\partial^2 x^*}{\partial s^2} + (p_{xs} + p_{sx})\frac{\partial x^*}{\partial s} + p_{ss}](L - \gamma K) - [(p_x\frac{\partial x^*}{\partial s} + p_s) - \frac{1}{2}(1-p)]\gamma(2K_s)} < 0 \tag{8}$$

From expression (7) we know that $p_x(x^{br}(s^*), s^*)\frac{\partial x^{br}(s^*)}{\partial s} + p_s(x^{br}(s^*), s^*)$ must be less than 0. The SYG law reduces γ, which incentivizes the victim to increase her defense effort. From expression (6) and (8), we find that the victim in both the planned and unplanned murder spend more defense effort when facing less punishment for self defense.

Proposition 1. *Assuming V is strictly convex in s. If $\frac{dx^{br}(s)}{ds} > 0$, then $s_u > s_p$ and $x_u > x_p$. If $\frac{dx^{br}(s)}{ds} < 0$, then $s_u < s_p$ and $x_u > x_p$. In either case, the offender puts more effort in an unplanned murder than in a planned murder.*

[3] Assuming the victim's expected loss function is strictly convex in s, the second order condition of equation (7) is,

$$[p_{xx}(\frac{\partial x^*}{\partial s})^2 + p_x\frac{\partial^2 x^*}{\partial s^2} + (p_{xs} + p_{sx})\frac{\partial x^*}{\partial s} + p_{ss}](L - \gamma K) - [(p_x\frac{\partial x^*}{\partial s} + p_s) - \frac{1}{2}(1-p)]\gamma(2K_s) > 0$$

Proof. We denote the offender's and the victim's equilibrium effort for an unplanned murder as x_u, s_u and for a planned murder as x_p, s_p.

$$\begin{aligned}
\frac{dV(x^{br}(s),s)}{ds}|_{s=s_u} &= \frac{\partial V(x^{br}(s_u),s_u)}{\partial s} + \frac{\partial V(x^{br}(s_u),s_u)}{\partial x}\frac{dx^{br}(s_u)}{ds} \\
&= 0 + \frac{\partial V(x^{br}(s_u),s_u)}{\partial x}\frac{dx^{br}(s_u)}{ds} \\
&> 0 = \frac{dV(x^{br}(s_p),s_p)}{ds} && \text{, if } \frac{dx^{br}(s)}{ds} > 0 \qquad (9) \\
&< 0 = \frac{dV(x^{br}(s_p),s_p)}{ds} && \text{, if } \frac{dx^{br}(s)}{ds} < 0 \qquad (10)
\end{aligned}$$

where we also make use of the fact that $\frac{\partial V(x,s)}{\partial x} > 0$.
From the expression (9), we have $s_u > s_p$. $\frac{dx^{br}(s)}{ds} > 0$ implies $x_u > x_p$.
From the expression (10), we have $s_u < s_p$. $\frac{dx^{br}(s)}{ds} < 0$ implies $x_u > x_p$. □

Proposition 1 compares the offender and the victim's equilibrium effort in a simultaneous game and in a sequential game. The offender always puts more effort in an unplanned than in a planned murder. From expressions (3), (9), and (10) we know that the victim's defense effort depends on whether the offender can be easily provoked or not. In the following, we discuss the proposition 1 under two main conditions and relate it to the influence of the SYG law.

Condition 1: $|\delta_s| > |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$ *for the period before the enactment of the SYG law*

When $|\delta_s| > |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$, the marginal impact of s on δ is high. Sensing that the offender can be easily provoked, the victim in planned murder will put less defense effort than the victim in unplanned murder. In planned murder, the offender observes the victim's defense effort before committing the crime, thus, greater defense effort than s_u prompts the offender to work harder ($\frac{dx^{br}(s)}{ds} > 0$) and make the crime more likely to succeed.

According to expressions (6) and (8), enacting the SYG law reduces the perceived punishment of the victim for over defense. Therefore, whether it is a planned murder or an unplanned murder, the victim exerts more efforts for defense than before. If $\delta_{ss} < 0$, conditon $|\delta_s| > |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$ still holds, the offender in either planned or unplanned murder exerts more effort when committing the crime. The unplanned murder becomes more violent under the law because both the offender and the victim put in greater effort. If $\delta_{ss} \geq 0$, conditon $|\delta_s| > |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$ may no longer be true. The increased defense effort discourage the offender's effort, which will elicit more defense effort from the victim in planned murder than in unplanned murder. Because the victim of an unplanned murder is less prepared $s_u < s_p$ and the offender is more aggressive $x_u > x_p$, the offender's probability of success in unplanned murder becomes larger than in planned murder, $p(x_u, s_u) > p(x_p, s_p)$

Condition 2: $|\delta_s| < |\frac{p_{xs}[(B+D)/F - \delta(s)]}{p_x}|$ *for the period before the enactment of the SYG law*

When $|\delta_s| < |\frac{p_{xs}[(B+D)/F-\delta(s)]}{p_x}|$, the marginal impact of s on δ is low. Knowing that the offender cannot be easily provoked, the victim in planned murder chooses better preparations to discourage the offender's effort ($\frac{dx^{br}(s)}{ds} < 0$). Greater defense effort than s_u reduce the likelihood of a successful crime.

Meanwhile, enacting the SYG law discourages the offender, because the increased defense effort reduces the offender's effort in planned or unplanned murder. If $\delta_{ss} \geq 0$, the condition $|\delta_s| < |\frac{p_{xs}[(B+D)/F-\delta(s)]}{p_x}|$ still holds. Passing the law discourages the offender's effort making both planned and unplanned murder less likely to happen. If $\delta_{ss} < 0$, the condition $|\delta_s| < |\frac{p_{xs}[(B+D)/F-\delta(s)]}{p_x}|$ may not hold after passing the law. The victim's defense effort may eventually lead to more effort from the offender. Although both s_u and s_p increase due to the law, s_u will increase further and surpasses s_p. After the law was passed, the unplanned murder becomes more violent since both the offender and the victim commit to a higher level of effort.

We find that the SYG law makes unplanned murder either more violent or more likely to occur compared to planned murder under condition 1. In condition 2, the unplanned murder also becomes more violent when $\delta_{ss} < 0$ and the victim's defense effort and the offender's effort in unplanned murder has a more significant increase than in other cases.

The offender is less likely to succeed and the crime is less violent only when $\delta_{ss} \geq 0$ and condition 2 is satisfied.

5 Data

We were able to obtain crime data and then proxied them for figuring out first degree and second degree murders.

5.1 Crime Data

We obtain crime data from Uniform Crime Report (UCR) from the UCR Data Tools website. We downloaded murder rate data by the state for the years 2000 to 2014, and then combined them into a panel.

We obtained the Supplemental Homicide Report (SHR) data from the National Archive of Criminal Justice Data (NACJD) hosted at the University of Michigan.

The UCR contains data on crime that has been reported to police, including the charge for the crime. What we are most interested in in the UCR data is murders.

The SHR contains more detailed data on homicides, including the circumstances under which the homicide occurs.

The time period we work with is 2000-2014, because the first state to pass the law is Florida which passed it in 2005. The latest year with available data is 2014. The data is by year and we merged all the yearly data together to generate a panel.

Data from certain years in states that have very small numbers of observations are dropped from the SHR.

Murder rate is defined as the number of murders per 100,000 people.

The summary statistics for the murder rate is below in Table 1:

Table 1: Summary statistics for murder rate at the state level

	max	min	mean	sd
murder rate	14.6	.6	4.536533	2.318049

The highest murder rate in the data is 14.6, the lowest is .6.

Summary statistics for murder rate after breaking down into with law and without law is in Table 2:

Table 2: Summary statistics for murder rate at the state level: after breaking down into with law and without law

	Without Law				With Law				Comparison	
	max	min	mean	sd	max	min	mean	sd	b	t
murder	13.20	0.60	4.22	2.31	14.60	0.90	5.35	2.10	-1.13^{***}	(-5.73)
N	551				174				725	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The average murder rate for state-years without law and with law are statistically significantly different. The average murder rate for state-years without the law is 4.22 and that for state-years with the law is 5.35.

5.2 Planned and Unplanned Murder Data

Data come from multiple sources. The first group of datasets is contained in *Murder Cases in 33 Large Urban Counties in the United States, 1988*. The datasets included are the offense file, the defendant file, and the victim file.

In the victim file, only around 12% of the victims have previously committed a crime. However, at least 17% of the victims had a weapon, and at least 15% have taken drugs. Around 32% of the offenders are provoked by victims or suspected provoked by victims, suggesting the occurrence of a certain level of conflict.

Analyses of the data show that most first degree murder offenders know their victims, which helps explain why it is possible for them to successfully plan ahead.

Table 3: Prior Relations

	Prior Relationship		
	Count	Percent	Cum Percent
Yes	1495	65.80106	65.80106
Likely	259	11.39965	77.2007
No	518	22.7993	100
Total	2272	100	

Out of all first degree murders, 65.8% of the murderers and victims have prior relationship with each other, 11.4% are likely to have prior relationship, and 22.8% have no prior relationship.

Further analyses of the circumstances of the murders shows differences between first degree and second degree murder.

First of all, there is a difference between drug use of first degree and second degree murder offenders. Table 4 shows that second degree murder offenders have higher percentage of using drugs than first degree murder offenders, consistent with our theory that first degree murder offenders are more deliberate.

Table 4: Drug Use Summary Statistics

	First Degree Murder			Second Degree Murder			Diff	
	Count	Mean	Std Dev	Count	Mean	Std Dev	Coeff.	t-stats
Drug in Defendent	617	.2463533	.4312363	183	.3114754	.4643671	-.0651	-1.76*

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Second, comparing the percentage of victims who had a weapon at the murder, we found that second-degree murder victims are more likely to have a weapon.

Table 5: Comparing Weapon Percentage between First-Degree and Second-Degree Murder

	First-Degree Murder			Second-Degree Murder			Diff	
	Count	Mean	Std Dev	Count	Mean	Std Dev	Coeff.	t-stats
Weapon on Victim	2014	.1475	.3547	648	.1790	.3837	-.032	-1.85*

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

14.75% of First-Degree Murder victims have a weapon compared to 17.90% of Second-Degree Murder victims. The p-value for a two sample t test is .06, which is significant at the 10% level.

We use these to find the proportion of murders that are planned and the proportion that is unplanned. Table 6 breaks the charges down into categories. Note that Table 6 is obtained from the defendant file.

Table 6: Murder Cases in 33 Large Urban Counties in the United States, 1988

Charge	No.
first degree murder	2,315
second degree murder	711
third degree murder	7
voluntary manslaughter/non-negligent - manslaughter 1st	72
accessory to murder	6
accessory after the fact	6
conspiracy to murder (includes solicitation to murder)	1
attempted murder	1
use of firearm (includes felony f/a, possession of f/a)	4
aggravated battery (includes assault with a weapon)	5
burglary	1
arson	3
involuntary manslaughter/negligent - manslaughter 2nd	2
child abuse	4
child abuse with death (Albuquerque only)	2
unknown	2
Total	3,142

The majority of the cases recorded are first degree murders, although a large number of them are second degree murders.

In the offense file, the variable "primary circumstance" describes the circumstance under which the murder happened. It is represented by the "Total" column in Table 7 and Table 8.

Table 7: Murder Circumstances I

Code	Circumstance	Total	First degree	Second degree
Felony-murder				
a01	Robbery	392	274	53
a02	Burglary	37	25	3
a03	Sexual assault	32	28	1
a04	Arson	9	9	0
a05	Kidnapping	3	3	0
a06	Escape	2	1	0
Other felony				
a07	Larceny	7	5	0
a08	Auto theft	26	24	2
a09	Other sex offense	0	0	0
a10	Homosexual prostitution (PRETEXT FOR ROBBERY)	3	3	0
a11	Heterosexual prostitution (PRETEXT FOR ROBBERY)	1	1	0
a12	Other	9	8	1
a13	Suspected felony	2	1	1
Issue Oriented Dispute				
b01	Romantic triangle	54	34	19
b02	Property/money	251	153	70
b03	Drugs (users dispute over drugs or paraphernalia)	18	11	6
b04	Business transaction/grievance	20	12	7
b05	Redress of insult/personal honor	236	173	54
b06	Matters of opinion	129	89	34
b07	Racial/ethnic clash	23	16	6
b08	Jealousy	41	33	8
b09	Traffic dispute	25	18	4
b10	Issue unknown	110	70	34
b11	Rebuff of sexual advance	32	22	8
b19	Other	8	7	1
Domestic/Personal Dispute				
c20	Lover/spouse quarrel	284	192	75
c21	Domestic quarrel (other family)	104	76	22
c22	Other	1	1	0
Situational Disputes				
d30	Barroom dispute/brawl	62	39	20
d31	Legitimate recreation	37	27	8
d32	Illegitimate recreation (gambling, cock fighting, etc.)	15	12	3
d33	Illegitimate recreation (drugs)	3	3	0
d34	"Street" fight	28	17	11
d35	Random "street" encounter	0	0	0
d39	Other	0	0	0

Table 8: Murder Circumstances II

Code	Circumstance	Total	First degree	Second degree
Homicide by-product of criminal business activity				
e01	Turf battle	34	11	22
e02	Bad deal/bad drugs	38	25	11
e03	Money owed	62	40	19
e04	Revenge for acting as police informant	6	4	1
e05	Punishment for skimming drugs/money	15	12	3
e06	Stealing drugs/drug money	111	77	29
e07	Dispute over drugs	24	18	5
e08	Drug manufacture	3	1	2
e09	Drug purchase/sale scam	52	45	5
e10	One of the above but can't distinguish	17	15	2
e11	Punishment for stealing drugs/money	28	10	14
e12	$ owed for crack house rent	0	0	0
e13	Sex for drugs	3	1	2
e14	Argument re drug house ops	5	1	4
e19	Other-, drug business	23	9	14
e20	Suspected drug business	9	6	3
e30	Prostitution	17	15	2
e39	Other	11	6	3
e40	Suspected other criminal business	1	0	1
Homicide involved "juvenile" organized gangs				
f01	Turf battle between rival gangs	7	7	0
f02	Other gang fight between rival gang members	24	23	0
f03	Gang fight between members of same gang	0	0	0
f04	Drive-by shooting	12	12	0
f05	One of the above but can't distinguish	1	1	0
f19	Other gang-related	27	23	4
f20	Suspected gang activities	1	1	0
Miscellaneous				
g01	Child abuse	92	55	16
g02	Psychopath	8	8	0
g03	Gun/weapon accident	47	18	14
g04	Other accident	33	12	16
g05	Assist in self-murder	3	2	0
g06	Mercy killing	1	1	0
g07	Justifiable homicide by police officer	1	0	0
g08	Justifiable homicide by civilian	0	0	0
g09	Sniper	0	0	0
g10	Reverse felony	10	1	5
g11	Unknown circumstance	73	58	12
g12	Bizarre/unprovoked behavior	60	46	13
g13	"Contract" killing/Hit for money/insurance scam	50	40	7
g14	Suicide pact	2	1	1
g19	Other	15	10	5
g20	"Thrill Kill"	7	5	2

Within the data, robbery is the biggest cause of murder, followed by lover/spouse quarrel, property/money disputes, redress of insult/personal honor.

Then we linked the defendant file with the offense file to uncover the relationships between

murder circumstances and charge. These relationships are represented by the columns called "First degree" and "Second degree." We obtain the percentage of each of these categories that are first degree and second degree, and use these percentages to approximate first degree murder and second degree murder in our main data.

We would like to see if planned murders increase less than unplanned murder. First-degree murder is defined to be an unlawful killing that is both willful and premeditated (FindLaw [a]). Second-degree murder is defined to be an intentional killing that is not premeditated (FindLaw [b]).

5.3 Self-Defense Data

Self-defense data from the National Crime Victimization Survey (1992-2016) shows that when someone faces forcible entry of the home, they are least likely to take self-defense action. When someone faces abusive language, they are most likely to take self-defense action. However, in situations such as someone insulting someone else, it is difficult to identify who is the party that initiated the fight. Also, when punishments for self-defense actions are relaxed, it is easier for small incidents to turn into more serious ones.

Table 9: Percent defense

	Count	Mean	Standard Deviation
Abusive Language	190	.33	.47
Attempted Theft	790	.28	.45
Forcible Entry of Car	205	.19	.39
Property Damage	357	.13	.34
Forcible Entry of Home	1561	.11	.31

Table shows the percentage of cases where a victim took self-defense actions. The highest percentage is for the category of abusive language, and the lowest is for forcible entry of home.

5.4 Controls

Levitt [2002] found that the size of the police force will significantly affect crime. The data for the size of the police force is obtained from the Uniform Crime Report Police Employee Data 2000-2014.

Unemployment rate data and public assistance data are obtained from the US Census 2000-2014.

Poverty rate, income and demographical data are obtained from the American Community Survey 2000-2014.

Levitt [1996] found that the number of prisoners will significantly affect crime. This data is

obtained from the Bureau of Justice Statistics Bulletin 1999-2014.

Kleck [2015] mentioned that percent of suicides committed with guns (PSG) is the best proxy for gun ownership. This data is obtained from the Centers for Disease Control 2000-2014.

The controls are similar to Cheng and Hoekstra [2013].

Table 10: Descriptive Statistics

	Mean (Unweighted)	Mean (Weighted by Population)
Dependent Variables		
Planned Murder per 100,000 Population	3.1	3.7
	(1.7)	(1.4)
Unplanned Murder per 100,000 Population	.7	.8
	(.4)	(.3)
Control Variables		
Police per 100,000 residents	338.2	326.5
	(114.6)	(79.6)
Unemployment Rate (%)	6.7	7.3
	(2.0)	(2.0)
Poverty Rate (%)	12.6	13.3
	(3.4)	(3.0)
Median Household Income ($)	47,984	48,420
	(8434.5)	(7509.6)
Prisoners per 100,000 residents	429.7	447.5
	(164.1)	(145.6)
Government spending (assistance and subsidies) per capita	120	107
	(55.9)	(48.9)
Government spending (public welfare) per capita	1,261	1,316
	(460.1)	(497.6)
% Black Male Aged 15-24	.9	1.1
	(.8)	(.7)
% White Male Aged 15-24	5.5	5.29
	(1.0)	(.7)
% Black Male Aged 25-44	1.4	1.7
	(1.2)	(1.0)
% White Male Aged 25-44	10.8	10.7
	(1.6)	(1.2)
Percent suicide by gun	.5	.5
	(.1)	(.1)
N	750	750

There are around four times as many planned murders than unplanned murders. There are six times as many white male as black male in the age group of 15-24, around ten times as many white male as black male in the age group of 25-44.

6 Empirical Strategy

The difference-in-difference framework is the most fitting to evaluate the effect of the law separately on planned and unplanned murders. This is because we have a number of states which passed the law, and a number of them that did not pass it. With a staggered difference-in-difference approach, we are able to find out the effect of the law on murder rate. Since the first states passed the law in 2005, we start our analysis from the year 2000, leaving some observations for comparison for the first group of states. Data is available from 2000 to 2014, which allows us to observe the differences between before and after the law for the maximum number of states.

Our outcomes of interest are natural log of planned and unplanned murder per 100,000 population. If unprepared offenders are more likely to cause an escalation of conflict, second-degree murder will increase more than first-degree murder.

We are able to account for the different trends of murder rate change over the years for different states.

This is a similar specification to Cheng and Hoekstra [2013]. i stands for state and t stands for year.

The empirical specification is

$$murder_{it} = \beta_0 + \beta_1 law_{it} + \beta_2 states_i + \beta_3 year_t + \boldsymbol{\beta_4 x_{it}} + \beta_5 law_{it} * year_t + \epsilon_{it} \tag{11}$$

The main variable of interest is the law_{it} variable that is either 0 or 1. The $states_i$ variables are the state fixed effects that capture factors such as the prevailing cultural attitude toward self-defense that differ between states but are fixed over time. The $year_t$ variables are the year fixed effects that capture factors such as improvements in police technology that vary through time but are constant between states. Inside $\boldsymbol{x_{it}}$ we have the size of the police force, the unemployment rate, poverty rate, income, prisoner count, last year's prisoner count, demographic variables (percentage of black males 15-24 and 25-44 years old, percentage of white males 15-24 and 25-44 years old), and government's spending on welfare (subsidy and public welfare spendings). All of the controls have been proven to be correlated with murder rate.

We are assuming that changes in murder rate don't affect the decision to pass the law. In other words, we are assuming there is no reverse causality. Figures 1 to 5 show that out of the 30 states that passed the syg law, 9 had an increase of murder rate before the law, and 19 had a decrease. β_1 is the parameter of interest here.

Equation 12 controls for state fixed effect and year fixed effect.

$$murder_{it} = \beta_0 + \beta_1 law_{it} + \boldsymbol{\beta_2 states_i} + \boldsymbol{\beta_3 year_t} + \epsilon_{it} \tag{12}$$

Equation 13 controls for region-by-year fixed effects as well. Due to cultural reasons, each region of the United States is likely to share a similar murder rate trend over time.

$$murder_{it} = \beta_0 + \beta_1 law_{it} + \boldsymbol{\beta_2 states_i} + \boldsymbol{\beta_3 year_t} + \boldsymbol{\beta_4 region_i * year_t} + \epsilon_{it} \tag{13}$$

Equation 14 also controls for time varying factors, which are listed above.

$$murder_{it} = \beta_0 + \beta_1 law_{it} + \beta_2 states_i + \beta_3 year_t + \beta_4 region_j * year_t + \boldsymbol{\beta_5 x_{it}} + \epsilon_{it} \tag{14}$$

Equation 15 controls for Ashenfelter's dip. This is to test whether there was an uptick of murders before the law was put into place.

$$\begin{aligned} murder_{it} = \beta_0 + \beta_1 law_{it} + \beta_2 states_i + \beta_3 year_t + \beta_4 region_j * year_t + \boldsymbol{\beta_5 x_{it}} \\ + \beta_6 prelaw_{it} + \epsilon_{it}, \end{aligned} \tag{15}$$

Equation 16 controls for crime's time trend for each state.

$$\begin{aligned} murder_{it} = \beta_0 + \beta_1 law_{it} + \beta_2 states_i + \beta_3 year_t + \beta_4 region_j * year_t + \boldsymbol{\beta_5 x_{it}} \\ + \beta_7 states_i * year + \epsilon_{it} \end{aligned} \tag{16}$$

Equation 17 controls for crime's post law time trend for each state.

$$\begin{aligned} murder_{it} = \beta_0 + \beta_1 law_{it} + \beta_2 states_i + \beta_3 year_t + \beta_4 region_j * year_t + \boldsymbol{\beta_5 x_{it}} \\ + \beta_7 states_i * year + \beta_8 law_{it} * states_i * year + \epsilon_{it} \end{aligned} \tag{17}$$

Now the data challenge here is that we don't have planned and unplanned murder data. What we do is to estimate the planned and unplanned murder rates based on the circumstances under which murder happens. One file where we find information about planned and unplanned murder is the *Murder Cases in 33 Urban Counties in 1988*. That file also has circumstances. Assuming the percent of planned murder under each circumstance doesn't change over the years, we can estimate the percentage of murder that are planned.

We weight all regressions by population.

Robustness checks will be performed regarding the truthfulness of our assumption.

7 Results

7.1 DID effect on Homicide

We estimate the difference-in-differences equations 12 to 17. The effect of the law on murder rate is reported in Table 11, together with heteroskedasticity-robust standard errors clustered by time and by state. It shows that, on average, the years after law passes have a higher murder rate than the years before the law passes, to be precise, between 8.4% and 9.3%.

We can see from column (1) that the law increases murder rate by 9.1% (statistically significant at the 10% level) more for states with the law than for states without it. Column (1) only includes state and year fixed effects. The significance level improves when we control for region-by-year fixed effects, as shown in column (2).

In column (3) we add time-varying controls such as the size of the police force. The point estimate decreases to 8.8% while the level of significance increases to 5% level. In column (4) we

estimate the equation with a dummy variable for the year when the law was passed. When this variable was added, the coefficient decreases by a small amount to 8.6%.

After adding time trends, the coefficient increases to 9%, while maintaining the same level of significance.

Table 11: The Effect of Stand Your Ground Law on Murder (UCR & Law Year Dummy)

	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.091**	0.084**	0.088***	0.086***	0.090***	0.093***
	(0.045)	(0.031)	(0.032)	(0.032)	(0.029)	(0.028)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Law Year Dummy				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	850	850	845	845	845	845

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12 shows the SYG Law has increased murder rate on average compared to three years or more before the law passes. The regressions are run on the state level. We control for state and year fixed effects throughout. Since each region will have similar characteristics in the same year when it comes to murder rate, column (2) controls for region-by-year fixed effects. Column (3) controls for time-varying factors such as incarceration rates. When we control for pre-trend in column (4), we see that compared to before, in the two years before law passes, we don't see significantly higher murder rate than even before that.

Column (1) - (3) tell us that the law has increased murder rate by around 9%, which is consistent with what is found in Cheng and Hoekstra [2013].

Column (4) adds a prelaw dummy, which is equal to one for two years before the year when the law passes, and it is equal to zero for all other years. For example, if the law passes in 2015, this variable would be equal to 1 in 2013 and 2014, and 0 in all other years. Compared to the average crime rate three or more years before the law passes, the two years before the law passes don't witness an increase of crime, meaning that the laws aren't passed in response to a rise in crime.

Table 12: The Effect of Stand Your Ground Law on Murder (UCR & Pre-Law Dummy)

	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.091**	0.084**	0.088***	0.093**	0.099***	0.098**
	(0.045)	(0.031)	(0.032)	(0.037)	(0.037)	(0.037)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Prelaw Dummy				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	850	850	845	845	845	845

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13 shows that compared to two years or more before the law passes, two years or more after the law passes don't see a much higher murder rate. law_b_year is a variable that takes on the value of 1 if the year is the year before the law passes. For the state of Florida, this variable will take on the value of 1 for the year 2004. law_a_year is a variable that takes on the value of 1 if the year is the year after the law passes. For the State of Florida, this variable will take on the value of 1 for the year 2006. Column (4) shows us that compared to two years or more before the law passed, the murder rate does not significantly increase two years or more after the law passes. This signals to us that most of the changes happen in the year prior to the law, the year when the law is passed, and the year after the law is passed.

Tables 11 and 13 therefore imply that either the year before law observe lower murder rate or the year after law observes higher murder rate.

Table 13: The Effect of Stand Your Ground Law on Murder (UCR & Around Law Year Dummy)

	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.091**	0.084**	0.088***	0.080**	0.070	0.075*
	(0.045)	(0.031)	(0.032)	(0.038)	(0.044)	(0.041)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Three Years Around Law Year				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	850	850	845	845	845	845

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7.2 Planned Murder vs. Unplanned Murder

What happens if we break down the murder rate into planned murder rate and unplanned murder rate?

Table 14 reports the coefficient β_1 in Equations 12 to Equation 17, estimated using different specifications, for planned and unplanned murder rate in logs. According to the planned murder regression in Panel A, column 1, SYG law increases planned murder by 10.1% on average. This estimate decreases to 7.3% when we include region-by-year fixed effects (column 2). However, when we include time-varying controls and law year dummy (columns 3 and 4), the estimate decreases to around 6%, and loses its statistical significance. When we add linear time trends, the coefficient estimates go back up and regain their significance, although not quite as large as before.

In Panel B we look at the impact of the SYG law on unplanned murder rate. The coefficient estimate is relatively stable across specifications, and it is larger than that of planned murder rate.

The mean increase for Panel A is 8.1%, while that for Panel B is 10.3%.

Table 14: The Effect of Stand Your Ground Law on Murder - with Law Year Dummy

Panel A: Planned Murder Rate	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.101*	0.073*	0.062	0.060	0.090***	0.097***
	(0.053)	(0.039)	(0.037)	(0.038)	(0.032)	(0.029)
Panel B: Unplanned Murder Rate						
Law	0.118**	0.095**	0.094**	0.092**	0.103***	0.114***
	(0.052)	(0.040)	(0.035)	(0.036)	(0.027)	(0.027)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Law Year Dummy				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	838	838	833	833	833	833

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15 shows the result comparing the murder rates after the law passed to three or more years before the law passed. The first three columns are the same as Table 14. However, coefficient estimates in columns 4 of Panel A is still not significant.

Column 4 - 6 in Panel B are statistically significant.

Table 15: The Effect of Stand Your Ground Law on Planned and Unplanned Murder

Panel A: Log Planned Murder Rate	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.101*	0.073*	0.062	0.059	0.093**	0.090**
	(0.053)	(0.039)	(0.037)	(0.042)	(0.036)	(0.035)
Panel B: Log Unplanned Murder Rate						
Law	0.118**	0.095**	0.094**	0.098**	0.119***	0.115***
	(0.052)	(0.040)	(0.035)	(0.041)	(0.035)	(0.031)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Prelaw Dummy				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	838	838	833	833	833	833

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16 shows that compared to two years or more before the law, two years or more after the law don't observe a significant increase in murder rate for planned murder. However, we do observe a significant increase in unplanned murder rate. This result is consistent with what we had with our general murder regressions.

Table 16: The Effect of Stand Your Ground Law on Murder - with Around Law Year Dummy

Panel A: Log Planned Murder Rate	(1)	(2)	(3)	(4)	(5)	(6)
Law	0.101*	0.073*	0.062	0.047	0.067	0.078*
	(0.053)	(0.039)	(0.037)	(0.044)	(0.049)	(0.043)
Panel B: Log Unplanned Murder Rate						
Law	0.118**	0.095**	0.094**	0.090**	0.096**	0.110**
	(0.052)	(0.040)	(0.035)	(0.044)	(0.048)	(0.044)
	(0.052)	(0.040)	(0.035)	(0.044)	(0.048)	(0.044)
State and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-by-Year Fixed Effects		Yes	Yes	Yes	Yes	Yes
Time-Varying Controls			Yes	Yes	Yes	Yes
Before and After Law Year Dummy				Yes	Yes	Yes
State-Specific Linear Time Pre-trends					Yes	Yes
State-Specific Linear Time Post-trends						Yes
N	838	838	833	833	833	833

Heteroskedasticity-robust standard deviations in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Tables 15, 14, and 16 present clear evidence that unplanned murder rates contributed to the increase in the total murder rate more than planned murder rates did. They are also consistent with the results from total murder rates.

7.3 Other Types of Crime

Robinson and Darley [2004] has found that when an action that was not previously punished is now punished, if the probability of punishment is quite low, it won't be able to suppress negative behavior very much. Since we have not seen a large increase in self-defense probability after the law, we can conclude that the level of self-defense has not increased enough to deter criminals.

The data we used for this exploration is the National Criminal Victimization Survey (2000-2017). It is conducted every year by the Census Bureau through in-person and phone interviews for each census region (Midwest, Northeast, South, and West). Of the questions asked, one of them is whether the respondent defended themselves or their property. We ran a panel regression of the percentage of respondents who defended themselves on the percentage of population in the census region who reside in a state with the law, and the results are in Table 17. One percentage point increase in population with law is associated with .02 percentage point decrease in self-defense. The

results are statistically significant, but not economically significant.

Table 17: Regression of Percent Defense on Percent Area with Law

Estimation Summary						
Dep. Var:	pdefense				**No. Obs:**	68
Entities:	4				**Time Periods:**	17
	Parameter	**Std. Err.**	**T-stat**	**P-value**	**Lower CI**	**Upper CI**
const	0.1348	0.0041	33.094	0.0000	0.1266	0.1429
perc_law	-0.0214	0.0100	-2.1321	0.0367	-0.0414	-0.0014

Correlation between percent respondent who carried out self-defense and percent population with law. When the population with the law increases by one percentage point, the percentage of population who carry out self-defense decreases by .02 percentage point.

Moreover, law change might cause confusion and have other negative implications. Robinson and Darley [2004] found that behavioral reasons lead offenders to offend more when there are law changes. The data is consistent with their findings, because none of the types of crime measured decreased, and homicide increased. For the SYG law, we are certain that there has been a large number of mistakes in jury instructions.

Table 18: Appeals Cases

Type of case	Numbers
Ruled as not self-defense	58
Ruled a more minor offense	26
Jury instructions error	42
Total	126

Out of 126 total appeals cases related to the SYG law, around half are ruled as not self-defense. Another one third had jury instructions error, and were granted a re-trial.

This might be why people are reluctant to carry out self-defense.

8 Policy Implications

We need to be careful about passing laws such as the SYG law, if it increases murder rate. Currently 30 states have passed the law. Law makers in the other 20 states should pay attention to this fact when they make decisions about passing it. Law makers in the 30 states with the law should consider potentially rolling it back. In 2017, Florida shifted the burden of proof in pre-trial

hearings. The prosecutor now has to prove that a person is not conducting self-defense rather than the offender having to prove their innocence. This is even more inductive for criminals and other states should not follow suit.

If such laws need to be passed, however, relevant training needs to be conducted. In order to be able to protect oneself, people need to be able to use the gun correctly and effectively. If people are unfamiliar with the use of the gun, they are likely to face retaliation and even more serious consequences than if they choose to walk away from a situation.

If such laws need to be passed, the administration needs to educate the public about them. This can be conducted by bringing prosecutors into the community for a talk, bringing prosecutors into schools for a talk, or even editing relevant information into the textbooks. During these talks/textbook edits, examples should be added so children and the general public can get a intuitive idea about what the law entails and have an opportunity to interact with prosecutors.

9 Conclusion

This paper looks at how the SYG law affects murder rate differentially for first-degree murder and second-degree murder. We present evidence that second degree murder is affected more by the SYG law than first degree murder. The results extend the finding that SYG law affects murder rate as a whole (Cheng and Hoekstra [2013], Humphreys et al. [2017a]). Our central estimate is that the rate of second degree murder increases by 1.5% more than the rate of first degree murder.

One limitation of this study is that it looks at the average effect of the law on all states. It is possible that different states face differential effects from the law. However, this study offers us a good idea of the overall impact of the law on the national level.

The data we are using come from first degree murder or second degree murder that is determined by the police when they generate the police report. However, when a conviction is made, it does not necessarily align with the determination of the police report. It is possible that the police report is biased towards a lighter crime, as evident in the Michael Drejka case, when the police did not initially arrest the gunman, but later he was convicted for manslaughter by the court. It is also possible that the police decide to report the case as a more serious offense, but later the court decides the case to be less serious than the police report suggests. We are in the process of obtaining some court convictions data to shed light on this issue. Our guess is that the bias can go both ways and as a result, they would likely cancle out with each other.

Compared to passing controversial laws such as the SYG law, a better way to deter crime is to increase education opportunities and economic opportunities in society. Anderson [2002] mentioned that educational programs, drug rehabilitation programs and youth programs could help reduce crime. Fighting violence with violence seem to have unintended consequences, as illustrated by this study.

10 Appendix

In 2005, Florida passed the stand-your-ground law; Arizona followed suit in 2006, then 28 other states gradually passed variations of this law, the last one being the state of Wyoming that passed it in 2018. Within these thirty states, North Dakota, Ohio, and Wisconsin have limited versions that restrict stand-your-ground to cars and business.

The complete list of states are as below:

Here is a list of states and dates of the passing of some law that expands the castle doctrine (NUL [2013]). In Florida, some arrests are not made because of a provision of the law. In this case the offender won't even be charged, so won't contribute to either murder or justifiable homicide.

Table 19: States that Passed the Stand Your Ground Law

States	Law Signed	Law Stipulations
Florida	4/26/2005	
Arizona	4/24/2006	
Kansas	5/25/2006	
Alabama	6/1/2006	
South Carolina	6/9/2006	
Georgia	7/1/2006	
Indiana	7/1/2006	
Mississippi	7/1/2006	
South Dakota	7/1/2006	
Kentucky	7/21/2006	
Louisiana	8/15/2006	
Alaska	9/13/2006	
Michigan	10/1/2006	
Oklahoma	11/1/2006	
Tennessee	5/22/2007	
North Dakota	8/1/2007	SYG from one's vehicle
Missouri	8/28/2007	House & Vehicle
Texas	9/1/2007	
West Virginia	3/12/2008	
Ohio	9/9/2008	SB184: car, home, temporary residence
Montana	4/27/2009	
Nevada	5/19/2011	
North Carolina	6/23/2011	
Pennsylvania	6/28/2011	
New Hampshire	9/14/2011	
Wisconsin	12/21/2011	car, business, and home (syg)
Iowa	7/1/2017	
Utah	5/8/2018	
Idaho	7/1/2018	
Wyoming	7/1/2018	

A list of states and dates when they pass the stand your ground law.

Below is a figure of how the murder rate has evolved over time. The orange dot denotes the year when the law was passed.

Figure 1: Time Series Graphs of State Murder Rate

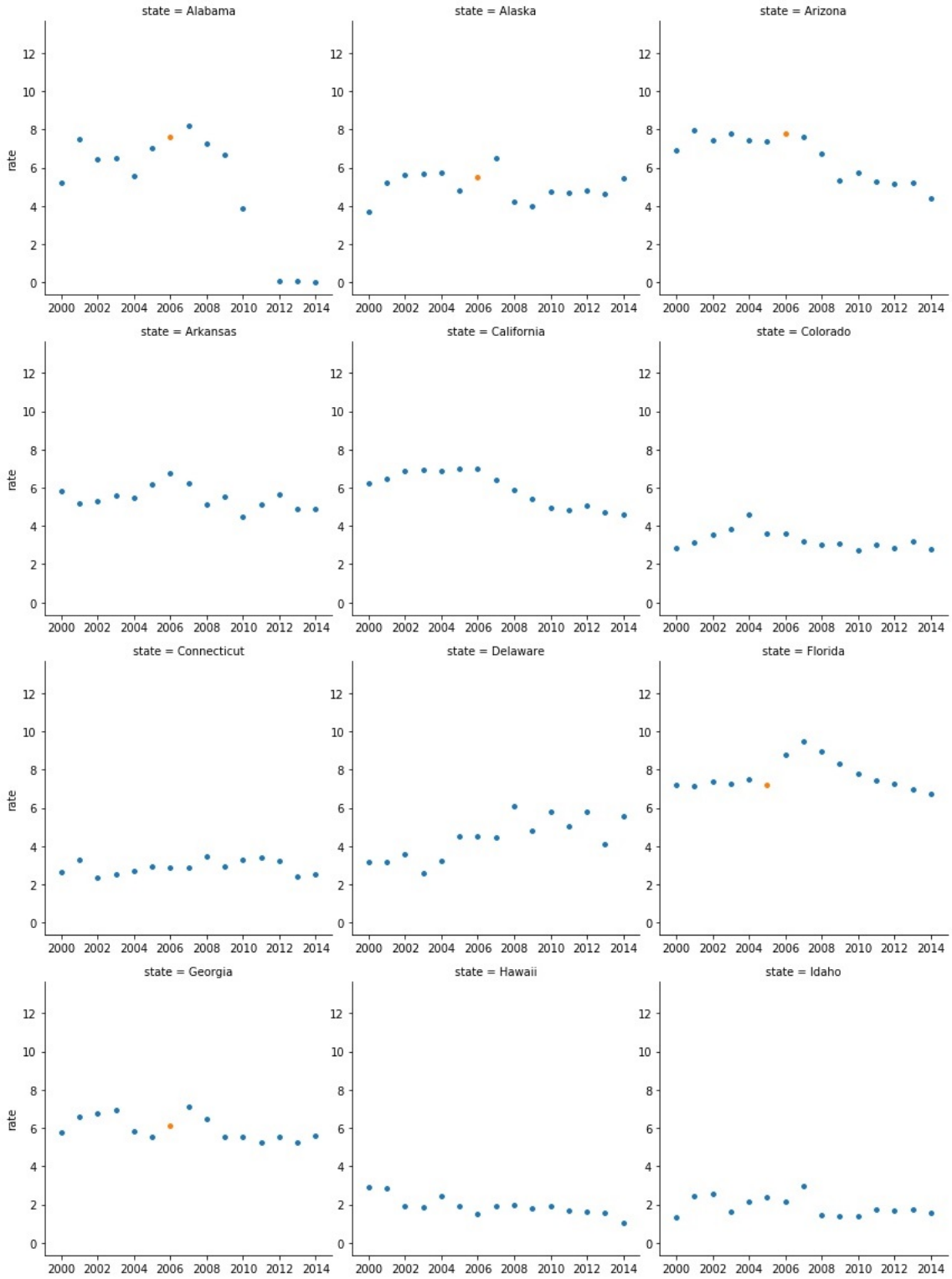


Figure 2: Time Series Graphs of State Murder Rate

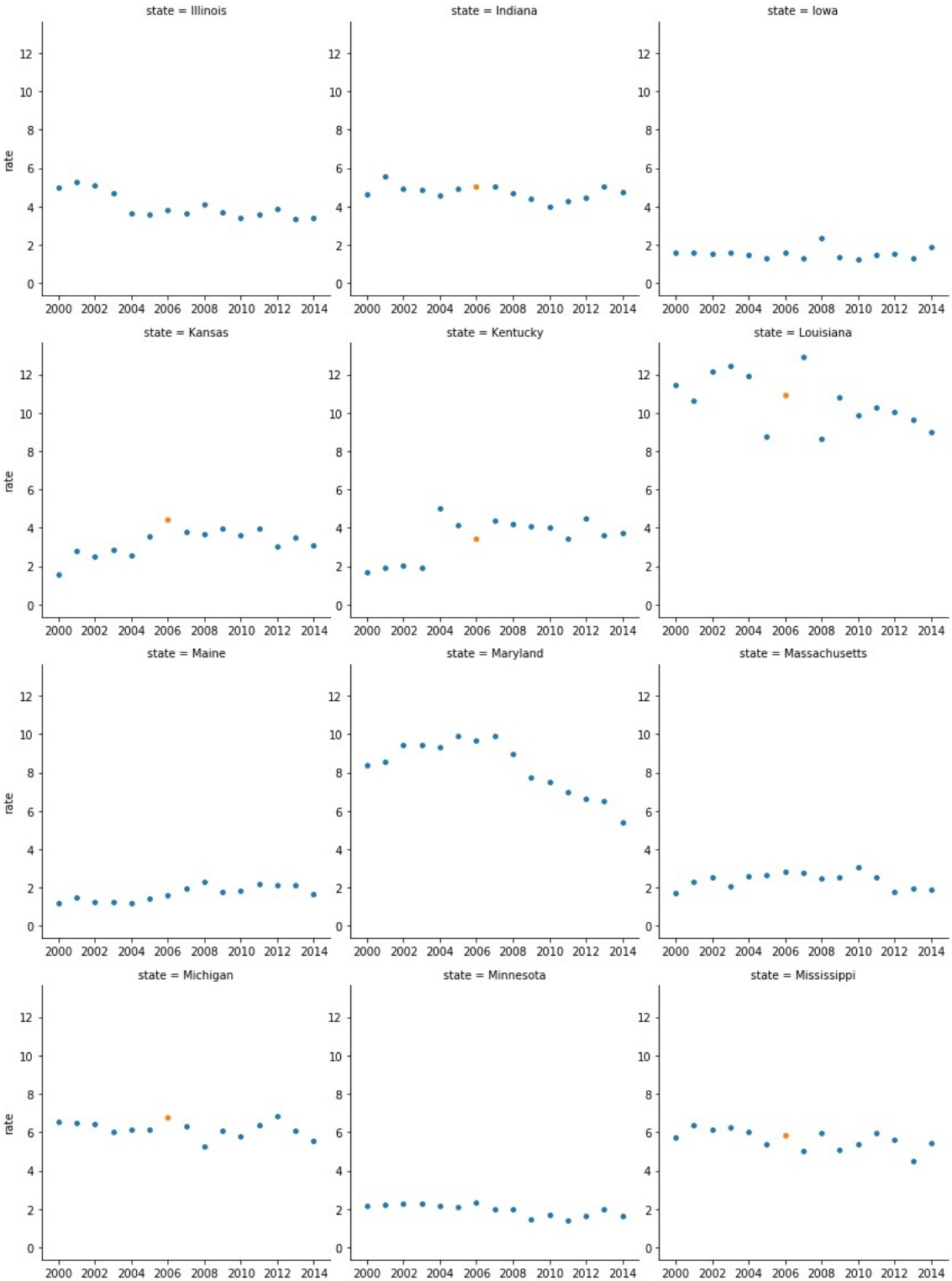


Figure 3: Time Series Graphs of State Murder Rate

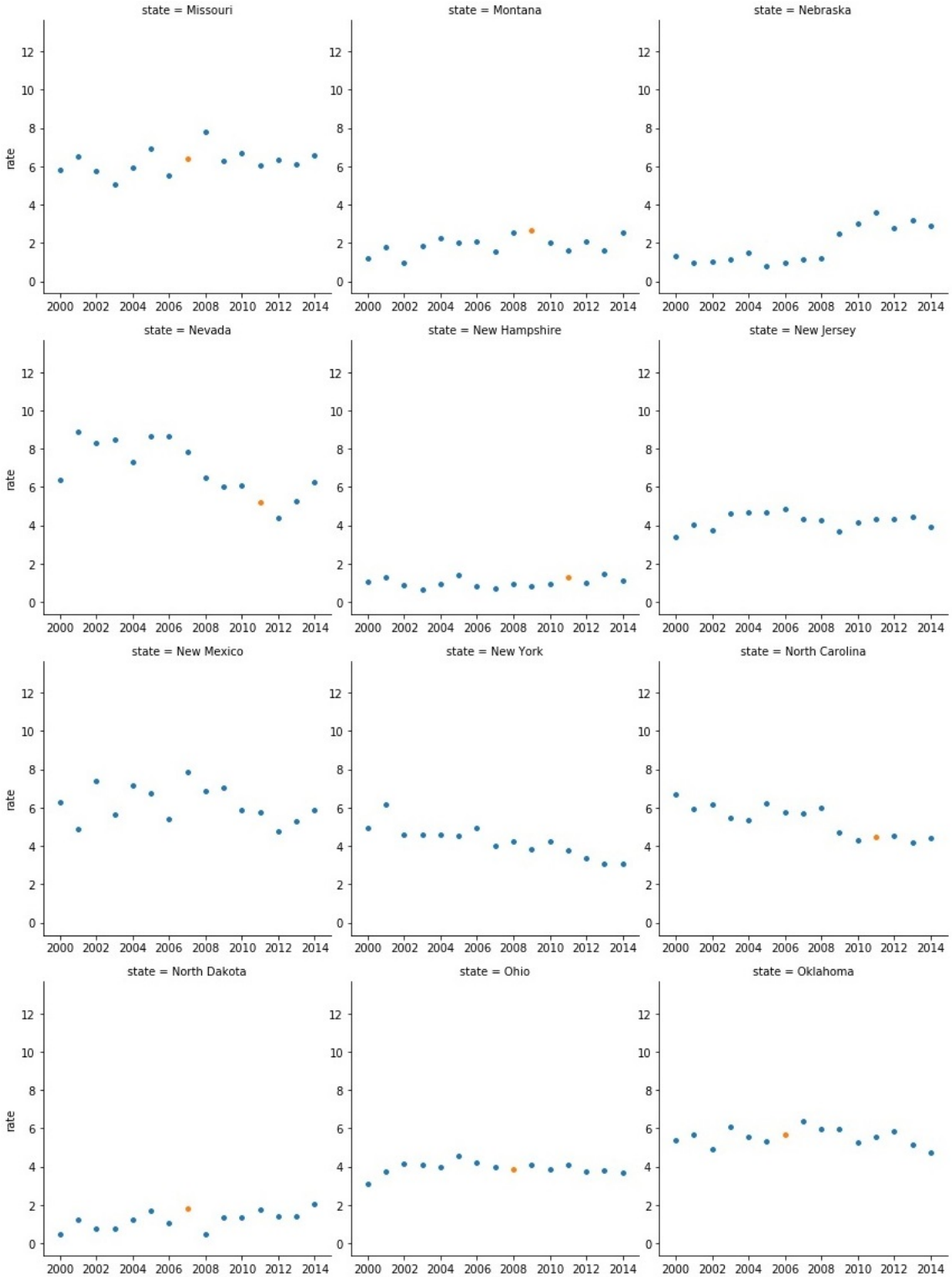


Figure 4: Time Series Graphs of State Murder Rate

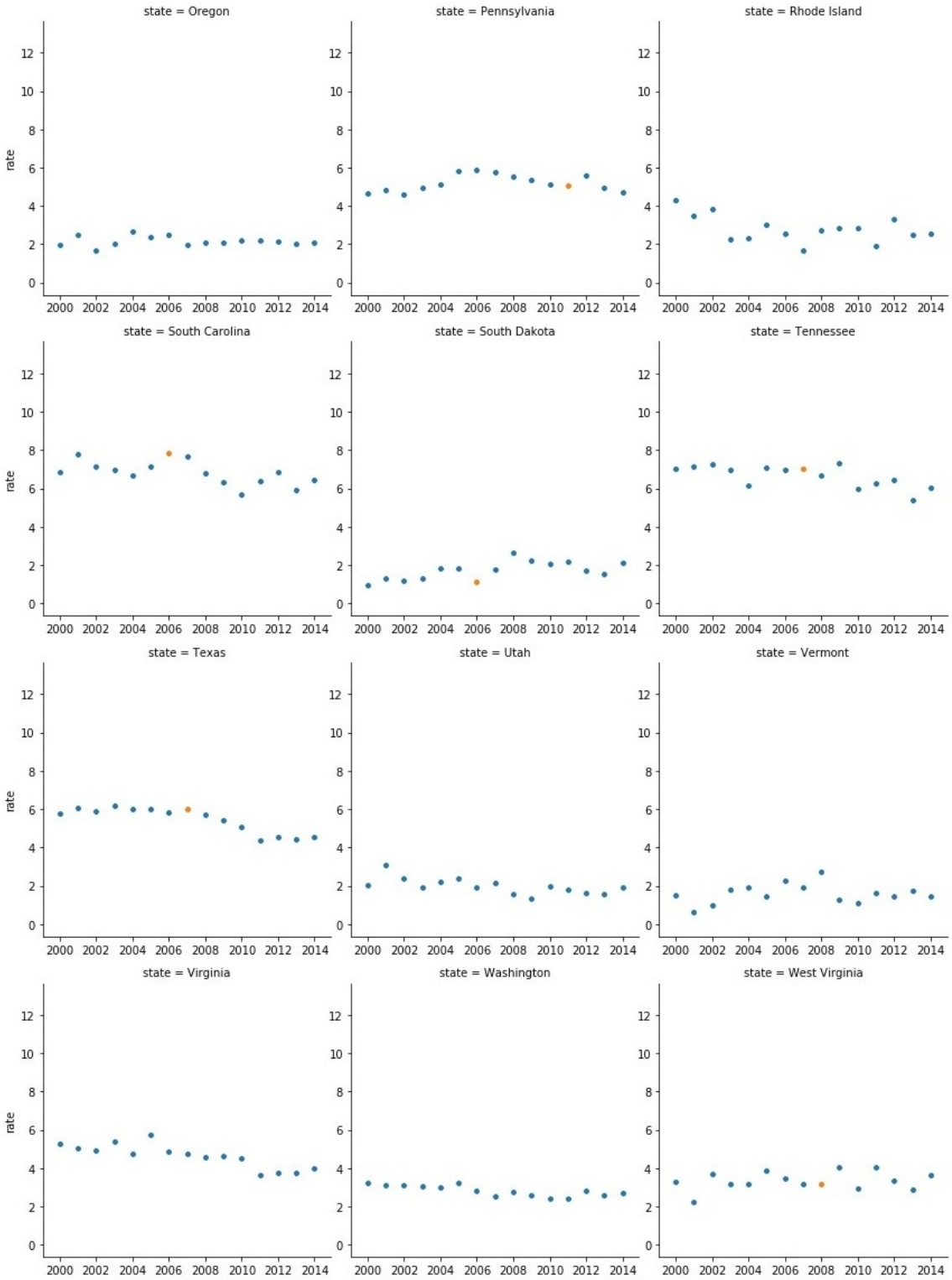
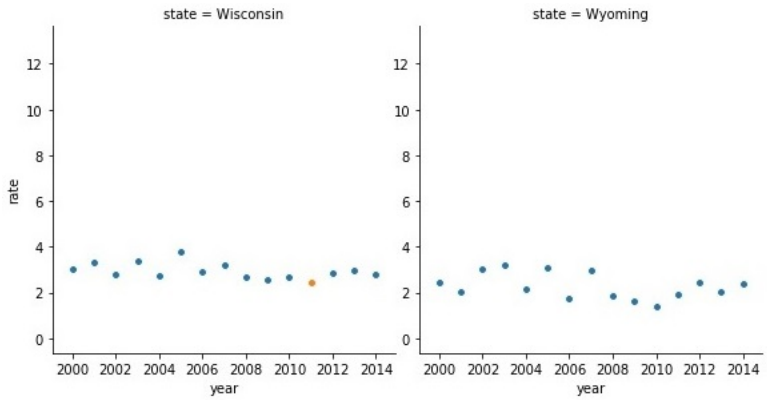


Figure 5: Time Series Graphs of State Murder Rate



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