An Economic Analysis if Legalization of Recreational Marijuana Impact Violent Crime?

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Abstract: This paper examine the whether the legalization of recreational marijuana impact violent crime. By replicating data for the same set of state on marijuana legalization, unemployment rate, death penalty, total law enforcement, poverty, graduation rates, households headed by single mothers, and gallons of alcohol, between the years 2003 to 2015, allowed me to control for unobservable characteristics and lags in behavior. Using 6 groups and 78 observations, evidence suggested that legalization is associated with a 4.75% decline in violent crime.

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Part I: Introduction

In 2012, Colorado became one of the first two states to legalize recreational marijuana. Although the enactment of recreational marijuana has proven to generate significant revenue to the state through taxation, there is still an ongoing debate about the effects marijuana has on criminality. While critics claim that marijuana causes violent crime through psychopharmacological effects, advocates argue that decriminalizing marijuana may eliminate the demand within the black market. By eliminating marijuana as a criminal offense for drug possession, the burden on law enforcement is decreased and thus releases budget and manpower, which instead can be spent on more severe crimes.

Previous research, however, has found that border regions to states that have legalized recreational marijuana have had higher rates of marijuana arrests than non-border regions (Hao and Cowan, 2017). This suggests, according to Becker's paper *Crime and Punishment: An Economic Approach*, that people who cross the border to obtain marijuana think that the expected benefits (possession of illicit drugs) exceed the economic cost (the risk of arrest). Another study made available by the U.S. Department of Justice stated that marijuana, among other drugs, are addictive substances, which can generate violent behavior. In other words, marijuana is seen as a "gateway" drug in which the continuous use of the drug can eventually lead to cocaine and heroin that are considered harder drugs; simultaneously increasing the crime rate to support these habits. On the contrary, evidence collect by Drug Policy Alliance showed that arrest for the possession of marijuana declined with 85% in Washington within the first year after that they legalized it in 2012. The legalization not only brought in $162 million in annual tax revenue in Washington, but it also helped reduce the savings in law enforcement by millions of dollars (Department of Revenue). Besides, in a scholarly journal written by Norwegian School of Economics together with Pennsylvania State University, violent crime within 350 kilometers from the border of Mexico decreased by 12.5% as marijuana became legalized (2017). According to their research, this resulted in a reduction of revenue of the Drug Trafficking Organizations (DTO's) because it allowed for new competitors to enter into the market to produce and sell marijuana safely. This ultimately reduced illegal transactions within DTO's, which in turn reduced violence along the border.

Since past literatures have come to different conclusion about how recreational marijuana impact violent crime, I found this topic worth investigating since crime rate is often a concern for the public safety and security within our communities.

Part II: The Model

This model is based on a two-way fixed effect model that controls for both stat-level and time-invariant unobservables. Table 1 present an overview of the dependent and independent variables, their definition, and expected sign. The expected signs presented below, describes the relationships between violent crime and economic and demographic conditions. The variable of interest in this analysis is whether

legalizing recreational marijuana (treatment) impact violent crime. However, to make the model robust, the model also controls for various observables and time fixed effects. The independent variables in this analysis include both continuous and binary variables that are manually collected from FBI, National Center for Educational Statistics, Bureau of Labor statistics, as well as United States Census Beureau.

Table 1: Variables, definition and expected signs

Variables	Definition	Expected Signs
Dependent Variable:		
Crime	Violent crime per 100,000 citizen	
Independent Variables:		
treat	1 if marijuana is legalized, 0 if not	Negative
urate	Unemployment rate (%)	Positive
dth_penalty	1 if death penalty, 0 if not	Negative
total_law	Total law enforcement employees	Negative
poverty	Poverty rate per thousands (%)	Positive
grad_rates	Graduation rate in High School (%)	Negative
single_mothers	Housholds headed by single mothers (%)	Positive
alcohol	Gallon of alcohol consumed per capita	Positive

The following model is set to determine crime, which is a continuous variable that represents violent crime per 100,000 residents. According to FBI, violent crime include four different criminal activities: murder, rape, robbery, and aggravated assault. On the other hand, the explanatory variable “treatment” is interpreted as a binary variable, where 1 signifies marijuana legalization and 0 if otherwise. The legalization of recreational marijuana is expected to be negatively correlated with violent crime as it reduce drug trafficking and illegal transaction. Holding all things equal, the effect of death penalty on crime is assumed to have a negative relationship as it discourages individuals from committing crime. Besides, I expect total law enforcement to decrease crime rate because as more officers are patrolling the streets, violent crime should go down due to their presence. At the same time, I anticipated poverty to be positive correlated with violent crime. One of many reason for this could be that people who live under lower socio economic standards have a higher level of stress that in turn may lead individuals to engage in violent acts to provide for themselves. Similarly, children growing up in households headed by single mothers is also expected to have a positive impact on crime because a child growing up without the influence of a father figure may be more prone to have violent tendencies. Another variable strongly correlated with violent crime is alcohol because not only does excessive drinking impair a person’s judgement but it also increase aggressive behaviors. Finally, graduation is expected

to lower crime rate because as student get more educated and earn more money, the opportunity cost to be involved in violent crime becomes less.

Part III: Data and Descriptive Statistics

With data compiled from FBI, NCES, BLS, and U.S. Census bureau between 2003-2015, I use descriptive statistics to compute the mean, standards deviation, minimum, and maximum for the dependent variable as well as the eight explanatory variables. That said, each estimation in the summary statistics is an average of six states; Colorado, Kansas, Nebraska, New Mexico, Utah, and Wyoming. Given the results, I will provide a brief explanation of the individual covariates at the end of this section.

Table 2: Summary Statistics for All Variables

Varibale	Obs	Mean	Std. Dev.	Min	Max
crime	78	347.54	143.63	195	702.2
lcrime	78	5.78	0.369	5.273	6.554
treat	78	0.051	0.222	0	1
urate	78	5.073	1.518	2.6	8.7
dth_peanlty	78	0.91	0.287	0	1
total_law	78	7636.11	4755.71	1419	17940
poverty	78	12.22	3.558	7.6	25.8
grad_rates	78	78.88	6.97	59.1	93.3
single_mothers	78	6.67	1.46	4.5	13.3
alochol	78	2.229	0.484	1.27	2.87

Table 2 indicated that out of 100,000 residence, on average 347 people engage in violent crime. However, the highest and the lowest number of crimes per 100,000 citizen were 702 and 195 respectively. The data also indicate that approximately 5% of the total population are unemployed whereas an average of 12% lived in poverty. For the total law enforcement employees, a state had on average 7,636 individuals. While the average graduation rate was 78.8%, the maximum rate was 93.3%. In addition, the percentage of household that were headed by single mothers were 6.67%, ranging from 4.5% to 13.3%. Finally, an average person across the six states consumed roughly 2.23% of pure alcohol a year.

Part IV: Empirical Results

The fourth section of the project present the empirical result using three different models. The first regression simply looks at the impact of the treatment (marijuana legalization) on violent crime, not controlling for any other observable factors or time fixed effects. The second model does the same as the first one, but now controls for the impact of time (time fixed effects) on the outcome given time-related impacts on all states (i.e. natural fluctuation). The last regression controls for various observables and time fixed effects.

TABLE 3: Regression Results (Dependent Variable: lcrime)

	Model 1	**Model 2**	**Model 3**
treat	0.1218***	-0.0515**	-0.0475**
	(-9.9e+0.7)	(-2.80)	(-2.95)
urate			0.00009
			(0.01)
dth_peanlty			0.0127
			(0.67)
total_law			-0.000013***
			(-4.49)
poverty			0.0096*
			(2.23)
grad_rates			-0.00129
			(-0.45)
single_mothers			0.0109
			(1.10)
alochol			0.2541**
			(3.41)
Constant	5.7848***	5.8515***	5.2517***
	(6.3e+09)	(221.67)	(14.05)
Number of obs	78	78	78
Number of groups	6	6	6
R^2	0.0005	0.0267	0.1693
State FE	Yes	Yes	Yes
Time FE	No	Yes	Yes

Note: T-statistics are in parenthesis underneath the coefficient estimates. The stars *, **, ***, indicate statistical significance at 10%, 5%, 1% respectively.

As presented in table 3, the coefficients estimated represent a difference in differences estimation that compared the world in which the treatment occurred to the world in which it did not. Since this paper looks at the causal effects of recreational marijuana legalization (RML) in Colorado, I used the bordering states as counterfactual. Given the results, model 3 which is the most robust specification, shows that the legalization is associated with a 4.75% decline in violent crime in the state. This implies that allowing Colorado's residence for the distribution and possession of marijuana helps to reduce violence in form of murder, robbery, rape, and aggravated assault. However, when looking at how RML change as we add time fixed effect, one can see that as we go from model 1 to 2, RML decline violent crime from 12.18% to 5.15%. This drop in covariant is natural as it accounts for natural fluctuations in the outcome stemming from time.

Holding all other factors constant, the most significant factors besides the variable of interest were total law enforcement employees, poverty rate per thousands, and gallon of alcohol consumed per capita. While total law enforcement employees were statistically significant at 1%, it was economically irrelevant as it was close to zero. Poverty, on the other hand, were found to have a significant and direct impact violent crime as it caused it to increase with 0.96%. This result is not unexpected as a person might engage in violence to provide for oneself. However, violence is a not cause of poverty, rather a symptom of living with lower socio-economic standards. Lastly, gallon of alcohol per capita were strongly correlated with violent crime. In fact, increasing alcohol consumption with one percent is estimated to rise criminal activity with 25.4%. Given these points, the standard errors for all three models above are clustered at the state level.

Figure 1: The Line Graph illustrating a relationship between lcrime and time

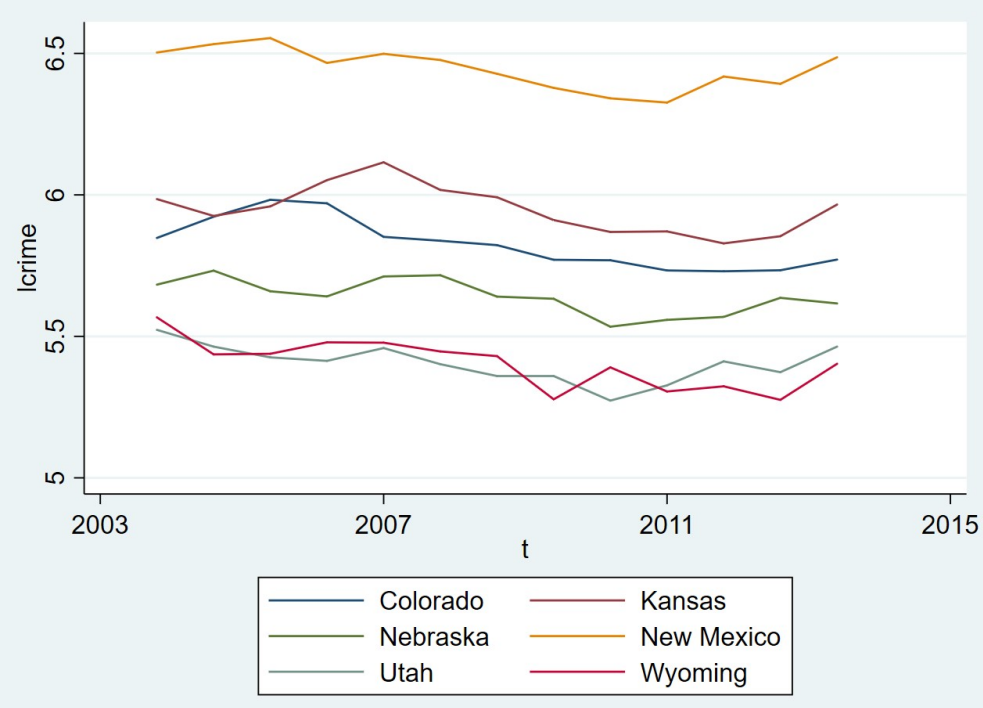

Figure 1 is a visual representation of the second model in the regression analysis above. The blue line shows the impact of the treatment (marijuana legalization) on violent crime in Colorado while controlling for the impact of time fixed effect. With this in mind, one can see a steady decline in violent crime over time.

Part V: Conclusion

This research paper is an economic analysis on whether the legalization of recreational marijuana in Colorado impact violent crime. The results suggested that legalization is associated with a 4.75% decline in violent crime in the state. This is achieved by using bordering states to Colorado as the control group. Besides the treatment, which was my variable of interest, total law enforcement employees, poverty, and gallon of alcohol per capita were statistically significant at 10%, 1%, and 5% respectively.

Given the overall findings of this project, R square indicated that only 16.9% of the variation in violent crime is explained by the independent variables. However, under the Ordinary Least Square assumptions, we are not interested in maximizing the residual. Rather the goal is to find betas that minimize the sum of squared residuals. However, all things considered there are definitely other economic and

demographic conditions that were not explored in this model that future researchers could include to better infere causality.

Yet, since the legalization of marijuana was enacted 3 years ago, little study has been done in the area of violent crime. This made it hard to collect sufficient post-legalization data to accurately interpret the true effect of legalization on violent crime. Given that marijuana possession according to federal law is still considered a crime, it is evident from these results that further research about the cost and benefit of legalizing marijuana needs to be done in order to determine if decriminalization is the best way to go.

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