

Racial Disparities in Marijuana Possession Arrests

Abstract

The purpose of our study is to examine the significant indicators for disparities in the rate of incarceration (by state) for marijuana possession arrests amongst Black and White individuals. We theorize that the status of marijuana decriminalization in a state and a state's expenditure on marijuana possession prohibition, drug prohibition, and policing are the most significant indicators when examining racial disparities in incarceration rates between states. We investigated this relationship with the use of R Studio, and ran multiple linear regression models to find correlations between the rate of incarceration for Black and White individuals and the predictive variables aforementioned. We found that the status of decriminalization is a good predictor of the incarceration rate for Black and White individuals. We did not find this same correlation between the incarceration rate for Black and White individuals and our expenditure regressors.

Introduction

Despite the recent wave of state legislatures legalizing and decriminalizing marijuana over the past two decades, the incarceration rate of Black individuals in these states continues to be significantly higher than that for Whites. To better understand why Black people are more likely to be arrested than White people for marijuana possession - even in states that have legalized marijuana - we investigate the relationship between a handful of legislative, expenditure, and Census data to the incarceration rates of Black and White individuals in each state. We theorize that the status of marijuana decriminalization in a state, the proportion of the state's population that is Black, and a state's expenditure on policing, drug prohibition, and marijuana possession prohibition are significant factors when determining the rate of incarceration for Black and White persons.

For our investigation, we considered multiple possible outcomes, and so we have multiple hypotheses.

- 1) We hypothesize that: if a state has decriminalized marijuana, then the rate of incarceration would decrease more dramatically for Black individuals than their White counterparts.
- 2) We hypothesize that: if a state is spending more on policing relative to other states, that the incarceration rate for Blacks will be relatively large compared to that of Whites
- 3) We hypothesize that: if a state's expenditure for drug and marijuana possession prohibition is relatively large compared to that of other states, then the latter state will have a greater rate of incarceration for Blacks

We are only able to validate our first hypothesis, but found interesting results for the latter two hypotheses. For our second hypothesis, we found that states' spending more on policing did not directly correlate with an increase in incarceration for Black and White individuals. Though a state's expenditure on policing decreases when a state decriminalizes marijuana, this decrease in expenditure was not found to be statistically significant as a predictor of increases or decreases in the incarceration of Black and White individuals. What we found to be most interesting was the relationship between drug and marijuana possession prohibition expenditure to the status of decriminalization. When a state decriminalizes marijuana, expenditure on drug and marijuana possession prohibition increase. Though this does not tell us anything about our outcome (rate of incarceration), we found this necessary to discuss.

Context

The production, sale, and use of cannabis has been and continues to be a highly contentious topic amongst state legislatures. Since the popularity of cannabis has risen dramatically in the past two decades, policy makers at the state level have begun implementing different forms of marijuana legalization. As of 2022, 39 states have legalized or decriminalized medicinal and/or recreational marijuana use, however, the implementation of legalization and decriminalization statutes are not equal across state lines. Alex Kreit, a professor at Northern Kentucky University, investigated differences between cannabis decriminalization implementation amongst different states and found that the penalties and fines imposed on marijuana users can vary drastically.

Similarly, states which have legalized or decriminalized marijuana may still spend significant funds on marijuana prohibition. How much state legislatures may spend varies, but for all drug prohibition expenditure, there does not exist any federal guidelines directing state action on intrastate cannabis legislation. So, states are free to impose fines and penalties for marijuana possession at any level and determine marijuana prohibition expenditure without federal insight. The freedom state legislatures have to dictate these monetary values are a burden to the Black residents in many states.

Black people (predominately Black men) make up a majority of America's prison population. In 2013, the ACLU reported that almost 50% of all drug arrests that year in the United States were for marijuana possession. Though White and Black people consume marijuana at similar rates, Black people are 3.73 times more likely than Whites to be arrested for marijuana possession (Edwards et al, 2013). Racial disparities in marijuana prohibition enforcement have been salient since the War on Drugs era; now, states continue to enforce marijuana prohibition while simultaneously profiting from the taxes imposed on marijuana

distributors and consumers. If cannabis's popularity continues to increase, and with it the legalization or decriminalization of marijuana, then it is necessary that more equitable methods of legalization be introduced so that Black people no longer bear the brunt of the burden for marijuana possession violations.

Data, Methods and Results

For our investigation, we collected data from multiple databases and concatenated that data into a single Excel file. We found our incarceration data from the FIBRS, our population data from the Census, while our expenditure and legislative variables were collected from independent research done prior to our investigation. We attribute our expenditure data to Jeffery Miron from the Cato Institute, and our legislative data from previous research done by our group members.

We conducted our analysis in R Studio, and used 3 primary packages for cleaning, transforming, and analyzing our data: readxl, tidyverse, and dplyr. We used readxl to transform and store excel files into the dataframe (Schauberger et al, 2022). We used the tidyverse visualization package, which includes ggplot2, to design and create different plots, such as: residual plots, bar plots, box plots, line plots, and scatter plots(Wickham et al, 2019). Within the tidyverse package is tidyr, a tool we utilized to tidy up the data (Wickham et al, 2022). Lastly we used dplyr, to create dataframes for our analysis (Wickham et al, 2022).

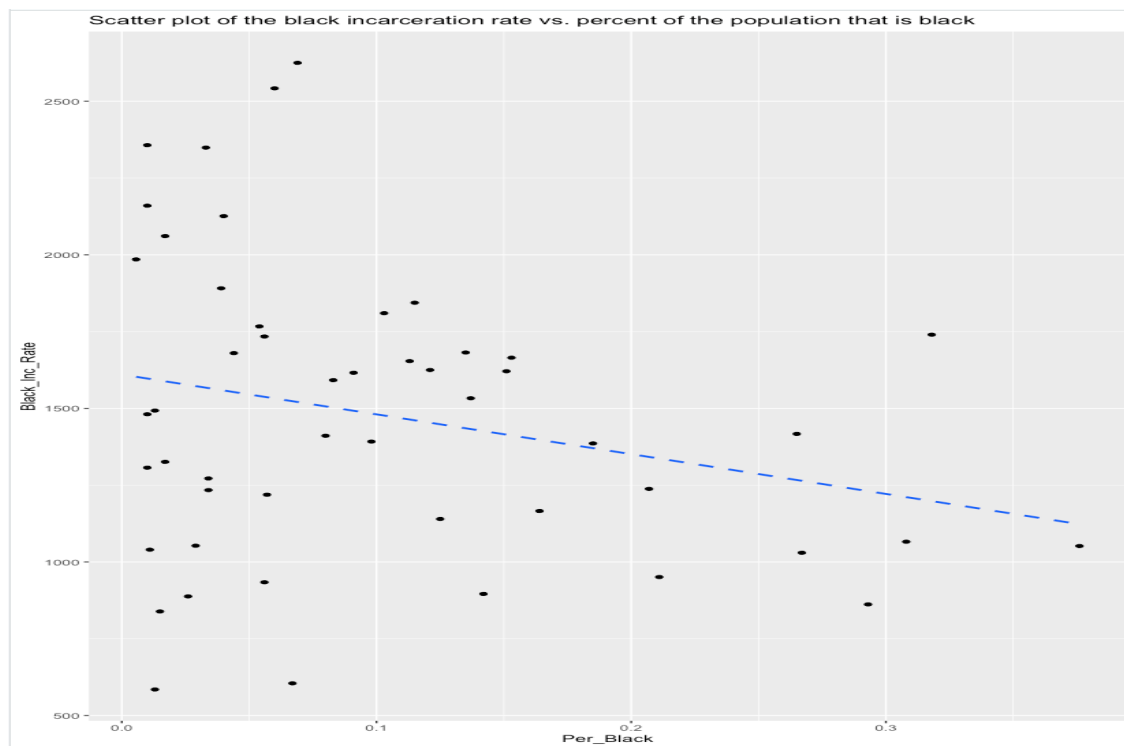
The dataset used consists mainly of rates, binaries, and integer data. The only binary we examine is for decriminalization, and the only two rates we examine are for incarceration. The rest of our data are integers for expenditure which are counted in the millions and billions.

When using the dataframe in R, there were multiple variables which were considered insignificant and unnecessary. We solved this in R by using: `df <- subset(df, select = -Illegal)`. The main application for plotting graphs was ggplot, a package inside tidyverse. The tool ggplot is very easy to implement, as once a template for the code has been filled, changing graph types only requires one word changed:

```
Line <- ggplot(df, aes(x=Police_Expend, y= Black_Inc_Rate, fill=Police_Expend)) +  
geom_[InsertGraphType]()  
Line <- Line + labs(title = "Line plot of the black incarceration rate vs. police expenditure in  
each state")  
Line
```

For line plots: `geom_line()`. Scatter plots: `geom_point()`. Boxplot: `geom_boxplot()` were used in the code. While many graphs have been introduced, one of the most interesting results

from our findings was a scatter plot comparing the percentage of Black people in a population to the Black incarceration rate:



While looking at the results, it is evident that the lower the percentage of Black people in a population is directly correlated with a higher Black incarceration rate. Following the line of best fit, the results that are higher for the Black incarceration rate almost exclusively belong in populations with under 50% black people. Much like ggplot, to plot a regression model the same template should be followed, only needing to change one variable to run different types of generalized linear models:

```
fit <- glm(X_variable~Y_variable+Y_variable+Y_variable$+Y_variable,
data=df,family=[GLM type]())
summary(fit)
```

We used 3 GLM models to run our regression: logit, quasibinomial, and poisson regression. The Poisson regression was helpful in producing results as it was best for modeling response variables that are counts. Logit was instrumental in our findings, for the predictive model generated from the logit regression provided us with incarceration outcomes when various regressors are inputted. Finally, the binomial regression displayed the binomial distribution, which was not primary to our analysis, but was helpful in visualizing the data with a slightly different model than the previous 2. As numbers give clearer results than anything else, it was

essential to provide statistics, from mean, median, and average to finding the 95% Confidence Interval, as well as t-tests with p-values. Linear regression was also implemented and once every model had been created, the data produced for the most significant of our regression is as follows:

```
> summary(df)
```

States	White_Inc_Rate	Black_Inc_Rate	Status	Per_Black
Length:50	Min.:81.0	Min.:585	Min.:0.00	Min.:0.0056
	1st Qu.:202.0	1st Qu.:1084	1st Qu.:0.00	1st Qu.:0.0300
	Median:256.0	Median:1449	Median:1.00	Median:0.0680
	Mean:279.1	Mean:1479	Mean:0.64	Mean:0.1014
	3rd Qu.:361.5	3rd Qu.:1738	3rd Qu.:1.00	3rd Qu.:0.1407
	Max.:580.0	Max.:2625	Max.:1.00	Max.:0.3760

Weed_Prohibition_Bil\$	Police_Expend	Possession_Expend	Possession_Arrests
Min.:17.40	Min.:1480	Min.:1022	Min.:166
1st Qu.:53.98	1st Qu.:14974	1st Qu.:11675	1st Qu.:2454
Median:75.10	Median:30236	Median:23142	Median:4922
Mean:120.56	Mean:60693	Mean:48324	Mean:10809
3rd Qu.:129.38	3rd Qu.:65745	3rd Qu.:53414	3rd Qu.:14256
Max.:951.40	Max.:388812	Max.:291939	Max.:65246

When looking for the 95% Confidence Interval, p-values, and t-tests, the easiest method to retrieve these results also included; Deviance Residuals, Estimated standard deviance, Error margin, Null/Residual deviance, and an AIC (Akaike information criterion). The results were:

```
>t.test(df$Black_Inc_Rate, df$White_Inc_Rate, correct=FALSE)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.8054	-1.1845	0.7014	0.9818	1.2846

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	1.047e+00	9.324e-01	1.123	0.261
White_Inc_Rate	-3.110e-03	2.770e-03	-1.123	0.261
Per_Black	-4.770e-01	3.321e+00	-0.144	0.886
Police_Expend	-3.932e-05	6.462e-05	-0.609	0.543
`Weed_Prohibition_Bil\$`	2.752e-03	4.557e-03	0.604	0.546

Possession_Expend	5.302e-05	7.820e-05	0.678	0.498
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(Dispersion parameter for binomial family taken to be 1)

Null deviance: 65.342 on 49 degrees of freedom

Residual deviance: 61.702 on 44 degrees of freedom

AIC: 73.702

Number of Fisher Scoring iterations: 4

Discussion

We investigated the relationship between the incarceration rates for Black and White individuals and various economic and legislative factors. We did so in the hopes of finding a correlation between these factors and incarceration, but were unable to prove - given the restrictions of our analysis - that these factors were statistically significant in all cases. However, we surmise that the relationship we found between these factors provide a base for others who'd like to further investigate racial disparities in the incarceration of Black and White people.

Our first hypothesis was validated by our analysis; however, the other two of our hypotheses could not be proven by our study, specifically that increased state expenditures would increase incarceration rates disproportionately for Black people, and that the states with the highest prohibition expenditures would also have the highest Black incarceration rates.

We recognize that our investigation was extremely limited. We were unable to do more deliberate predictive analyses for Black and White incarceration rates. One reason for this is how we cleaned the data, and the transformations we made to the data concurrently. For example, in many states in the Northwest, Black populations are relatively small compared to Southern states. Because of this difference, the magnitude of the Black incarceration rate in these small states seems excessively large even when the actual count of Black persons incarcerated is relatively small. Had we made a logarithmic mutation to the data, then this issue of magnitude could have been avoided. Many of the limitations of our analysis stem from our cleaning and transformations, and we are certain that better predictive models can be created.

For those hoping to replicate the models we've created (or make them better), and continue research on the racial disparities in incarceration for marijuana possession, we'd recommend greater consideration for differences in marijuana jurisprudence. We focused our study on decriminalization, but that is a blanket term for various enforcement methods states may consider when determining the status of marijuana legalization. Because decriminalization is not uniform across the nation, we'd recommend other researchers to cluster decriminalization

(unpack the binary we created) into proper subgroups by similarities. For example: Boston, New York, and New Jersey have all recently (within the past decade) legalized or decriminalized marijuana. Due to proximity, shared cultures and economics, and relatively fluid political relationships, all three states have implemented similar forms of legalization. However, these forms are starkly different from Colorado's legalization of marijuana, which is more liberal and does not harshly penalize marijuana users or sellers. Even though a state like New Jersey has legalized marijuana, marijuana users in the state are at greater threat of incarceration for their use compared to a marijuana user in Colorado. Had we clustered the different types of marijuana legalization by similarity, then we could have told a more comprehensive story about how marijuana decriminalization impacts racial disparities in incarceration.

References

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