**The Effects of Incarceration on Illicit Drug Use**

**An Economic Approach**

Connor Vaughan

Spring 2019

**I. Abstract**

This paper examines the correlation between a state’s rate of incarceration and its rate of illicit drug use. Using economic crime models, it will attempt to determine the effects of incarceration on illicit drug use and suggest reform to public policy. This analysis finds that increasing incarceration does reduce rates of illicit drug use. However, further research needs to be done to determine if this is the most cost-effective solution to lower rates of drug use. Current research has evaluated the effectiveness of other options to combat drug use and used in conjunction with these findings, public policy can reconsider its approach to dealing with drug offenses.

**II. Introduction**

The U.S. accounts for 5% of the world’s population yet is home to 25% of the world’s prisoners. (Savage, 2013) Of these incarcerated individuals, 45.4% are there for drug related offenses according to the Federal Bureau of Prisons. (2019) This primarily began with President Nixon declaring a war on drugs 1971, which saw prison and jail sentences for drug related crimes rise dramatically; and while this may have been with the best intentions, it seems to have done more harm than good. While illicit drugs are harmful to a society, the negative externalities associated with incarceration are arguably much worse. Laws and policies should be constantly evaluated to determine if they are the most cost-effective solution to a social issue. There is significant research into drug treatment methods to determine their effectiveness, and they have been shown to perform better than incarceration. The goal of this paper is to use economic tools to determine if the U.S.’ approach to dealing with drug offenders through incarceration is effective. This motivated the research question for this project: How does a state’s incarceration rate affect its rate of illicit drug use?

Many U.S. citizens have begun to question the U.S. justice system’s approach to dealing with drug offenders and some states have begun to roll back some of the harsh laws relating to drug offenses. For example, some states have gone as far as legalizing marijuana and the impact of this decision is still being researched. However, the number of people incarcerated for drug offenses if barely falling. This paper is not attempting to make any moral arguments, but rather look for correlation between a state’s incarceration and its illicit drug use.

It is difficult to determine exactly what the proper punishment is for any given crime, as this can be ambiguous and based on opinion. However, through economic analysis, it can be determined if states that have adopted and maintained a more aggressive approach to dealing with drug offenders have been able to lower their rates of illicit drug use compared to other states. Economists have attempted to create models that determine the social welfare maximizing punishment for a crime, but these seem to be underutilized.

The rest of this paper is structured as follows: section III will discuss the current relevant research on factors that affect illicit drug use, followed by section IV, the economic models that determine the welfare maximizing punishment for a crime. Section V consists of important statistics about the data as well as graphs and diagrams to help visualize it, followed by section VI which will cover the results and evaluation of the regression analysis, then there will be a conclusion, section VII, reflecting on the results, and finishing with a list of references used.

**III. Review of Literature**

In order to solve any social issue, research must be conducted into the causes, as well as the effectiveness of previously attempted solutions to determine the optimal course of action. Social intervention into substance abuse is a perfect example of this because the government as well as other social programs have been trying to combat this issue, with varying degrees of success. Applying economic analysis to this problem can offer powerful insights to provide policymakers with information that can guide their decisions.

**Economic Factors Correlated to Illicit Drug Use**

The economic factors that may influence illicit drug use have been examined at both the individual and macro level. In the U.S. the number of fatal drug overdoses increased by 146% between 1999 and 2014, which has been primarily attributed to the rise in opioid abuse. (Rudd, 2016) Hollingsworth, Ruhm, and Simon (2017) decided to study specifically how macroeconomic fluctuations effect the illicit use of opioids. To measure the level of opioid abuse they used regressions with either opioid related mortalities or emergency department visits as the dependent variable. The variable used to track macroeconomic conditions was unemployment, because this is standardly measured and is a good proxy for macroeconomic conditions. They also included other independent variables to control for other factors that may have influenced illicit opioid use over this time period. Their results found that a one percentage point increase in the unemployment rate was correlated to a .19 per 100,000 increase in opioid related deaths at the county level. Their results also show a seven percent increase in opioid related emergency department visits. When they used their regressions with state level data the results were even greater, with unemployment coefficient rising to .33 per 100,000. The opioid related emergency department visits also rose significantly to 3.12 per 100,00. The researchers believe that the primary causal linkage between macroeconomic conditions and opioid abuse is related to the increase in mental health issues associated with economic weakness. They do acknowledge that there are many factors that affect drug abuse but do believe their regressions properly accounts for these. One primary factor that was not addressed in this article was the rapid increase in the prescription of opioids and other pain killers during this time period. Other research suggests that the primary cause of the “opioid epidemic” is the over prescribing of illicit drugs by healthcare professionals.

While there is some research about macroeconomic conditions influencing drug abuse, most research focuses on variables that make individuals more prone to illicit drug use. Many of these variables are psychological, but studies have found statistically significant correlations between a person’s economic wellbeing and their likelihood of drug abuse. Basic economic theory suggests that because drugs are considered a normal good, their consumption should rise as an individual’s income rises. However, the results of a study by Corman, Dhaval, Dhiman, and Reichman (2013) don’t support this idea. Their study examined how the welfare reforms that began in 1992 have affected the illicit drug use of women. They predicted that these reforms led to a decrease in overall illicit drug use due to potential sanctions from welfare programs as well as drug testing conducted by employers. Using data from the Household Survey on Drug Use and Health, they applied a multivariate regression with illicit drug use as the dependent variable. The independent variables were welfare policy, individual characteristics such as age, race/ethnicity, highest grade completed, as well as time-varying factors. The regression equation was run on both the test group which consisted of women currently on welfare as well as a control group which consisted of women not enrolled or potentially in need of welfare. Corman, Dhaval, Dhiman, and Reichman’s study found several statistically significant results on the effects of welfare reforms on illicit drug use by women. First, welfare reform saw reported illicit drug use in the past month fall by 2.6% among low educated single mothers even when other factors are accounted for. When they examined specific welfare programs, they found that AFDC was associated with a 3.8 percentage point decrease in illicit drug use over a year and TANF was associated with a 2.9 percentage point decrease. When compared to the control group these effects are even greater because during this same time period illicit drug use was on the rise amongst other adult women. These results were all based on the data from the National Household Survey on Drug Use and Health which leads to some potential limitations. Primarily, during this time period drug related policy was resulting in harsher punishments for drug use, which may have led to individuals under-reporting their illicit drug use.

In an attempt to account for the potential under-reporting of illicit drug use Corman, Dhaval, Dhiman, and Reichman (2013) also used drug related prison admissions data to further confirm their findings. The results from this regression suggest that the reforms related to TANF and AFDC led to an 11% decline in drug related prison admissions. Unfortunately, these results were statistically insignificant but do have t values greater than 1. It is not surprising that the results from this regression are insignificant because it seems difficult to directly correlate welfare reform to incarceration rates. However, this study was able to find statistically significant results in the decline of drug related arrests correlated to the TANF and AFDC waivers, which was between 6 and 7%. Similarly, the number of drug related hospital emergencies was 5-8% lower for the test group than the control group. When they considered the reduction in all these variables, they concluded that the welfare reforms led to a 10-21% decline in illicit drug use by women on welfare. Corman, Dhaval, Dhiman, and Reichman (2013) make an important point that it is difficult to determine if the decline in illicit drug use was directly related to the welfare reform’s drug policies or if it was more related to employer drug testing. (Corman, Dhaval, Dhiman, and Reichman 2013) Other studies have shown that TANF increased labor force participation and it may be that being employed caused individuals to alter their behavior to abstain from illicit drug use. It is also important to consider the variations between drug enforcement policy between states and years, which can be difficult to control for in regression analysis.

**How Illicit Drug Use Can Affect the Economy**

In the previous section the effects of economic factors on illicit drug use were examined but is important to consider the direction of causality. Research suggests that illicit drug use effects the economy to the same magnitude that economic conditions effect drug abuse. Conceptually it seems reasonable that individuals addicted to illicit drugs will have higher levels of unemployment and lower labor force participation. French, Roebuck, and Alexandre (2001) conducted a research study to test this theory. They began with 2 separate univariate probit regressions, the first with the dependent variable being employment, and in the second, the dependent variable was labor force participation. The first independent variable for both was a vector of demographic characteristics that influence employment and labor force participation such as age, race, education, marital status, etc. The second independent variable was a dichotomous measure of illicit drug use; he also ran various regressions, some using chronic drug use and some light drug use. The data used was from the National Household Survey on Drug Abuse which sampled individuals from all 50 states ages 12 and older. The results of this study confirmed that drug use was associated with a .089 decrease in the probability a male is employed as well as a .037 probability of being in the labor force. For females, drug use led to a .091 decrease in the probability of being employed but was not statistically significantly related to labor force participation. The insignificance of drug use effecting labor force participation for women is most likely because of the greater variance in labor force participation overall by women. When French, Roebuck, and Alexandre (2001) separated drug use into chronic and non-chronic they found that the results for chronic drug use were similar to the previous regressions, but non-chronic had statistically insignificant results.

The primary limitation of this study is that it used survey data. An accurate sample requires the individuals surveyed to be honest, which is questionable when they are asked about illegal activities, which may lead to an underrepresentation of drug use. They also mention the limitations of the survey being cross-sectional because it prevents them from comparing the same individuals from year to year. French, Roebuck, and Alexandre (2001) also consider that the direction of causality may be difficult to determine for these variables. It is possible that drug use should be the dependent variable and employment should be one of the independents because being employed may lead to less drug use rather than vice versa. Further research should test these variables both directions to see which correlation is stronger.

**Current Efforts to Reduce Illicit Drug Use**

Public policy should frequently be reviewing its efforts to address destructive social behavior to determine what is most cost effective. In recent years the criminal justice system has received a lot of criticism for the way they handle drug offenders. Many activists argue that incarceration is not the best method to deal with drug abusers, but policy should be driven by data, not opinion.

One potential alternative that is currently being used in the U.S. to help alleviate the drug problem is drug courts. Instead of sending drug offenders to prison or jail, drug courts consider their eligibility to enter drug treatment programs, and closely monitor participants to ensure they are abstaining from illicit drug use. Drug courts have been shown to have a higher success rate in reducing drug use and criminal activity of drug offenders when compared to standard correctional facilities. However, the research done on the effectiveness of drug courts in reducing prison and jail populations is ambiguous, which motivated a study by Sevigny, Pollack, and Reuter. The primary argument for why drug courts aren’t reducing prison populations is because of resource constraints. Currently they are far less funded than the traditional justice system even though drug offenses are the highest proportion of arrests. There are also strict eligibility requirements that prevent many offenders from being accepted to these programs, particularly if they have a prior conviction for a violent offense. Sevigny, Pollack, and Reuter (2013) found that the probability of a jail inmate being eligible for the drug court programs to be between 15 and 50% and for prison inmates, eligibility probability ranged between 17 and 37%. The reason behind these wide ranges is due to the nature of their offense as well as prior convictions. In addition to other eligibility constraints, 1/3 of at-risk offenders are unable to be processed by drug courts due to overriding mandatory sentencing laws. They also estimate that between 7 and 11% of inmates could qualify for drug court programs but aren’t admitted due to capacity constraints. (Sevigny, Pollack, and Reuter 2013) The primary criticism of the drug court rehabilitation method is that between 40 and 50% of participants fail to complete the program and are then incarcerated. Although the failure rate of participants in drug court programs may seem high, they are still much more effective in preventing future infractions than jail or prison sentences. The criticisms of drug courts have been evaluated and this study shows there are still significant benefits to increasing their funding to help at-risk offenders. Advocates for drug courts don’t want to significantly reduce the eligibility requirements because this may lead to higher failure rates. Instead, they want to increase the chances that potentially eligible participants will be processed by the drug courts before being incarcerated. The continued efforts of drug courts look promising, but the certainty of their future is somewhat politically based.

One of the most obvious ways to help drug abusers convicted of drug offenses is to treat them while they are incarcerated. There currently are drug treatment programs in state prisons, but they are arguably underfunded and underutilized. According to a study by Mumola and Karberg (2006), 53% of inmates qualify as either drug abusers or drug dependent, but less than 10% receive medically based treatment. This prompted a study by Zarkin (2012) that evaluated the cost effectiveness of substance abuse programs in state prisons as well as community-based aftercare. They believe that improving these programs as well as increasing their participation rates will lead to inmates committing less crimes when they are released. To perform this analysis Zarkin (2013) used five different scenarios of varying levels of substance abuse treatment and compared the effects to a baseline, which was little or no treatment. Scenario 1 was greater access to in prison substance abuse treatment. Scenario 2 was more effective treatment. Scenario 3 was greater access to aftercare treatment. Scenario 4 was greater access to more effective substance abuse treatment. Scenario 5 was greater access to more effective prison-based substance abuse treatment and greater access to aftercare. They evaluated each scenario and estimated the effectiveness as well as the cost to fund the treatment programs. They found that as the scenarios increased, variables such as number of crimes committed, number of arrests, and number of reincarcerations all went down. The biggest declines were seen between the baseline and Scenario 1, and between Scenario 1 and Scenario 2. They then used these results to create a lifetime simulation model that compares the benefits and costs of these programs. The lifetime economic benefits were defined as the present value of earnings minus the sum of the present value of crime victimization costs, arrest, court, incarceration costs, and healthcare costs. They also ran tests without the crime victimization costs because these can be easily over or underestimated. Zarkin’s results showed that total lifetime economic benefits increased across all 5 scenarios. All scenarios except Scenario 1 when compared to the baseline led to increased savings to the criminal justice system. The increase between each scenario in lifetime economic benefits and savings to the criminal justice system were all statistically significant except between scenario 4 and scenario 5. The probability of success of the prison treatment and aftercare also increased with each scenario. While this article does give the results and estimated values for variables such as crimes committed, future arrests, and reincarceration, it doesn’t do a good job of discussing the success of these treatment programs. All the other variables are explicitly defined while probability of success of treatment is much vaguer, which is a major limitation of this paper. If they are overestimating the success of these programs this would lead to the benefits appearing to be much greater than reality. However, the results show that improving prison-based treatment programs result in societal benefits as well as savings to the criminal justice system. Future research that could expand on these findings should apply some of these same methods to jail based treatment programs because drug offenders are more likely to go to county jails than state prisons, and these could potentially benefit even more from improving substance abuse treatment programs.

**This Research Project’s Intended Contribution**

The current research has been able to find positive and negative correlations between several variables and illicit drug use, but there is little research to determine if the tougher criminal justice policies towards drug offenses has had the intended effect of decreasing illicit drug use. The goal of this research project is to expand on this literature by determining if the increases in incarceration have had the desired result of reducing illicit drug use. Economic models have been developed to help explain the factors that influence or deter an individual from committing a crime but have been scarcely applied to drug offenses. These models can also be used to determine the economically appropriate punishments for people who commit a crime. This project will determine if the current economic models support the current punishment for drug offenses as well as search for a correlation between incarceration and illicit drug use. The outcomes of this research can be used to guide public policy going forward and determine if public funds are being used effectively. If states with high incarceration rates and strict drug policies consistently have lower rates of illicit drug use, then it can be assumed that these policies are effective. However, if states have high incarceration rates and long mandatory sentences for drug offenses and have not seen their rates of illicit drug use go down, then public policy should look for alternatives to dealing with drug offenders. This analysis will try to control for other variables that may influence illicit drug use such as race, age, sex, poverty, etc. but these may in fact be more influential than drug policy. If that is the case, then this information would be just as important as the incarceration correlation to policymakers. Ideally, at the end of this research project, the analysis will empirically show the effects of incarceration on illicit drug use.

**IV. Economic Model**

When people make decisions, they are almost always considering the costs and benefits of their actions, and illicit activities are no different. Economics assumes that individuals do their best to maximize utility, which means that illicit drug use must provide some level of utility greater than abstaining from drug use to people who are chronic drug users. As a society, we have decided that to combat drug abuse we should make certain drugs illegal, but the proper punishment is debatable. Gary Becker in a paper published 1974, developed a model of how an individual might weigh the costs vs. benefits of committing a crime as well as define how a society can empirically determine the appropriate punishment.

The basic framework to determine if an individual will commit a crime is as follows: U. Where P is the probability of getting caught and punished, is the utility of successfully committing the crime, is the utility of committing the crime but getting punished (most likely negative), and U is the utility of not committing the crime. While this equation may seem simple it actually incorporates a lot of different factors. For example, if someone doesn’t commit crime simply because they believe it is the morally right thing to do, they place a large value on U. The value of U also increases if they have a high paying job, because this is included in their utility if they don’t commit a crime.

Using this model, a formula has also been developed for determining socially optimal punishments as a function of the crime’s cause of loss to society. The loss to society is defined as a function of the damages caused by the offense, the cost of combatting the offense, and the costs of punishment. Written out the formula looks like this: . D(O) is the damages per offense, pO is the probability of convicting an offense, C(pO) is the cost of combatting offenses, and bpfO is the total loss from punishments. (i.e. costs of incarceration) When determining the appropriate punishment for a crime the goal is to minimize L, the loss to society. The variables that the criminal justice system can control are C, p, f (the punishment per offense), and b (the form of punishment). However, C is typically not considered directly when determining the optimal form of punishment, it is usually implicitly determined by f and b; and for simplicity, b is assumed to be a constant greater than zero. This leaves p and f to be the deciding variable to determine the optimal punishment to minimize L. To determine to socially optimal values of p and f, take the derivative of the original equation, with respect to p and f separately, and set it equal to zero.

When Becker applied this model to crimes such as murder, rape, burglary, auto theft, and a few others he found the values of p and f to be roughly what the model suggests they should be. However, in the original paper he doesn’t apply it to drug offenses, predictably because the value of p is likely to be small and the value of f is likely much larger than the model suggests is the optimal value. This is primarily because drug offenses don’t seem to cause significant damages or loss to society in comparison to other crimes. This research paper will focus primarily on the value of f to determine if the current punishments for drug related crimes are socially optimal.

Graphing the utility from drug use is an interesting concept to think about. For starters, the law of diminishing marginal utility may or may not apply to drug use. If the law of diminishing marginal utility applied to drug use, it would be expected that drug users would stop using at some point without outside intervention. While this may sometimes be the case, more often there are other factors that lead to an individual stopping drug use. However, using this model, the probability of getting punished for drug related offenses increases the more an individual uses drugs, which would lower the marginal utility as frequency increases. This effect causes the total utility of drug use to increase at a decreasing rate, and will eventually start decreasing.

Figure 1 displays the concepts of this equation: U. The marginal utility from illicit drug use is high when frequency is low because the probability of punishment is low, this is the value of . As the probability of punishment increases the value of decreases and the value of increases; keep in mind is a negative number so as it increases, the total utility decreases. The intersection represents that point of maximum total utility, after that point will be larger than which will cause total utility to decline. and represent the equilibrium points for the expected amount of drug use for this individual and the corresponding marginal utility. Figure 2 displays this individual’s total utility associated with illicit drug use. The total utility is increasing at a decreasing rate; once is reached, total utility beings to decline because the marginal utility associated with drug use is negative. These marginal utility lines differ for each individual. The slopes and intercepts will vary depending on three primary factors: the marginal utility the individual places on illicit drug use, their perceived probability of getting punished, and the loss of utility they associate with that punishment. It’s important to note that because this model is based off of individuals’ expected utility it is subjective, but the basic principles still apply.



**Figure 1: Marginal Utility Associated with Illicit Drug Use**

**Figure 2: Total Utility Associated with Illicit Drug**



**V. Empirical Methodology**

To answer this research question, data are needed on rates of each state’s illicit drug use as well as incarceration. Data on state level illicit drug use come from the National Survey on Drug Use and Health (2016), which has collected data on illicit drug use every year since 1990. Data on incarceration rates was gathered from the Bureau of Justice Statistics. (2016) It is important to control for other variables that may influence a state’s rate illicit drug use to ensure the analysis’ accuracy. The control variables chosen were the unemployment rate, GDP per capita, and high school graduation rates. These data are acquired from resources such as the Bureau of Labor Statistics, Bureau of Economic Analysis, and U.S. Department of Education. (2016) These control variables were chosen based on the current research previously discussed that determined they effect illicit drug use.

Figure 3: State Illicit Drug Use Density Map

Figure 3 shows incarceration per capita measured against illicit drug use per capita for all 50 states. There appears to be a downward sloping trend between these two variables, which will likely lead to a negative correlation. This result is somewhat surprising because states with higher rates of any illegal activity should have higher rats of incarceration, which would cause a positive sloping trend. This does however support the idea that incarceration does lead to fewer instances of an illegal activity. Ideally, states with higher rates of incarceration should see their rate of illicit drug use to fall towards the average over time. It is important to note that there are some outlier states to the general trend that have rates of incarceration and low rates of illicit drug use. However, there are outliers in the top right quadrant that have high rates of incarceration and high rates of illicit drug use.

Figure 4: State Illicit Drug Use Density Map

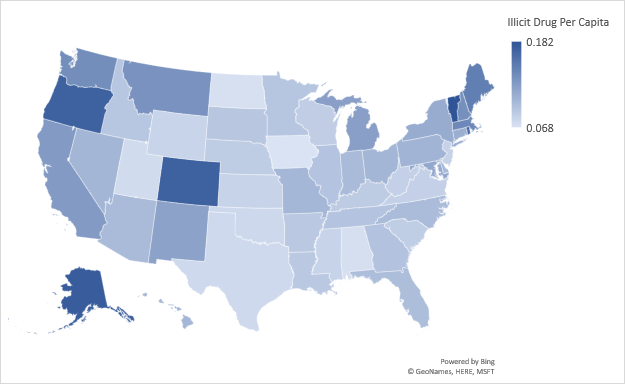


Figure 4 displays the density distribution of illicit drug use across the United States. It does seem that the northern coastal regions have slightly higher rates of illicit drug use compared the central U.S. A possible explanation for this could be that it’s easier to traffic illicit drugs into these parts of the U.S. and becomes more difficult towards the center. Other than that, there doesn’t appear to be any significant geographical trends for illicit drug use.

Table 1: U.S. Averages of Each Variable

|  |  |  |
| --- | --- | --- |
|  | Mean | Standard Deviation |
| Illicit Drug Use Per Capita | .106 | .029 |
| Incarceration Per Capita | .0058 | .0019 |
| Unemployment Rate | 4.6 | .99 |
| % H.S. Graduate | 87.11 | 3.34 |
| GDP Per Capita | 47,686.22 | 9,105.79 |

Table 1 shows the averages across all 50 states for each variable, as well as their standard deviations. 10.6% of U.S. citizens reported using illicit drugs within the past month to the National Survey on Drug Use and Health. States average having .58% of their population incarcerated, with a standard deviation of .19% at the 95% confidence level. The average unemployment rate in the U.S. at the end of 2016 was 4.6%. The average percent of people who graduate high school is 87%. The average GDP Per Capita in the U.S. for 2016 was $47,686.

Using these variables, a regression equation can be developed that will determine the correlation between the independent variables and the dependent variable as well as their statistical significance. The equation is set up as follows:

Illicit Drug Use = Incarceration Rate, Unemployment Rate, GDP per Capita, High School Graduation Rate)

The sign on the incarceration rate is expected to be positive because the states that have high rates of incarceration will most likely also have high rates of illicit drug use. The coefficients on the lagged incarceration rates are expected to be positive, but could be negative if incarceration is effective in reducing future rates of illicit drug use. Multiple regressions will be run that use the percent change in the incarceration rate from 2015, 2014, and 2013. If incarceration does reduce illicit drug use then these coefficients will be negative. The coefficient on the unemployment rate will likely be positive based on the prior research on the correlation between illicit drug use and the labor market. The coefficient for GDP per Capita is predicted to be negative because, based on the crime model, individuals with higher salaries have more to lose from being punished for committing a crime, causing them to be more likely to abstain from criminal activities. The coefficient for High School graduation rates is predicted to be negative because increased educational attainment will likely raise an individual’s utility from not using illicit drugs. All of these variables were chosen because they are expected to be statistically significant, however, a state’s rate of illicit drug use may also vary due to other difficult to measure variables.

**VI. Results**

Table 2: Regression Results

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Regression 1  2016 | Regression 2  % △ 2015 | Regression 3  % △ 2014 | Regression 4  % △ 2013 | Regression  5  % △ 1985 |
| Incarceration Per Capita | -7.83\*\*\*  (2.65) | -.29\*\*  (.122) | -.18\*\*  (.074) | -.20\*\*\*  (.059) | -.64  (.64) |
| Unemployment Rate | .0095\*  (.0048) | .00096  (.0055) | .0041  (.005) | .0021  (.0048) | -.0069  (.0052) |
| % High School Graduate | .0017  (.0016) | .0025  (.0016) | .0029\*  (.0016) | .0032\*\*  (.0015) | .0035\*\*  (.0017) |
| ln(GDP)  per Capita | -0.014 (0.024) | -.013  (.025) | -.013  (.023) | -.013  (.023) | -0.010  (.024) |
| Adjusted R Squared | .18 | .13 | .14 | .23 | .10 |
| # of Observations | 50 | 50 | 50 | 50 | 50 |

\*\*\*, \*\*, \* represent statistical significance at the 99%, 95%, and 90% respectively.

Table 2 shows the results of various regressions to determine the correlation and statistical significance between incarceration rates and the variation of illicit drug use among states. The top number in each cell is the coefficient for each variable and the bottom number in parenthesis is the standard error. The numbers that are in asterisks show which variables are statistically significant. The difference between regressions one through five is the incarceration per capita variable. Regression one is the correlation between the 2016 incarceration rate and illicit drug use, which found that states with a one percent higher incarceration rate on average have a 7.83 percent lower rate of illicit drug use. However, this isn’t the best way to use this coefficient because the incarceration rate is rarely going to increase by a full one percent. It’s better to think of it as a .1 percent higher incarceration rate is correlated with a .783 lower rate in per capita illicit drug use, because these magnitudes of variations may actually occur in the real world. Regression two, three, and four show the correlation between the percent change in incarceration from 2015, 2014, and 2013 respectively. All three of these regressions find a statistically significant negative correlation between the percent change in incarceration and illicit drug use. Regression 5 represents the correlation between the percent change in the incarceration rate from 1985 to 2016, and while this was found to be negatively correlated as well, it is statistically insignificant. Every other independent variable was found to be statistically insignificant. The adjusted R squared values range from .07 to .23, which suggests these variables account for a small amount of the variation in a state’s rate illicit drug use. This is to be expected because the variation in drug use at the state level can be caused by a large number of potentially unmeasurable variables.

Table 3: Regression Results Continued

|  |  |
| --- | --- |
|  | Regression 6 |
| # of Individuals Under Correctional Supervision per Capita | -.251  (.604) |
| Unemployment Rate | .007  (.005) |
| % High School Graduate | .003\*\*\*  (.001) |
| ln(GDP)  per Capita | -0.012  0.024 |
| Adjusted R Squared | .028 |
| # of Observations | 50 |

\*\*\*, \*\*, \* represent statistical significance at the 99%, 95%, and 90% respectively.

Regression six measures the correlation between the number of individuals under correctional supervision per capita and a state’s illicit drug use. This difference between this variable and the incarceration per capita variable from the previous regressions is that this includes individuals who are on probation or parole. It is interesting that this variable is statistically insignificant because people who are on probation or parole are subject to drug tests and may be sent back to prison or jail if they fail. This leads one to believe that states with a high number of individuals on probation or parole should have lower rates of illicit drug use based on the crime model, but this isn’t what this analysis found. It is important to include a regression with this variable to show that the data used can impact the results of the regressions and can alter the conclusions.

The low adjusted R squared suggests there are potentially more variables that that influence a state’s rate of illicit drug use. While some of these may be ambiguous and hard to measure, a state’s political stance is easily measurable and will likely be correlated for two reasons. First, republican states tend to have stricter laws regarding illicit drugs leading to harsher punishments and longer sentences. Second, the values associated with the republican party tend to promote abstaining from illicit drug use more so than the democratic party. However, including this variable in the regression analysis may lead to issues with multicollinearity due to its correlation with the incarceration rate. The following correlation matrix begins to examine which variables may be too correlated to include in the same regression and the next table runs multiple regressions with omitted variables.

Table 4: Correlation Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *% Illicit Drug Use 2016* | *# In Prison or Jail Per Capita 2016* | *UR 2016* | *% HS Graduate* | *GDP per capita 2016* | *% Voted Trump* |
| % Illicit Drug Use 2016 | 1 |  |  |  |  |  |
| Incarceration Per Capita | -0.431 | 1 |  |  |  |  |
| UR 2016 | 0.0051 | 0.427 | 1 |  |  |  |
| % HS Graduate | 0.263 | -0.582 | -0.563 | 1 |  |  |
| GDP per capita 2016 | 0.164 | -0.435 | -0.098 | 0.401 | 1 |  |
| % Voted Trump | -0.542 | 0.578 | 0.076 | -0.148 | -0.313 | 1 |

Table 4 shows that % high school graduate is much more correlated with the other independent variables than it was with the dependent variable, so it was omitted from the next few regressions. The only other independent variables that are highly correlated are incarceration per capita and percent voted Trump, which will be addressed in the following regressions. An interaction term between these two variables was created because if a state has republican policymakers this may influence their incarceration rate through policies towards crime.

Table 5: Regression Variations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Regression 7 | Regression  8 | | Regression 9 | |
| Incarceration Per Capita | -12.33  (11.51) |  | | -8.69\*\*\*  (2.51) | |
| Unemployment Rate | .0047  (.0042) | .0013  (.0038) | | .0071  (.0043) | |
| ln(GDP)  (per Capita) | -.011  (.022) | -.0015  (.0211) | | -.0072  (.0232) | |
| % Voted Trump | -.0020  (.0012) | -.0016\*\*\*  (.0003) | |  | |
| Incarceration \* % Voted Trump | .1495  (.2177) |  | |  | |
| Adjusted R Squared | .27 | .25 | | .18 | |
| # of Observations | 50 | | 50 | | 50 | |

\*\*\*, \*\*, \* represent statistical significance at the 99%, 95%, and 90% respectively.

Regression seven has removed percent high school graduate and added in percent voted Trump, as well as an interaction term between incarceration and percent voted Trump. This interaction term was chosen because a state’s political leaning can potentially influence its incarceration rate. The relatively high R squared in regression seven, yet no statistically significant coefficients suggests there is a high degree of multicollinearity. To address this, the other regressions omit highly correlated variables and did find statistical significance when they were separated. The results of table five do confirm the primary finding of the previous regressions that higher incarceration rates are correlated with lower rates of illicit drug use.

Table 6: Regressions 2013

|  |  |  |  |
| --- | --- | --- | --- |
|  | Regression 10 | Regression  11 | Regression 12 |
| Incarceration Per Capita | -1.05\*\*\*  (.195) |  | -.366\*\*\*  (.0439) |
| Unemployment Rate | .0055  (.0051) | -.011  (.007) | .012\*\*\*  (.005) |
| ln(GDP)  (per Capita) | -.026  (.038) | -.016  (.059) | -.012  (.045) |
| % Voted Romney | -.0101\*\*\*  (.0020) | -.0059\*\*\*  (.0011) |  |
| Incarceration \* % Voted Trump | 1.349  (.362) |  |  |
| Adjusted R Squared | .75 | .38 | .60 |
| # of Observations | 50 | 50 | 50 | |

Table six shows regression results of the same variables but from 2013 to make sure the results were consistent even for a different year. The coefficient on the incarceration variable has the same sign as before but is significantly smaller than the 2016 one. This suggests that while higher incarceration rates are correlated with lower rates of illicit drug use, the percent lower may not be as large as the other regressions suggest. Some of the variation in the size of the coefficient between the regressions may be due to unaccounted for factors such as the movement of prisoners between states. The percent voted Romney data is from 2012, but should still represent the percent republican in a state for 2013. The results of regressions ten through twelve do confirm the previous findings that states with higher incarceration rates do tend to have lower rates of illicit drug use, but how much lower seems to vary significantly.

**VII. Conclusions**

The results of this analysis suggest that states with higher incarceration rates per capita have lower rates of illicit drug use per capita. The first four regressions show that a higher incarceration rate in the current year has the largest impact on reducing rates of illicit drug use, and the correlation is smaller in prior years. This result does seem odd because in the if a state has high rates of illicit drug use in the current year then the incarceration rate should be higher that year and lower the following years. When considering the effects of incarceration on reducing an illegal activity, it works through two forces: deterrence and incapacitation. The best explanation for the large negative coefficient on the current year incarceration rate reducing illicit drug use would be the idea of incapacitation, where a state has a more individuals in prison or jail which lowers the number of people reporting illicit drug use to the survey. The results for the prior years do intuitively make sense because of the idea that prison and jail work as a deterrent against illicit drug use, people who have been incarcerated for a drug related offense may be more likely to abstain from that activity. However, regression six doesn’t support this idea because this regression accounts for individuals who are on probation or parole who should have significantly lower rates of illicit drug use because the probability of them getting caught and punished is much higher, but this was found to be statistically insignificant. The adjusted R squared is below .2 for all but one regression, which is not surprising because a state’s aggregate rate of illicit drug use is going to vary significantly for many reasons that are unaccounted for and difficult to quantify.

The original motivation for this study was derived from the large increase in the incarceration rate that began in 1980s primarily caused by the war on drugs. The first four regressions measure the correlation between a state’s incarceration rates and illicit drug use, but only over four recent years. Regression five measures the correlation between the increase in incarceration per capita between 1985 and 2016 and illicit drug use, to determine if states that had large increases in incarceration over this time period have lower rates of illicit drug use in comparison to states that didn’t increase their rates of incarceration as much. This regression found no statistical significance between these two variables, which could mean the large increases in incarceration didn’t significantly lower rates of illicit drug use. However, this regression does oversimplify the question and this is an area that certainly could benefit from more research with better data.

**Policy Implications**

Based on the results from regressions one through four, one could argue that policy should increase incarceration rates to lower rates of illicit drug use. On the other hand, regression five and six suggest that increasing incarceration as well as parole and probation will have no significant impact on reducing rates of illicit drug use. One could use either set of results to support their argument, but both of these don’t consider other important factors. Primarily, the additional cost of increasing the incarcerated population compared to the benefits to society. Gary Becker’s model determined that the optimal punishment for a crime is based on the crime’s cause of loss to the society. The loss to society for a crime like illicit drug use is relatively low, while the costs of combatting the offense and punishment are much greater. This is an area where public policy needs more evaluation and additional research is necessary to determine if the benefits from the decreases in illicit drug use are greater than the costs associated with the increases in incarceration. Specifically, are the states with higher rates of incarceration and lower rates of illicit drug use maximizing their social welfare better than states with lower rates of incarceration and higher rates of illicit drug use? Based on the existing literature, there are more cost-effective ways in reducing illicit drug use than incarceration. The findings from the study done by Zarkin (2012) suggest that one way to decrease illicit drug use would be to improve the substance abuse programs in prisons and jails. This would not only lower rates of illicit drug use among previously incarcerated individuals, but would also lower the rates of reincarceration and save the criminal justice system money over time. It is also important to note that policymakers have been reviewing their approach to dealing with drug offenders, and minimum sentences have been reduced in some states. Overall the incarcerated population has slight declined since 2009, but is still higher per capita than in the 1980s. Some states have also gone as far as legalizing marijuana because there seems to be a consensus that it’s less harmful than other illicit drugs. The movement to reform how the criminal justice system’s approach drug offenses has made progress; however, it seems to be based heavily on people’s moral beliefs and it would be beneficial to see policymakers utilize some of these empirical methods.

It’s interesting to see how correlated the incarceration variable was to the % voted Trump. This doesn’t necessarily imply that states that vote more republican commit more crimes, it may be due to their approach to dealing with crime. Republican politicians historically have been “tougher” on crime and these states tend to have longer sentences for any given crime than more democratic states, which may be the cause of the correlation between these variables. This certainly is a correlation that should be further explored if it hasn’t been already.

**Limitations and Future Research**

The primary limitation of this study is that the data further back in time becomes limited and incomplete. The first four regressions focused on the years 2013 through 2016 which had complete and sufficient data. This study would have benefited from looking at incarceration rates by state in time periods like the 80s or 90s, but this data is scarcely available and much more sporadic. Another major limitation is that the incarceration data was for all offenses. The results could lead to stronger conclusions if data was available on incarceration rates specifically for drug related offenses. This seems like a good place for future research because correctional facilities have to keep records on all the inmates, so somewhere there must be data on each state’s incarceration rates for drug offenses, it’s just a matter of getting access to it. Another possible way to improve this study would be to use panel data that has information on variables such as incarceration and illicit drug use as well as all the control variables. This would allow the analysis to examine how the variables influence illicit drug use on an individual level, rather than state aggregates. Another interesting variable to consider with this type of data would be whether the individual has been prescribed an opioid before. A lot of policy has been specifically focused on the opioid epidemic, which has seen opioid abuse and overdoses increase dramatically over the past decade. One of the initial motivations for this study was that, intuitively, the costs associated incarcerating drug offenders seems to be much greater than the benefits to society. It is surprising that there isn’t more economic research that does a cost-benefit analysis specifically focusing on incarcerating drug offenders and this seems like an area economic analysis could provide useful empirical insights.

**VII. Refrences**

Becker, Gary S. 2014. “Crime and Punishment: An Economic Approach.” In *Economic Models of Law,*

edited by Thomas J. Miceli and Matthew J. Baker, 423-71. Elgar Research Collection. Economic Approaches to Law, vol. 44 Cheltenham, UK and Northampton, MA: Elgar. <http://proxy.lib.csus.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1658207>

Bureau of Economic Analysis. “Per Capita Real GDP by State, 2016.”

<https://apps.bea.gov/iTable/iTable.cfm?0=1200&isuri=1&reqid=70&step=10&1=1&2=200&3=sic&4=1&5=xx&6=-1&7=-1&8=-1&9=70&10=levels#reqid=70&step=10&isuri=1&7003=1000&7035=-1&7004=naics&7005=1&7006=xx&7036=-1&7001=11000&7002=1&7090=70&7007=-1&7093=levels>

Bureau of Labor Statistics. “Unemployment Rates for States, 2016 Annual Averages.”

<https://www.bls.gov/lau/lastrk16.htm>

Corman, Hope, Dhaval M. Dave, Dhiman Das, and Nancy E. Reichman. 2013. “Effects of Welfare

Reform on Illicit Drug Use of Adult Women.” *Economic Inquiry* 51 (1): 653 -74

doi:http://onlinelibrary.wiley.com.proxy.lib.csus.edu/journal/10.1111/%28ISSN%291465-7295/issues.

“Correctional Populations in the United States, 2016.” Bureau of Justice Statistics.

<https://www.bjs.gov/index.cfm?ty=pbdetail&iid=6226>

Federal Bureau of Prisons. Inmate Statistics by Offense, last updated April 13, 2019.

<https://www.bop.gov/about/statistics/statistics_inmate_offenses.jsp>

French, Michael T., M. Christopher Roebuck, and Pierre Kebreau Alexandre. 2001. “Illicit Drug

Use,Employment, and Labor Force Participation.” Southern Economic Journal 68 (2): 349–68. doi:http://onlinelibrary.wiley.com.proxy.lib.csus.edu/journal/10.1002/(ISSN)2325-8012.

Hollingsworth, Alex, Christopher J. Ruhm, and Kosali Simon. 2017. “Macroeconomic Conditions

and Opioid Abuse.” Journal of Health Economics 56 (December): 222–33. <http://proxy.lib.csus.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1690598>.

Mumola CJ, Karberg JC. 2006. Drug use and dependence, state and federal prisoners, 2004.

Bureau of Justice Statistics Special Report, NCJ 213530, Revised 19 January 2007, U.S. Department of Justice, Office of Justice Programs, Washington, DC.

Rudd, Rose. “Increases in Drug and Opioid Overdose Deaths - United States, 2000–

2014.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 1 Jan. 2016, [www.cdc.gov/mmwr/preview/mmwrhtml/mm6450a3.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6450a3.htm).

Savage, Charlie. “Justice Dept. Seeks to Curtail Stiff Drug Sentences.” *The New York Times,*

August 12, 2013,

<https://www.nytimes.com/2013/08/12/us/justice-dept-seeks-to-curtail-stiff-drug-sentences.html>

Sevigny, Eric L., Harold A. Pollack, and Peter Reuter. 2013. “Can Drug Courts Help to Reduce

Prison and Jail Populations?” Annals of the American Academy of Political and Social Science 647 (May): 190–212. doi:http://ann.sagepub.com.proxy.lib.csus.edu/content/by/year.

Substance Abuse and Mental Health Services Administration. “State Reports From the 2016

NSDUH.”

<https://www.samhsa.gov/data/nsduh/state-reports-NSDUH-2016>.

U.S. Department of Education, Office of Elementary and Secondary Education, Consolidated State

Performance Report, 2015–16. “Public High School Graduation Rates, 2016.”

<https://nces.ed.gov/programs/coe/pdf/coe_coi.pdf>

Zarkin, Gary A. 2012. “Benefits and Costs of Substance Abuse Treatment Programs for State

Prison Inmates: Results from a Lifetime Simulation Model.” Health Economics 21 (6): 633–52. doi:http://onlinelibrary.wiley.com.proxy.lib.csus.edu/journal/10.1002/%28ISSN%291099-1050/issues.