



Recreational Marijuana in Ohio: A Cost Benefit Analysis

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Abstract

This study aims to analyze the cost and benefits of legalizing recreational marijuana in Ohio by estimating the monetary value of major cost and benefit items caused by legal recreational marijuana being implementing in Ohio. Key areas that are used in the analysis to give an accurate picture of the costs and benefits of marijuana are the areas of: tax revenue, the labor market, the criminal justice system, public health and safety, and educational attainment. By focusing on changes experienced in other states that have legalized, a realistic estimation of what will happen in Ohio can be made.

Data shows that implementing legalized marijuana in Ohio will result in a positive social net benefit for the state. The estimated social net benefit that will be experienced by the state has a value of more than \$444 million. The biggest benefits that the state will experience come from the tax revenue, jobs, and lower DUI arrest rates that will be created by legalization. The biggest cost to the state will come in the form of increased drug rehabilitation admittance and car insurance claims. The positive social net benefit derived from variables used in this analysis implies that it will be economically beneficial for Ohio to legalize recreational marijuana.

I. Introduction

The topic of marijuana legalization is a widely discussed political issue in the United States, thus there already exists a large body of literature on the topic. This study conducts a cost benefit analysis of the legalization of recreational marijuana in Ohio. This analysis identifies large cost and benefit items based on changes that occurred in other states after legalization, and other countries where no data for states exists. The state of Ohio does seem to be gradually moving away from treating marijuana as a taboo. In Ohio medical marijuana became legal in 2019. If Ohio follows the same path as many other states, of legalizing medical marijuana and then recreational marijuana it may be the case that recreational marijuana is close down the road for Ohio.

The legal status of marijuana has been changing over the past several decades in America. Marijuana has gone from being illegal in all 50 states, to slowly being legalized on a state level in various states. Across the nation 15 states as well as 2 territories and Washington D.C. have legalized recreational marijuana, with 34 states and 2 territories allowing medical marijuana. It is safe to say that marijuana legalization is a growing movement in the country. But what does this have to do with the state of Ohio?

With marijuana not having a fully legal status, resources from the criminal justice department are used to arrest, try, and imprison people for it in Ohio. In Ohio, as in the rest of the country marijuana arrests account for the largest portion of drug arrests. Resources that are being dedicated to stopping the spread of dangerous illegal drugs are mostly just arresting people for marijuana¹. Less incarceration for marijuana can also create less incarceration of young

¹ According to data from the FBI's Uniform Crime Reporting Program, marijuana accounted for 40% of all drug arrests in 2018

individuals and minorities, and not creating a criminal record for individuals over marijuana consumption thus giving them a criminal record and hurting future labor market opportunities.

Additionally, it is possible that legalizing recreational marijuana may benefit Ohio economically as well. Legalization would entail a new industry being set up around growing, distributing, and selling the marijuana. Ohio already has a large agricultural industry and adding marijuana to existing farms may not require farmers to make huge investments. This new industry could create new jobs, and tax revenue for Ohio. There are benefits that other states have experienced, and it is important for these to be considered in Ohio's case.

There may be other costs to recreational marijuana being legalized in Ohio as well. For instance, there may be an increase in car accidents from people driving while under the influence of marijuana, increased marijuana use may lead to increased use of other drugs, or there may be a negative effect to public health due to marijuana smoking. Before implementing a legalization policy, it is important to identify and quantify the economic costs.

The goal of this study is to identify the cost and benefits of marijuana legalization in Ohio on a state scale to inform Ohio for lawmakers and the public of the costs and benefits of implementing the new policy. Recreational marijuana may potentially be on the ballot of Ohio voters in the future, meaning that understanding both the costs and benefits is more important now than ever. Ohio policy makers will benefit from being able to make informed marijuana policy decisions. Also, voters will be able to understand why legalization will be beneficial or detrimental and vote accordingly.

The rest of this paper is organized as follows: a review of the relevant literature, discussion of the theory used in the analysis, description of the data used in the analysis, a

description of the empirical methodology used in the analysis, as well as the results of the analysis and conclusions that can be drawn from the results. All data used in this analysis is comes from government databases. The analysis uses changes experienced in other states that have legalized marijuana to estimate what would be experienced in Ohio. These predicted changes in Ohio are then converted into an estimated monetary value. The monetary value of costs subtracted from the monetary value of benefits, and if benefit exceed costs, then it can be concluded that it would be economically beneficial for Ohio to legalize recreational marijuana.

II. Literature Review

There are three policy options that are often considered with marijuana: prohibition, regulation, and laissez faire. Prohibition and strict regulation can lead to a decrease in the social harms that marijuana can cause, but not having a free market can increase the harms from criminal activities and a reduction in the benefits from consumption (Rogebert, 2018). The possible benefits of legalization include the increased tax revenues, increased non-marijuana drug arrests, and new jobs created (Wright & Metts, 2016; Doussard, 2019; Reid, 2020). Economic costs of legalization include an increase in all of the following: car insurance claims, DUI arrests, admittance to rehab facilities, emergency department visits involving marijuana, and negative impacts on educational attainment (Maggs et al., 2015; Hunt & Pacula, 2017; Valeriy et al., 2019). Moreover, a large concern for legalization is the gateway drug effect, which is still being debated largely in the literature (Chu, 2015; Kleinig, 2015; Miller & Hurd, 2017; Williams, 2020).

Previous cost benefit analyses in Australia and Canada found varying results. In Australia Shannon and Ritter (2014) found that a legalized-recreational option would lead to an NSB² of

² NSB, or Net Social Benefits, is defined as Total Social Benefits minus Total Social Costs

from \$234.2 million AUD³, and the status quo of prohibition created an NSB of \$294.6 million AUD⁴, these NSB values are not substantially different enough to suggest one economically favorable option. On the other hand, a Canadian study concludes that a legalized regulated approach would be more beneficial as it increases tax revenue, allows for quality control and sales restrictions, and lowers profits for drug dealers (Ducatti, 2012).

A survey of students at a private, residential college in southwest Ohio can provide insights into the attitudes of new voters. 67% of respondents would have voted for Ohio Issue 3⁵ back in 2015 to legalize the recreational marijuana in Ohio, a positive correlation also exists between marijuana use and voting for Issue 3 (Wagstaff & Knopf, 2017). When marijuana consumption for medical reasons increases, then we would expect the support for full legalization of it increase. Since medical marijuana has since been legalized in Ohio, increased use may mean that more support for legalization will occur in the future.

Evidence in the literature suggests that policies impacting local labor market conditions are a more effective deterrent than prison, since prison is a theoretical punishment that may occur if an individual decides to turn to crime, whereas employment or higher wages are more immediate solutions for economic difficulties (Chalfin & McCrary, 2017). When wages are higher or unemployment is lower, people are less likely to commit property crime. It is also important to note that there is evidence suggesting that wages matter more, as many criminals reported wage earnings and the pool of those employed in low wage jobs vastly outnumbers the unemployed. If legal marijuana in Ohio can create new jobs that provide adequately high wages,

³ \$222.3 million USD, based on an average exchange rate in 2014 of 0.9491USD

⁴ \$279.6 million USD

⁵ Issue 3, which was defeated in 2015, would have legalized the limited sale and use of marijuana in various amounts to individuals over 21. Entities would have been required to buy a special license to sell marijuana. Moreover, under Issue 3, only 10 companies would have exclusive commercial rights to grow marijuana.

it may be reasonable to then suggest that legalizing marijuana can deter other crimes from being committed if it benefits local labor markets.

III. Theoretical Discussion

The question of marijuana legalization can be modeled as an economic policy question. This approach implies that if the economic benefits of marijuana legalization exceed its costs, and thus has a net social benefit, then it is in the best interest of the society to legalize it. As discussed before, several variables are mentioned in the literature as relevant benefit and cost factors. An increase in a variable that is beneficial to society will be counted as a benefit, while the fall of the same variable will be counted as a cost. For variables that are detrimental to society an increase will count as a cost, while a decrease will count as a benefit. These variables can be divided into several categories including tax revenue, impacts on the labor market, impacts on the criminal justice system, impacts on public health and safety, and impacts on educational attainment.

For each of these categories of variables it must be considered what is a benefit to society, and what is a cost, and how each cost and benefit can be causally linked to marijuana legalization. For tax revenues, all tax revenues that are linked to the legal marijuana industry can be considered a benefit to society. In the labor market any jobs that are created because of the marijuana industry can be considered a benefit. The reallocation of police resources from enforcing current marijuana prohibition can be used to approximate the benefits experienced in the criminal justice system⁶. Increases in non-marijuana drug arrests will be the key variable in this category, as it is an indicator of police being able to allocate resources towards fighting other

⁶ Legalization would also result in a reduced number of people in prison due to marijuana related crimes, though this would be an economic benefit it is not included in the scope of this analysis. Other related variables like court costs are also not included.

drugs. In the category of public health and safety, any increases in car insurance claims, DUI arrests, admittance to rehab facilities, or emergency department visits involving marijuana can all be considered a cost to society. The key variable for educational attainment will be the marijuana use in the last 30 days among college aged people⁷. An increase marijuana use among this group will be considered a cost, as it has been linked to a lower likelihood of attaining a bachelor's degree (Maggs et al., 2015).

I. Data

While marijuana is still federally illegal in the US it has been legalized in several different states. Data from these states, especially regarding realized gains and losses can significantly improve the quality and reliability of a cost benefit analysis for marijuana legalization in Ohio. There are some variables for which data is not available from states. In these cases, like in the case of the cost of car insurance claims, national data can be used.

All the data used in this analysis comes from various government databases. For data on marijuana tax revenue and jobs created by the legal marijuana industry, data is available from the marijuana tax regulating body in each respective state. The FBI's Uniform Crime Reports provides the data necessary for non-marijuana drug arrests. The Highway Loss Data Institute has published data for car insurance claims. DUI arrest data is available through the National Highway Traffic Safety Administration. Data for the admittance to rehab facilities is available from the Substance Abuse and Mental Health Data Archive. The Drug Abuse Warning Network has published data on the number of marijuana exposure emergency department visits. And

⁷ College age will be considered 18-25 years old.

finally, the necessary data for the rate of past 30-day marijuana use among college aged people is available through the National Survey on Drug Use and Health.

Table 1: Variables for Analysis		
Variable	Variable Name	Source
X	Marijuana Tax Revenue	State Department of Revenue, or Equivalent Marijuana Regulatory Agency
Y	Marijuana Jobs	Varies by State
Z	Non-Marijuana Drug Arrests	FBI Uniform Crime Reports
D	Car Insurance Claims	Highway Loss Data Institute
E	DUI Arrests	National Highway Traffic Safety Administration
F	Admittance to Rehab Facilities	Treatment Episode Data Set: Admissions, Substance Abuse & Mental Health Data Archive
G	Drug Related Emergency Department Visits	Substance Abuse and Mental Health Services; Drug Abuse Warning Network
H	Past 30 Day Marijuana Use in College Aged People	National Survey on Drug Use and Health

Note: This table includes all variables used in the analysis and the data sources used.

Table 2: Total State Changes in Drug Crime			
Years	Year 1	Year 2	Change
Total Marijuana Crimes	60981	57127	-3854
Total Non-Marijuana Crimes	235821	254194	18373
% Change in Non-Marijuana Crimes	Total		0.077910788

Note: Number of arrests from FBI UCR data from the states of AK, CA, CO, IL, ME, MA, MI, NV, and OR.

Table 3: DUI Arrests				
State	Year 1	Year 2	Change	% Change
Oregon	17341	11882	-5459	-0.3148031
Washington, D.C.	1648	1346	-302	-0.1832524
Alaska	3161	3036	-125	-0.0395444
Average	7383.333333	5421.33333	-1962	-0.2657336

Note: Data from OR, AK, and D.C. (Valeriy et al., 2019).

Table 4: Rehab Admittance				
State	Year 1	Year 2	Change	% Change
Washington, D.C.	607	1226	619	1.019769357
Washington	7914	8430	516	0.06520091
Nevada	1086	1629	543	0.5
Oregon	3664	5120	1456	0.397379913
Massachusetts	2652	3105	453	0.17081448
Maine	1196	1789	593	0.495819398
Total	17119	21299	4180	2.648984058
Average	2853.166667	3549.833	696.66667	0.441497343

Note: Data from D.C., WA, NV, OR, MA, and ME (Valeriy et al., 2019).

Table 5: Past 30-Day Marijuana Use - College Age			
State	Year 1	Year 2	% Change
Alaska	20	24.5	4.5
California	14.7	19.93	5.23
Colorado	20.7	27.7	7
Maine	20.3	25.04	4.74
Massachusetts	17.1	21.88	4.78
Nevada	12.9	19.6	6.7
Oregon	20.1	28.16	8.06
Washington	19.4	24.61	5.21
Average	18.15	23.9275	5.7775

Note: Data from NSDUH for AK, CA, CO, ME, MA, NV, OR, and WA.

II. Empirical Methodology

For each variable used in the analysis, estimations are needed to calculate the projected cost or benefit that would be experienced for the state of Ohio. Estimates are based off the change experienced in states that have legalized marijuana comparing years before and after the legalization. The data is then adjusted by the state population size to account for the projected impact on a state with Ohio's population. The exact benefit from each new job can be calculated by identifying another similar paying job in other states, and then using the Ohio average wages for that job to calculate the benefit. To avoid counting the same benefit twice, income tax from these jobs will not be counted as a benefit. In cases where data is available for multiple states

that have legalized, multi-state averages are used to account for potential outliers and to create more reliable benchmark values.

For the variables of non-marijuana drug arrests, rehab admittance, past 30-day marijuana use for college aged people, DUI arrests, and car insurance claims multi-state average changes the year after legalization are used. For marijuana tax revenue, marijuana jobs, and marijuana exposure emergency room visits single state data is used to estimate the impact in Ohio.

The marijuana tax rate varies widely from state to state. Each state taxes retail and wholesale marijuana at a different rate. This is further complicated by some states taxing different potencies of marijuana, as well as flowers, leaves, and plants at different rates. To control for this, a state similar to Ohio can be used to calculate Ohio's predicted marijuana tax revenue. Out of the states used in this analysis Nevada has the closest excise tax on cigarettes to Ohio's tax on this⁸. By selecting a state with similar excise taxes on cigarettes, the effect of excise tax on marijuana expenditures can be controlled for, if Ohio marijuana users react to taxes in a similar way to tobacco users. In 2018, Nevada collected \$86.9 million in marijuana tax revenues through using a 15% wholesale and 10% special retail tax. To calculate the benefit in Ohio, a ratio of the Nevada tax revenue from marijuana and the population of Nevada can be multiplied by Ohio's population to estimate Ohio's tax revenue.

Estimates must also be used to assign a value to the specific costs and benefits of each variable. For marijuana jobs the monetary value can be calculated by multiplying the estimated number of jobs by the estimated wages. Similarly, the Ohio state average value of a marijuana exposure ER visits, car insurance claim, and rehab cost can be used to calculate the cost from

⁸ Nevada Cigarette Tax per pack of \$1.80 is the closest to Ohio's rate of \$1.60. Nevada also had a 2020 per capita personal income of \$53,635 which is very similar to the \$53,296 per capita personal income in Ohio.

increased medical emergencies, car accidents, and drug rehabilitation admittance, respectively. The cost of marijuana use in college aged people can be calculated by applying the impact on likelihood to finish a bachelor's degree and then multiplying it by the percentage of Ohio's population this will likely affect, as well as the estimated impact on their average per-year income. For non-marijuana drug arrests an average percent change in these arrests from legalized states can be calculated. This percent change can be used to calculate an estimated change that Ohio will see in non-marijuana drug arrests. By multiplying this number of new drug arrests by the amount currently spent by Ohio police per drug arrest, a monetary value can be assigned to the new drug arrests.

By combining all the estimated monetary values of cost and benefits the following model is the basis of the cost benefit analysis, using variables from Table 1:

$$\text{Model 1: Net Social Benefit} = X + Y + Z - D - E - F - G - H$$

Table 6: Variable Estimation of Monetary Value			
	Variable Name	Calculation	Notes
X	Marijuana Tax Revenue	(NV Pop./ NV Tax Rev.) * (OH Pop.)	Legalized states used vastly different tax schemes for marijuana. Nevada is used for a single state estimate instead due to it having the closest cigarette excise tax to Ohio.
Y	Marijuana Jobs	(WA Marijuana Jobs / WA Pop.) * (OH Pop.) * (OH Expected Wage)	Washington experienced a growth of 10,894 marijuana jobs upon legalization. According to BLS data, average wage paid was similar to a short order cook, which in Ohio earns a wage of \$10.81.

Z	Non-Marijuana Drug Arrests	(Ohio Police Budget/ All OH Arrests)*((Avg. % Change in Non-Marijuana Drug Arrests) * (OH Drug Arrests))	Avg. % Change in Non-Marijuana Drug Arrests calculated using data FBI UCR data from AK, CA, CO, IL, ME, MA, MI, NV, and OR
D	Car Insurance Claims	(OH Claims) * (Avg. % Change in Claims) * (Avg. Cost of Claim)	Avg. % Change in Claims calculated using data from CO, WA, and OR (Valeriy et al., 2019). Avg. Cost of claim from NHTSA data.
E	DUI Arrests	(Avg. Cost of DUI) * (Ohio DUIs) * (Avg. % Change in DUIs)	Avg. Cost of DUI from (Kenkel, 1993). Avg. % Change in DUIs calculated using data from OR, AK, and D.C. (Valeriy et al., 2019).
F	Admittance to Rehab Facilities	(OH Rehab Admittance)* (Avg. % Change in Admittance) * (Cost of Rehab)	Avg. % Change in Admittance calculated with data from D.C., WA, NV, OR, MA, and ME (Valeriy et al., 2019). Cost of Rehab from White House Office of National Drug Control Policy.
G	Marijuana Exposure ER Visits	(CO Change per 100k) * (Ohio Pop. / 100k) * (Avg. Cost of Non-trauma ED visit)	CO Change per 100k from (Valeriy et al., 2019). Avg. Cost of Non-trauma ED visit from (Bamezai et al., 2005).
H	Past 30 Day Marijuana Use in College Aged People	(Avg. % Inc in 30 Day Marijuana Use) * (OH College Age Pop.) * (Inc. % Chance to Not Graduate) * (Yearly Lost Wages)	Avg. % Inc. in 30 Day Marijuana Use calculated using data from NSDUH for AK, CA, CO, ME, MA, NV, OR, and WA. Inc. % Chance to Not Graduate from (Maggs et al., 2015). Yearly lost wages calculated using BLS data.

III. Results

Upon calculation of social net benefits, a few additional estimations were used. A potentially conservative estimate was used for non-marijuana drug arrests, and a potentially optimistic estimate for marijuana jobs. For the benefit received from marijuana jobs the estimated number of jobs may be an optimistic calculation. The total number of marijuana jobs created by legalization are counted as a benefit, but some of these jobs may be displacing jobs in other industries. Additionally, the estimation of benefit received from additional non-marijuana drug arrests may be underestimated. To estimate the police budget spent in Ohio per arrest, the state police budget is used. To calculate this budget, the Ohio Dept. of Public Safety funds allocated to criminal justice are used⁹. This budget does not include the funds used by localities within the state to contribute to total Ohio arrests. If the budget of localities were included, it could be expected that the cost per arrest would go up, and so the benefit received from the reallocation of police resources would also increase.

Most variables experienced change as expected, however DUI arrests ended up being counted as a benefit. DUI arrests were predicted to be a cost, but the rates of DUI arrests decreased in states where marijuana was legalized. Since DUIs are not a favorable outcome for Ohio the predicted decrease of DUI arrests was then counted as a benefit to society instead of a cost like originally predicted. Other than DUI arrests, all benefits behaved as predicted. Marijuana tax revenue, marijuana jobs, and non-marijuana drug arrests all increased¹⁰. Costs also

⁹ Funds allocated for criminal justice includes funds allocated to Ohio State Highway Patrol, Criminal Justice Services, Investigative Unit, and Homeland Security.

¹⁰ Marijuana tax revenue = \$7.43 per capita, marijuana jobs = 10,894 new marijuana jobs, and non-marijuana drug arrests = 0.078% increase in arrests.

changed as predicted with car insurance claims, admittance to rehab facilities, marijuana exposure ER visits, and past 30-day marijuana used among college aged people all increasing¹¹.

The analysis of all cost and benefit items revealed a few important things. Overall, the benefits outweighed the cost resulting in a value of \$444,798,176.58 for net social benefits. This value means that legalization would result in a per capita net social benefit of \$38.05. This net social benefit is based on a one-year timeframe after legalization. For the benefits, the largest items were tax revenue and marijuana jobs. The largest cost items were admittance to rehab facilities and past 30-day marijuana use in college aged people. If the analysis had only used either of the benefit items of marijuana jobs or tax revenue alone it would have still resulted in a positive net social benefit.

Table 7: Results of Cost Benefit Analysis	
Benefits	
Variable	USD Benefit to Ohio
Marijuana Tax Revenue	\$ 86,856,700.00
Marijuana Jobs	\$ 361,566,066.08
Non-Marijuana Drug Arrests	\$ 3,319,613.82
DUI Arrests	\$ 29,402,056.17
TOTAL BENEFITS	\$ 481,144,436.06
Costs	
Variable	USD Cost to Ohio
Car Insurance Claims	\$ 5,437,755.50
Admittance to Rehab Facilities	\$ 27,950,719.52
Marijuana Exposure ER Visits	\$ 551,768.00
Past 30 Day Marijuana Use - College Age	\$ 2,406,016.45
TOTAL COSTS	\$ 36,346,259.48
Total	
Net Social Benefits	\$ 444,798,176.58
Net Social Benefits per Capita	\$ 38.05

¹¹ Car insurance claims = 2.7% increase in claims, admittance to rehab facilities = 0.44% increase in admittance, marijuana exposure ER visits = 16 per 100k increase in ER visits, and past 30 day marijuana used among college aged people = 5.78% increase in usage.

IV. Conclusion

There are various limitations to this analysis. One large area that can be addressed in future research is the long-term effects of marijuana. In the long term, marijuana may cause more severe health effects, as well as losses in efficiency in the workforce, due to these health effects. Due to the limited scope of this analysis, these long-term effects were not considered. Instead, a focus was placed on more immediate effects that can be directly contributed to legalized marijuana. This analysis also did not take into account the gateway drug effect in regard to emergency department visits from drugs other than marijuana. Additionally, future research will have access to more data from Ohio after the implementation of medical marijuana in the state.

This study does not include an analysis of other policy options. It could be possible that other possible policy options like legalized and strictly regulated marijuana may also have a positive net social benefit. If that is the case, then the policy that would create the greatest social net benefit would ideal policy to implement for economic reasons. Future research on both other options, as well as the statistical significance of findings will provide more insight into the findings of this analysis.

The social net benefit calculated by this study was more than \$444 million. For Ohio this is a per capita social net benefit of \$38.05. Because the calculated value of social net benefit is positive, it would be economically beneficial for Ohio to implement recreational marijuana. The largest benefit items consisted of the tax revenue, jobs, and lower DUI arrest rates that will be experienced by legalization. For cost the largest items were rehab admittance and car insurance claims. Knowledge of the economic benefit of marijuana in Ohio can guide both voters and

legislators, as well as informing those who will be affected by the changes in cost and benefit items experienced by legalization.

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