DRUG ENFORCEMENT
AND **POLICY CENTER**

SUMMARY OF FINDINGS

Impact of Recreational Marijuana Legalization on Regional Economies

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INTRODUCTION

Adult-use marijuana legalization has been a widely debated policy topic among U.S. states and the federal government. At the state level, proponents of legalized adult-use marijuana contend there are multiple positive impacts such as producing (net) reductions in crime rates (though legalization proponents acknowledge that legalization could lead to some offsetting increases crime in other forms such as possible thefts near marijuana dispensaries). Legalization proponents further argue that considerable sums of money will be saved by no longer imprisoning tens of thousands of people for minor possession violations, while providing these people with a much better chance for success in the labor market because "frivolous" criminal convictions will no longer damage their work and education prospects. Finally, legalization proponents expect that states and localities would raise badly needed revenue from the taxation and regulation of marijuana. Of course, opponents have counter-arguments such as legalization having disproportionate adverse health effects on teens and young adults and other externalities such as increased traffic fatalities and accidents.

A comprehensive evaluation of commercial marijuana legalization should entail how legalization affects the state and local regional economies—e.g., wages, housing prices/rents, and demographics. In this project, we systematically investigated the impact of commercial marijuana legalization on state and local economies at the county level.

STATE-LEVEL ECONOMIC OUTCOME ANALYSIS – SUMMARY OF FINDINGS

 In our first analysis, we examine state-level outcomes for how legalizing recreational marijuana impacted state economic outcomes. We have a draft that is nearing completion for peer-reviewed journal submission and our findings are outlined below.

Our empirical analysis indicates that states that legalized recreational marijuana experienced statistically significant increases in their overall employment growth rate and in average housing rents (for statistical reasons, we did not consider housing values, but they generally move in correspondence with rents). Higher housing rents imply that residents place greater value in living in states that legalized marijuana, which is capitalized by housing markets in much the same way as other favorable amenities, such as ocean view, which result in higher home prices. Below, we describe whether these effects reflect positive firm-productivity effects or positive household-amenity effects that residents value.

We find no statistically significant impact on state wage levels or average educational attainment. Thus, the job growth spurred by legalization is skill-neutral with no apparent differences across education levels. No statistical change in wages is suggestive of little productivity effect because the (theoretical) one-to-one correspondence between worker productivity and wages, which is consistent with average educational attainment remaining unchanged. Further, because wages did not increase, but housing costs increased in states that legalized recreational marijuana, real wages (purchasing power) declined. In the dominant regional economic theoretical model (Spatial Equilibrium Model, SEM), this result is interpreted as residents value recreational legalization and are willing to "pay" for legalization by taking a lower real wage (by paying more for housing).

We did not find a statistically significant result for population growth in the first five years after legalization, but by the sixth year, we find a statistically significant positive effect at the 10% level. The delayed population growth result suggests that for employment growth to immediately increase, there was some combination of an increase in

the state's labor-force participation rate or a change in the relative age-composition of the state's populations.[1] In the latter case, it could be that older (retired) residents left the state, perhaps due to an aversion to legalized cannabis as polling data suggests, replaced by younger residents who are more likely to seek employment and favor marijuana's legalization. Indeed, we find a statistically significant increase in labor-force participation in states that legalized. Regarding the possible change in the age composition of states that legalized, that data is "statistically noisy" in U.S. Census Bureau annual estimates, but we will try again to examine this question using updated 2021 state-level age-distribution data released earlier this spring.

We are also examining the age composition of the labor force to examine whether labor-force participation was potentially boosted by reportedly lower opioid abuse in states that legalized recreational marijuana (Chan, Burkhardt and Flyr, 2020). If so, we would expect labor-force participation would have been especially likely to have risen for older whites (approximately 50-70 years old) and in rural areas, the cohorts that were at least initially identified as most prone to opioid abuse and suffer greater "deaths of despair" from suicides and drug overdose.

The analysis overall implies that recreational marijuana legalization had a positive impact on household amenities with ambiguous results for regional productivity. For productivity, there may have been virtually no impact or perhaps a small positive effect. As noted above, the wage results suggest no productivity effect, but because employment increased in these states, we would expect that wages would have declined due to the labor supply increases from greater labor-force participation. Thus, wages holding steady may reflect greater productivity that roughly offset the negative wage effects from the labor supply increase.

In summary, recreational marijuana legalization appears to increase state employment growth and increases housing costs. It is valued by residents as an amenity they "pay" for through accepting lower real wages. Legalization has very small productivity effects, but to the extent they exist, productivity may have very modestly increased (future work should examine whether legalization set off a change in industry composition with higher or lower average productivity or whether individual productivity changed in general regardless of industry). Productivity effects in the "formal" economy likely increased by simply shifting some of the economic rents from illegal cannabis sales to state and local taxes, providing a government revenue source that can support productivity-enhancing services such as education.

At the moment we cannot state whether there are "first-mover" advantages in that early adopters of legal cannabis were able to gain more due to the novelty. Yet, the positive effects may dwindle as more states follow and the ability to attract younger migrants declines as there are fewer non-adopter states from which to attract those young migrants. Thus, we cannot at the moment declare whether a state like Ohio would show equally positive effects as compared to states who were first to legalize adult-use marijuana. But there is no evidence to suggest that Ohio's economy would suffer from legalization.

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[1] We also considered annual net-migration rates to assess whether generally more people moved to these states (defined as in-migration minus out-migration ÷ initial population). For the first five years after legalization, there is no statistically significant effect on net-migration, but in the sixth year, the effect becomes positive (a rather large one percentage point increase in population due to migration) and statistically significant. Thus, the results are consistent with the population results. Perhaps these results indicate that migrants took time to adjust and/or respond to the cannabis policy change. However, the statistical identification of the sixth-year population/migration results are based on the relative increase in sixth-year net-migration rates for Colorado and Washington, the only states that have had lengthy enough post-legalization data to observe net-migration/population six years after treatment. Yet, many things happened in those two states since their legal markets took effect in 2014. It seems a reach to definitively describe that this finding is due to marijuana legalization, or at least until we have more states reach six years post legalization. [To be sure, generally states that legalized marijuana had faster population growth well before they legalized marijuana—which means they attracted younger workers who are most prone to migrate and younger voters especially favor legalization. Yet, we are looking at the *change* in net-migration rates, so we are observing that Washington and Colorado's positive net migration rate accelerated in 2019-2020.

METHODOLOGY

Our data for this analysis was state-level (and county-level data for the county-level analysis) on economic conditions, demographic factors, and the month and year when recreational marijuana legalization took place. Our statistical approaches are (1) two-way fixed-effect counterfactual estimator and (2) two-way interactive fixed-effect counterfactual estimator used in dichotomous treatment cases and in the presence of a control group (Bai, 2009; Liu, Wang and Xu, 2020; Xu, 2017). The model accounts for differing effects across time periods (e.g., state job growth is usually higher in years when national job growth is high) and for state-specific factors such as business climate or natural amenities including nice climates, oceans, and mountains. For example, simply concluding that Colorado's recent fast growth is solely due to marijuana legislation is misleading due to Colorado long being one of the nation's fastest growing states, decades before legalization. So, the model's state fixed effects essentially capture each state's average effect over the entire sample period conditional on the effects of the other control variables—i.e., what we are measuring is an increase in Colorado's already robust performance *after legalization*.

INTERPRETATION

We interpret these results using the theoretical Spatial Equilibrium Model (SEM), which is commonly used by regional and urban economists to assess the underlying causes of regional economic growth or decline. There are two key assumptions information this model. The first assumption is that households maximize utility which is related to their income, local cost of living (primarily driven by different local housing prices) and their "consumption" of (good or bad) local amenities that are typically referred to as quality-of-life factors. These can include anything from a nice climate, clean environment, and recreational opportunities. Access to legal recreational marijuana may be another "amenity" that the typical household values (whether for their own use or for other reasons including personal political preferences). Of course, it may be a negative household amenity for those who do not use cannabis or fear the negative socioeconomic consequences of legalization.

The second key assumption is that firms maximize profits, which are inversely related to local wages and cost of land, as well as being related to local firm "amenities" such as access to local infrastructure, governmental regulatory environment, access to quality labor, and taxes. Basically, the model assumes that households move to places that offer higher utility (or satisfaction)—i.e., people are not just interested in "money" but also quality-of-life. Second, firms move to (or invest in) locations that offer higher profits or lower costs.

Using the SEM, our empirical analysis suggests that the dominant economic effect from legalizing recreational cannabis is that households view it as an amenity that enhances quality of life. This result follows because net-migration/population is flat, or perhaps begins growing six years after legalization even though wages are flat and housing costs have increased (implying declining real income). That is, households are willing to tradeoff a slighlty lower real income in return for legal recreational marijuana. There may be increased firm productivity because even as more people moved into locations with legalized recreational marijuana, the increased local labor supply did not lead to a wage decline as would normally be expected from enhanced labor supply. Rather, it suggests modest firm-productivity increases occurred to allow wages to remain (statistically) unchanged. Yet, we would expect nominal wages to also increase if productivity increases, but we did not find a statistically significant effect. Recent releases by U.S. Bureau of Economic Analysis allows us to obtain another rough measure of labor productivity denoted as:

$$\text{Output per-worker} = \text{GDP/total employment,}$$

which provides one more way of examining the effects on productivity growth.

ECONOMIC DYNAMICS AFTER LEGALIZATION

We also investigate the length of time for these economic effects to occur after legalization. The results indicate that as time passes, the economic effects increase. For instance, Figures 1 and 2 compare the employment growth rate and the median rent growth in "treated" states versus non-treated states. The corresponding 95% confidence interval is shaded in gray (ATT refers to average treatment effect). The X-axis reports the number of years before and after recreational use was legalized. The blue bars at the bottom reflect the number of "treated" states in each time period. They decline over time as the number of states in which legalization was in effect for that number of years eventually declines to just two, i.e., Colorado and Washington. Clearly, both graphs show that as more years pass after recreational legalization, the economic effects also become more statistically significant. In sum, we conclude that the economic effects from recreational marijuana legalization do not diminish with time.

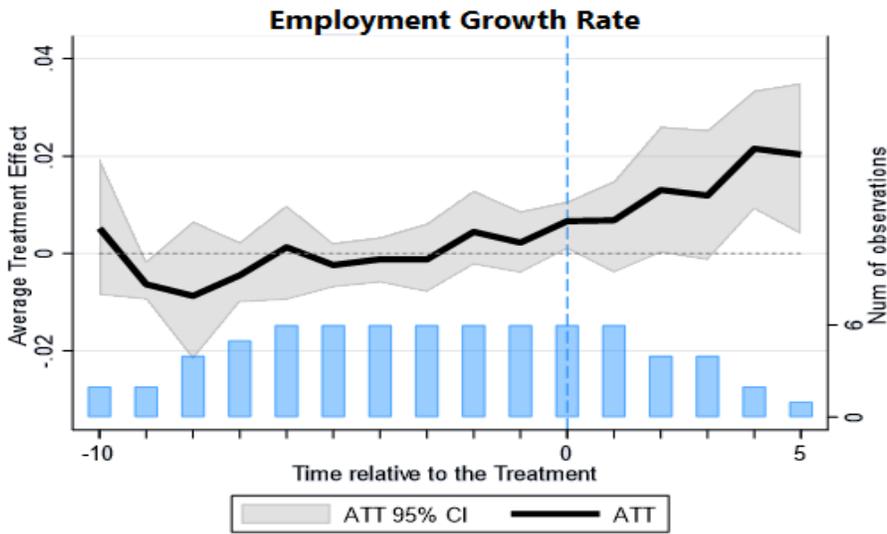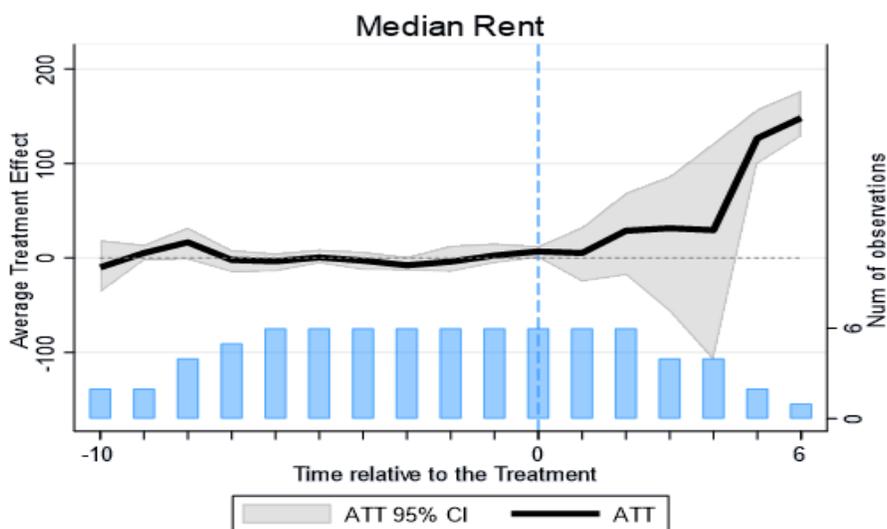**Figure 1: Impact of Legalization on Employment Growth Rate**

Figure 2: Impact of Legalization on Median Rent

COUNTY-LEVEL ANALYSIS

The second analysis is in more preliminary stages. It examines county-level data with significant data requirement such as identifying the status of the recreational market in each county due to local opt-in/opt-out options. We are currently investigating the economic impacts of legalizing recreational marijuana at the county-level by exploiting the county/local options for whether recreational marijuana dispensaries are allowed. First, we are examining how the benefits are distributed between counties with and without recreational dispensaries. Second, we are examining the types of local areas that especially benefit—e.g., it may vary across urban and rural counties or certain demographic measures may have intervening effects.

We start with using county-level data from Colorado because it was the earliest adopter of legalized recreational cannabis along with Washington. In this case, we have the most time to identify whether counties that allowed dispensaries had different outcomes than those who did not—e.g., did communities that did not allow recreational sales suffer a relative loss of young adults. Colorado is especially an interesting case study. First, unlike Washington, there are a large number of counties that have not allowed any recreational dispensaries (or very few), providing enough variation to identify a result.

One particularly interesting case is El Paso County, home of Colorado Springs, Colorado's second largest city. The county's population is nearly 750,000, which makes it a very rare example of a larger urban center that did not allow recreational sales. Rural Manitou Springs is the only El Paso County community that allows recreational sales. It has two recreational dispensaries, reportedly the most profitable in Colorado and a major tax generator for the small rural community. One estimate is that the city of Colorado Springs has lost $150 million in tax revenue by not allowing recreational sales, which is one of the main arguments made by proponents for allowing recreational sales in that city.[2] Moreover, we will examine whether there are spillovers in cases that counties that allow recreational sales are adjacent to counties that do not. [In effect, we will use a measure such as sales per capita to capture cases like El Paso County which have very limited access to recreational sales.]

The second way we will assess the county-level effects will be to use the Synthetic Control approach for every county in states that legalized sales as the treatment group while counties in states that do not allow these sales serve as the source of donors for the construction of the synthetic control units. Identifying counterfactuals is statistically challenging. We are using the Synthetic Control approach augmented with standard two-way fixed effects models. The Synthetic Control approach is similar to propensity-score matching but allows a weighted average of multiple counties to produce even closer counterfactual "county" matches. For each county in a "treated" state (i.e., legalized recreational marijuana), Synthetic Control approach determines the specific (multiple) counties in non-treated states from which a weighted average of those counties' characteristics produce a good counterfactual synthetic control county. For example, for Los Angeles County, its synthetic-control-county variable values would be created by weighted averages of (say) 50% of Fulton County, Georgia's (Atlanta) values, 35% of Harris County, Texas's (Houston) values, and 15% of Hennepin County, Minnesota's (Minneapolis) values as our control-variables for the synthetic county counterfactual.

We believe we have worked out the programming issues for using Synthetic Controls in this manner. Canned statistical software for the Synthetic Control model is designed to create one synthetic control unit to compare to one treated unit, not like our case of several hundred treated counties each requiring their own Synthetic Control "county." Fortunately, the theoretical approach in interpreting the county-level results follows from the same approach used in the state-level analysis and is relatively straight forward. Rather than state fixed effects, we will employ county/synthetic-control fixed effects to serve as the base value for the county—e.g., does it historically

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[2] Julie Fennel, "Recreational marijuana campaign in Colorado Springs can collect signatures." *Colorado Newsline.* March 21, 2022. https://coloradonewsline.com/briefs/legalization-recreational-marijuana-sales-colorado-springs/.

have fast or slow job growth regardless of marijuana's legal status.

We will use most of the same demographic, geographical, and economic control variables as for the state models with the exception of variables such as including county-level measures of natural amenities from the U.S. Department of Agriculture, county population, size of county, number of dispensaries by year (assuming that is available for the entire sample, but it is available for most of the states that have legalized recreational sales), as well as measures representing the recreational cannabis regulations in adjacent counties. The county's recreational marijuana sales per capita reflects a measure of the "treatment intensity," i.e., the degree to which recreational cannabis can be locally accessed.

One particular item of interest is whether heavy recreation destinations are differentially affected—i.e., do tourists make holiday destinations based on the legal status of recreational marijuana sales, which in turn affect the local economy. Some have hypothesized that legalization has particularly benefited Colorado's tourism industry, for example.

CONCLUSION

The empirical analysis indicates that states that legalized recreational marijuana experienced statistically significant increases in their overall employment growth rate and in their housing rents. On the other hand, there was no statistically significant impact on average wages or average educational attainment. The analysis indicates that recreational marijuana legalization has positive impacts on household amenities (quality of life) and possibly on state productivity, according to the SEM.

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