(Pot)Heads in Beds: The Effect of Marijuana Legalization on Hotel Occupancy in Colorado and Washington

Brian Meehan
Berry College

Corey J. Rusko
Unaffiliated Scholar

E. Frank Stephenson
Berry College

Abstract

This paper uses monthly hotel occupancy data to examine the effect of marijuana legalization on tourism in Colorado and Washington. The results indicate a large increase in hotel rooms rented in Colorado, with a considerably smaller effect for Washington. The effects are larger in both states once commercial sale is permitted above and beyond legalizing possession and individual cultivation.

1   Introduction

In November 2012, voters in Colorado and Washington approved statewide referenda legalizing the personal possession and recreational use of marijuana, subject to a regulatory framework similar to those for alcohol and tobacco. Marijuana remained illegal at the federal level as a Schedule I controlled substance, but Colorado's Amendment 64 and Washington's Initiative 502 effectively created a patchwork legal status for marijuana within the United States. While the U.S. Constitution establishes the supremacy of federal law and thus marijuana's *de jure* status, an August 2013 memo from the Department of Justice institutes *de facto* legal status for individuals and licensed distributors in states that lift prohibition while maintaining adequate regulations (Dennis, 2013). Thus the legal usage of marijuana has become an exclusive privilege defined by geographic boundaries.

It is easy to see the implications marijuana legalization might have for tourism. Amsterdam's permissive legal tolerance of drugs (and other activities) attracts visitors from around the world, sometimes to the weariness of the Dutch public (Jolly, 2012). However, *de facto* legalization in Colorado and Washington means that Amsterdam lost its unique status as a destination for people wanting to be able to consume marijuana without the threat of arrest and prosecution. Travel to Colorado or Washington is cheaper than travel to the Netherlands for most Americans, and travel to Colorado or Washington might also be a less expensive option for some people living in other countries (e.g., Japan or western Canada). Hence, these states provide reasonable substitutes to Amsterdam for people seeking to legally consume marijuana.

Unsurprisingly, it was not long after commercial sales began in Colorado that news reports appeared about the burgeoning pot industry. One CNN headline (Smith, 2014) reads: "Tourists flock to Colorado to smoke legal weed." The accompanying article contains anecdotal reports from Colorado dispensary owners of "tour buses coming in every day" filled with people from places ranging from Texas and Georgia to Japan and Saudi Arabia. Indeed, so many people from Oklahoma and Nebraska traveled to Colorado to buy pot that those states sued Colorado because of the large number of residents caught with marijuana when they

returned home. Alan Feuer (2016) of the *New York Times* details the emergence of a niche industry in Colorado offering travel packages catering to marijuana tourists:

> I found the options dizzying: In the two years since the state first permitted the sale of weed to recreational users, an intricate economy has rapidly sprung up. Dope-smoking ski buffs can ride to the slopes in weed-friendly charter S.U.V.s, and arriving potheads can schedule pickups from the airport through dedicated delivery services like THC Limo. There are stoner painting classes, stoner mountain treks and stoner chefs who will cook you a four-course marijuana dinner.

> In the end, I elected a three-day sampler tour of Denver offered at the price of $1,295, not including airfare, by one of Colorado's most popular pot tourist firms, My 420 Tours. A cannabis concierge helped me plan my weekend, mellowly insisting on the foodie tour and the private massage with medicinal marijuana oil.

A cursory Google search shows that such business ventures have also popped up in Washington. Travel planning resources are also available for people opting to create their own itineraries. For example, they can find marijuana vendor locations easily with web services such as *Leafly* or *Weedmaps* or book a "bud and breakfast" with *TravelTHC*.

While Colorado and Washington seem to have become attractive destinations for avid cannabis users, news reports provide only anecdotal evidence of pot tourism. This paper provides a more formal analysis of marijuana legalization's effect on tourism in Colorado and Washington.

Since Colorado and Washington were the first states to legalize marijuana, it is not surprising that they have been the subject of scholars studying the effects of this policy change. Larson et al. (2015) examine the effect of legalization on market prices in Colorado and Washington. Using a difference-in-differences model and data scraped from a website where users post anonymous information about marijuana purchases, they find that legalization reduced prices in Colorado but increased prices in Washington. Larson et al. attribute the different outcome to Washington's initially not allowing personal growing of marijuana but suggest that prices have likely fallen since the period of their study (it ended with October 2013).[1] Gavrilova et al. (2019) examine the impact of legalized medical marijuana (including in Washington and Colorado) on U.S.-Mexico border crime and find that medical marijuana legalization reduces violent crime at the border. They attribute the crime reduction to Mexican cartels' market share shrinking as medical marijuana production becomes legal and replaces cartel distribution. Turning to domestic crime, Dragone et al. (2019) find that recreational marijuana legalization in Washington increased marijuana use and subsequently reduced rape, property crime, and the consumption of other drugs (including alcohol).

As marijuana consumption increases among residents, or brings in tourists, roadways may become more dangerous as a larger percentage of motorists may be under the influence of marijuana. Aydelotte et al. (2017) assess roadway safety after recreational legalization in Colorado and Washington and do not find a statistically significant difference in roadway fatalities in these states relative to a group of similar control states, suggesting that marijuana legalization did not make roadways more dangerous. Hansen (2019) finds that drunk driving related accidents fall dramatically in an area after the opening of legal marijuana dispensaries in neighboring jurisdictions, suggesting that marijuana and alcohol are substitutes. As marijuana related accidents are much less common than alcohol related accidents, the overall impact of increased marijuana tourism on road safety may be ambiguous. More relevant to our paper, Kim and Monte (2016) analyze panel data of cannabis-related hospital emergency room (ER) visits in Colorado before and after retail marijuana sales began and find that ER visits "increased disproportionately among out-of-state residents."

Hao and Cowan (2020) analyze spillover impacts of recreational marijuana legalization in neighboring states to Colorado and Washington. They find that marijuana possession arrests increase in counties that border Colorado and Washington after recreational use is legalized, suggesting that individuals in neighboring states are traveling into Colorado and Washington to obtain marijuana and then try to smuggle it over the border. Yet, these results may be driven by an increase in police enforcement near the border after

---

[1]Malivert and Hall (2013) use data from the same website to examine the effect of medical marijuana legalization and find that medical marijuana laws are associated with decreases in extralegal marijuana prices. Davis et al. (2016) also use data from the same source and OLS and IV models to estimate the price elasticity of marijuana demand but their data cover September 2010 to August 2011 so their paper does not directly consider legalization in Colorado and Washington.

legalization in a border state, rather than only from increases in cross-border marijuana transportation. In a report prepared for the Colorado Department of Revenue, Light et al. (2015) examine marijuana sales tax receipts, and other local sales data, and estimate that out of state tourists account for 44% of metro-level marijuana sales, and about 90% of marijuana sales in Colorado's mountain counties, which are popular tourist destinations. While these results suggest an uptick in tourism following marijuana legalization, there have been no studies directly examining the effect of legalization on tourism.

In recent years, STR, a firm compiling hotel industry data, has begun making its data available to researchers who purchase annual subscriptions. The newly available hotel occupancy data have been used to study tourism associated with sports or other events (Depken and Stephenson (2018); Heller et al. (2018); Chikish et al. (2019)). This paper uses hotel occupancy data to analyze the effect of marijuana legalization on tourism in Colorado and Washington.

2   Empirical Framework

We examine the effect of legal marijuana on tourism using monthly hotel occupancy data from the 48 contiguous states over 2011-2015, a period spanning legalization in Colorado and Washington. Figure 2 plots the number of rooms rented each month in Colorado and Washington. The most prominent feature of the diagram is the strong seasonality in both states' hotel markets; room rentals are much higher in summer months than winter months. In Colorado, however, the summer peaks were below 2.5 million and basically flat over 2011-2012 but show an upward trend over 2013-2015. Likewise, Colorado's winter troughs increase in 2013-2015 relative to 2011-2012. Potential pot-induced tourism increases are less noticeable in Washington than Colorado.

Figure 1: Monthly Hotel Room Rentals in Colorado and Washington
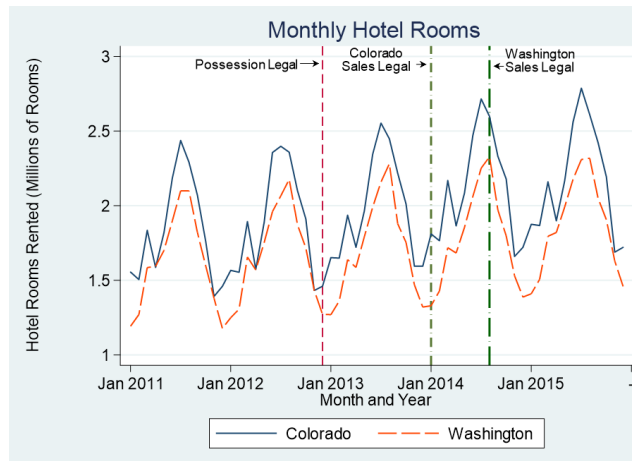
In any event, determining the effect of marijuana legalization on tourism requires comparing Colorado and Washington to other states that did not change the legal status of recreational marijuana. Hence, we estimate the following difference-in-differences models:

$$DEP_{it} = \alpha_0 + \alpha_1 COLegal_{it} + \alpha_2 CO * COLegal_{it} + \alpha_3 COSale_{it} + \alpha_4 CO * COSale_{it} + \theta\Omega_{it} + \varepsilon_{it} \quad (1)$$

$$DEP_{it} = \beta_0 + \beta_1 WALegal_{it} + \beta_2 WA * WALegal_{it} + \beta_3 WASale_{it} + \beta_4 WA * WASale_{it} + \Gamma\Omega_{it} + \varepsilon_{it} \quad (2)$$

Table 1: Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.
Full Sample				
Rooms Rented	1,895,445	2,139,240	121,276	13,024,152
ADR	99.3	24.45	65.01	241.42
Revenue (millions)	205.89	280.78	11	2,139.24
Unemployment Rate	7.17	1.33	5	9.1
Gas Price	3.29	0.5	2.05	3.96
International Arrivals (millions)	5.85	0.96	3.85	8.36
Colorado				
Rooms Rented	1,989,724	368,890	1,391.96	2,787,123
ADR	117.16	16.36	91.02	153.24
Revenue (millions)	233.41	54.51	126.7	372.24
Washington				
Rooms Rented	1,727,595	323,419	1,178,242	2,327,449
ADR	109.61	12.42	91.85	144.94
Revenue (millions)	192.66	56.72	108.23	336.02

Note: All data are monthly over the period 2011-2015.

In both models, DEP is one of three dependent variables: the number of hotel rooms rented in each state in a given month, the average daily room rate (ADR) of hotel rooms rented in each state in a given month, or total hotel revenue in each state in a given month. Descriptive statistics for hotel room rentals, ADR, hotel revenue, and all continuous explanatory variables (discussed below) are reported in Table 1. Equations 2 and 2 are estimated in both level and log forms for each of the three dependent variables so there are total of 12 models estimated.[2] (The level and log results are similar, but estimation in log form is our preferred specification because it mitigates heteroskedasticity that might arise from large differences across states in the number of hotel rooms rented, hotel room rates, or hotel revenue.) Equation (1) is estimated using data from Colorado and all other contiguous states except Washington; equation (2) is estimated using data from Washington and all other contiguous states except Colorado. Hence each estimation has 2,820 observations (=60 months*47 states).

In both Colorado and Washington, possession and use were legalized before commercial sale was permitted. Tourist effects would not necessarily be the same under both regimes; pot tourists would presumably be more amenable to visiting Colorado or Washington once commercial sale was legal. Hence the models are formulated to allow for different effects during the possession legal and sales legal periods. In Colorado, possession and use were legal from December 2012 to December 2013 and sale was permitted beginning in January 2014. Hence the variable COlegal in equation (1) takes a value of one from December 2012 to December 2013 and the variable COsale takes a value of one from January 2014 to December 2015. As is typical for difference-in-differences estimation, the variables of interest are the interaction terms CO*COlegal and CO*COsale where CO is an indicator variable taking a value of one for Colorado and zero for the other 46 states used in the estimation.

In Washington, the period in which possession was legal but sales were not permitted extended from December 2012 to June 2014. In equation (2), therefore, WAsale takes a value of one for the period December 2012 to June 2014 and WAsale takes a value of one for July 2014 to December 2015. Again the variables of interest are the interaction terms WA*WAlegal and WA*WAsale, where WA is a dummy taking a value for Washington and zero for the other 46 states used in estimating equation (2).

The vector Ω contains the control variables included in the estimation. These include total overseas

---

[2]We also attempted to quantify these impacts using a synthetic control model. However, the nested optimization techniques used in the synthetic control estimation could not optimize the synthetic counterfactual needed to calculate the estimated impact. This was probably due to the nature of the data used, as the variation in month-to-month hotel occupancy and revenue in this data is very large (see Figure 2).

arrivals in the U.S. in each month, the average monthly price of gasoline, and the monthly unemployment rate.[3] (These macroeconomic control variables are in levels when the dependent variable is in level form and are logged with the dependent variable is in log form.) State fixed effects, including the previously mentioned dummies for Colorado and Washington, are included in Ω to control for systematic differences across states in the number of rooms rented per month, ADR, and hotel revenue. Likewise, month fixed effects are included to control for systematic increases or decreases in tourism throughout the year, as evident in Figure 2 (e.g., most family vacations occur during summer months). Including the macroeconomic controls and the state and month fixed effects is necessary to isolate the effects of marijuana tourism from other factors affecting the number of hotel rooms let.

3   Results

The estimation results for Colorado are presented in Table 2. The top panel contains level and log estimates for the number of rooms rented, the middle panel contains level and log estimates for the ADR, and the bottom panel contains level and log estimates for monthly hotel revenue. The parentheses below the coefficient estimates contain standard errors estimated with clustering by state. For brevity, the state and month fixed effects are not reported.

For the model estimated in levels, the estimated coefficient on CO*COlegal indicates that legalization in Colorado is associated with an increase of nearly 51,000 hotel rooms rented per month, an increase of about 2.5% relative to Colorado's average of approximately 2,000,000 rooms let per month. Similarly, the estimated coefficient on CO*COsale indicates that once commercial sale is permitted, there is an increase of almost 120,000 room rentals per month or about 6% of the mean. The estimates from the log specification are a bit larger; the coefficients on CO*COlegal and CO*COsale imply that legalizing marijuana possession increased room rentals by about 4% and permitting commercial marijuana sales increased hotel room occupancy by about 7.2%. As expected, legalizing marijuana sales is associated with a larger increase in hotel room rentals than merely legalizing marijuana possession.

If legalizing marijuana increases pot tourism then there should also be an increase in hotel room rates. Looking at the ADR results reported in the middle panel of Table 2, the estimated coefficients on CO*COlegal and CO*COsale indicate that ADR did increase with the legalization of marijuana. The levels (logs) estimation indicates that room rates increased by $3.76 (2.8%) when possession became legal and by $6.31 (3.8%) when sales were legalized. As expected, the effect of legal sales is larger than the effect of legal possession.

If legal weed increases room rentals and room rates then hotel revenue should also increase. The results reported in the bottom panel of Table 2 indicate that legal possession increased revenue by $9.33 million per month (or, from the log estimation, about 6.75% per month) and that legal sales increased revenue by $23.71 million per month (or roughly 11% per month). Marijuana tourism had an economically significant as well as a statistically significant effect on the hotel industry in Colorado.

Estimation results from Washington (equation (2)) are reported in Table 3. The model estimated in levels yields small and imprecisely estimated effects for both legal possession and legal sales on hotel room rentals in Washington. However, the log model indicates that legalizing possession increases room rentals in Washington by about 1% and legal sales increase rooms let by about 3.5%, effects that are less than half as large as found for Colorado. The estimated ADR effects are much smaller in Washington than Colorado for legalized possession, but legal sales has a larger effect on ADR in Washington than Colorado. With the room rental effects in Washington being smaller than Colorado, it is not surprising that the effects on monthly hotel revenue are smaller as well.

As for the control variables, international arrivals are positively related to hotel room rentals, ADR, and revenue in both states and in both level and log specifications. Similarly, the unemployment rate is negatively related to room rentals, ADR, and hotel revenue in both states and in both level and log specifications. The price of gasoline is not related to hotel room rentals, ADR, or hotel revenue in either state in either level or log specifications. The unreported month fixed effects show, as indicated in Figure 2, that room rentals

---

[3]International (I-94) arrivals come from the Department of Commerce (through Homeland Security); data for 2015 is preliminary. Unemployment data come from the Bureau of Labor Statistics. Gas price data come from the Energy Information Agency.

Table 2: Colorado hotel occupancy estimation results

	Levels	Logs
Dependent Variable: Rooms Rented		
COlegal	2807.69	0.0006
	(5497.37)	(0.0026)
CO*COlegal	50,955.44**	0.0397**
	(12,299.99)	(0.0036)
COsale	19,897.08	0.0100*
	(10,159.07)	(0.0048)
CO*COsale	119,888.90**	0.0720**
	(34,540.36)	(0.0046)
Unemployment rate	-39,154.64**	-0.0208**
	(9850.47)	(0.0030)
Gas price	-10,086.70	-0.0019
	(8339.11)	(0.0052)
International arrivals	31,611.31*	0.0089*
	(12,087.77)	(0.0042)
Dependent Variable: Average Daily Room Rate		
COlegal	0.23	0.0041
	(0.24)	(0.0023)
CO*COlegal	3.76**	0.0277**
	(0.40)	(0.0047)
COsale	-0.44	-0.0023
	(0.46)	(0.0047)
CO*COsale	6.31**	0.0381**
	(0.68)	(0.0051)
Unemployment rate	-3.48**	-0.0349**
	(0.25)	(0.0021)
Gas price	-0.49	-0.0041
	(0.38)	(0.0036)
International arrivals	1.30**	0.0114**
	(0.25)	(0.0020)
Dependent Variable: Hotel Revenue (in Millions)		
COlegal	1.14	0.0047
	(1.17)	(0.0037)
CO*COlegal	9.33*	0.0674**
	(4.07)	(0.0055)
COsale	2.39	0.0076
	(1.88)	(0.0071)
CO*COsale	23.71*	0.1100**
	(10.79)	(0.0076)
Unemployment rate	-11.31**	-0.0557**
	(2.77)	(0.0046)
Gas price	-3.37	-0.0059
	(1.95)	(0.0081)
International arrivals	7.82**	0.0203**
	(2.55)	(0.0054)

* p¡0.05; ** p¡0.01 N=2,820. The unemployment rate, gas price, and international arrivals variables are all logged in the models with logged dependent variables. All models contain month and state fixed effects and a constant. Parentheses contain standard errors clustered by state.

Table 3: Washington hotel occupancy estimation results

	Levels	Logs
Dependent Variable: Rooms Rented		
WAlegal	1400.97	0.0005
	(5322.38)	(0.0025)
WA*WAlegal	-20,624.54	0.0098*
	(18,760.53)	(0.0048)
WAsale	15,035.95*	0.0099*
	(7347.90)	(0.0043)
WA*WAsale	33,373.14	0.0346**
	(35,734.48)	(0.0047)
Unemployment rate	-41,694.62**	-0.1155**
	(9757.16)	(0.0161)
Gas price	-3640.63	0.0032
	(8344.28)	(0.0040)
International arrivals	35,635.91**	0.1541**
	(12,120.19)	(0.0242)
Dependent Variable: Average Daily Room Rate		
WAlegal	0.58**	0.0102**
	(0.20)	(0.0019)
WA*WAlegal	1.10**	0.0062
	(0.41)	(0.0033)
WAsale	0.93**	0.0100**
	(0.31)	(0.0028)
WA*WAsale	7.46**	0.0525**
	(0.81)	(0.0059)
Unemployment rate	-3.09**	-0.2288**
	(0.19)	(0.0135)
Gas price	-0.35	0.0030
	(0.33)	(0.0022)
International arrivals	1.31**	0.0641**
	(0.24)	(0.0206)
Dependent Variable: Hotel Revenue (in Millions)		
WAlegal	1.68	0.0107**
	(1.18)	(0.0032)
WA*WAlegal	-4.47	0.0159*
	(5.49)	(0.0071)
WAsale	4.70**	0.0199**
	(1.64)	(0.0047)
WA*WAsale	12.70	0.0871**
	(11.69)	(0.0085)
Unemployment rate	-10.86**	-0.3442**
	(2.69)	(0.0219)
Gas price	-2.00	0.0062
	(1.88)	(0.0054)
International arrivals	8.43**	0.2182**
	(2.55)	(0.0371)

* $p<0.05$; ** $p<0.01$ N=2,820. The unemployment rate, gas price, and international arrivals variables are all logged in the models with logged dependent variables. All models contain month and state fixed effects and a constant. Parentheses contain standard errors clustered by state.

have an inverse U-shape over the course of the year, with more room rentals peaking in the summer months and bottoming out during the winter months.

4 Discussion

Marijuana legalization led to a larger increase in tourism in Colorado than Washington. One possible explanation is that Colorado is an easier travel destination than Washington because it is more centrally located and Denver's airport is a major hub for United Airlines. Another possible explanation is that Colorado may have achieved a first mover advantage over Washington since it legalized commercial sale six months earlier than Washington. A third possible explanation is that Washington is adjacent to British Columbia which has a strong reputation for growing marijuana and a laid back attitude toward marijuana consumption (though use remains illegal). While marijuana legalization increased tourism, especially in Colorado, the benefit may wane as additional states including California, Michigan, and Illinois, legalize the possession and sale of marijuana.

References

Aydelotte, J. D., Brown, L. H., Luftman, K. M., Mardock, A. L., Teixeira, P. G., Coopwood, B., and Brown, C. V. (2017). Crash fatality rates after recreational marijuana legalization in Washington and Colorado. *American Journal of Public Health*, 107(8):1329–1331.

Chikish, Y., Humphreys, B. R., Liu, C., and Nowak, A. (2019). Sports-led tourism, spatial displacement, and hotel demand. *Economic Inquiry*, 57(4):1859–1878.

Davis, A. J., Geisler, K. R., and Nichols, M. W. (2016). The price elasticity of marijuana demand: Evidence from crowd-sourced transaction data. *Empirical Economics*, 50(4):1171–1192.

Dennis, B. (2013). Obama administration will not block state marijuana laws if distribution is regulated. *Washington Post*, 29 August.

Depken, C. A. and Stephenson, E. F. (2018). Hotel demand before, during, and after sports events: Evidence from Charlotte, North Carolina. *Economic Inquiry*, 56(3):1764–1776.

Dragone, D., Prarolo, G., Vanin, P., and Zanella, G. (2019). Crime and the legalization of recreational marijuana. *Journal of Economic Behavior & Organization*, 159:488–501.

Feuer, A. (2016). Taking a trip, literally, on Colorado's pot trail. *New York Times*, 14 April.

Gavrilova, E., Kamada, T., and Zoutman, F. (2019). Is legal pot crippling Mexican drug trafficking organisations? The effect of medical marijuana laws on US crime. *The Economic Journal*, 129(617):375–407.

Hansen, B. (2019). Are marijuana and alcohol substitutes? Evidence from neighboring jurisdictions. *The Center for Growth and Opportunity Working Paper 2019.16*.

Hao, Z. and Cowan, B. W. (2020). The cross-border spillover effects of recreational marijuana legalization. *Economic Inquiry*, 58(2):642–666.

Heller, L. R., Matheson, V. A., and Stephenson, E. F. (2018). Unconventional wisdom: Estimating the economic impact of the Democratic and Republican national political conventions. *Papers in Regional Science*, 97(4):1267–1278.

Jolly, D. (2012). Law could hamper drug tourism in the Netherlands. *New York Times*, 2 April.

Kim, H. S. and Monte, A. A. (2016). Colorado cannabis legalization and its effect on emergency care. *Annals of Emergency Medicine*, 68(1):71.

Larson, R. A., Rusko, C. J., and Secor, A. E. (2015). A blunt analysis: Marijuana policy liberalization and market prices in Colorado and Washington. *Centre College Empirical Analysis Paper*.

Light, M. K., Orens, A., Lewandowski, B., and Pickton, T. (2015). *Market size and demand for marijuana in Colorado*. Marijuana Policy Group.

Malivert, R. and Hall, J. C. (2013). The effect of medical marijuana laws on extralegal marijuana prices. *Atlantic Economic Journal*, 41(4):455–456.

Smith, A. (2014). Tourists flock to Colorado to smoke legal weed. *CNN Money*, 22 August.