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The Economic Impacts of Marijuana Sales in the State of California

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Executive Summary

With the passage of Proposition 215 in 1996, California became the first state to permit the possession, cultivation, and consumption of marijuana for medical purposes. Recent surveys of likely California voters indicate majority support for the legalization of recreational marijuana. While there is still significant debate regarding the regulatory and legal foundations that will govern the recreational marijuana industry in the Golden State, an initiative is expected to appear on the 2016 ballot.

This analysis presents estimates of the potential economic benefits of legal medical and recreational marijuana sales in California. We use a demand estimation methodology based on data collected by the National Survey on Drug Use and Health (NSDUH)—a national- and state-level survey on substance use—to estimate the aggregate quantity of marijuana consumed by California residents. We use the resulting demand estimates and industry trends from Colorado since the legalization of marijuana for recreational use (January 1, 2014) to estimate the potential demand for marijuana by visitors to California.

Using low- and high-consumption demand scenarios to account for uncertainty, we estimate that California residents could consume between 1,302 million and 1,654 million grams of marijuana per year—amounting to between 1,435 and 1,824 tons, respectively—if marijuana is legalized for recreational use. These resident demand estimates correspond to visitor demand estimates of 95 million and 121 million grams per year, which amounts to between 105 and 133 tons, respectively. We use the average cost of illegal and legal medical marijuana sales in California in 2015 (\$11.37 per gram) to convert these demand estimates to annual sales revenue. We estimate sales revenue between \$15.9 billion and \$20.2 billion per year. Using the California state sales tax base rate of 7.5 percent, these sales revenue estimates amount to tax revenue between \$1.2 billion and \$1.5 billion per year. If Senate Bill 987 (known as the Marijuana Value Tax Act) passes, these tax revenue estimates would double to at least between \$2.4 billion and \$3.0 billion per year.¹

We use the sales revenue estimates to estimate the potential economic benefits of marijuana using the IMPLAN input-output modeling framework. Our estimates indicate that legal sales of marijuana to California residents and visitors could support between 81,000 and 103,000 annual jobs and between \$8.4 billion and \$10.6 billion in total industry activity, of which \$5.5 billion to \$7.0 billion would be new value added to the economy.

This analysis does not consider the possible costs associated with marijuana use, such as increased security requirements, increased energy usage, physical and mental health impacts, public education campaigns, or changes to worker productivity. This analysis is limited because of the short time frame of data available since the legalization of recreational marijuana in Colorado and Washington State. Further research may shed light on additional positive and negative economic impacts created by the legalization of marijuana.

¹ This assumes that recreational marijuana sales would be subject to an excise tax of at least 15 percent.



1. Introduction

In 1996, California voters passed Proposition 215, which added Section 11362.5 to the state's Health and Safety Code. Section 11362.5—also known as the Compassionate Use Act (CUA)—introduced regulations permitting patients with a valid doctor's recommendation and their designated primary caregivers to possess and cultivate marijuana for personal medical use. The CUA was the first medical marijuana initiative promulgated at the state level, even though federal law prohibits the possession, cultivation, and consumption of marijuana and related products. The state of California passed Senate Bill 420 in 2003, which introduced guidelines pertaining to Proposition 215, such as a voluntary identification card system, marijuana possession and cultivation limits, and provisions to protect patients and their caregivers from arrest. Three additional bills were signed into law in 2015 (Assembly Bills 243 and 266; Senate Bill 642) that will establish a licensing and regulatory framework for medical marijuana when they are developed into regulations.²

In 2000, Colorado voters passed Initiative 20, which legalized the use of marijuana for medical purposes. Like Senate Bill 420 in California, Initiative 20 established an identification card system for patients and their caregivers. Voters passed Colorado Amendment 64 in November 2012, which provided the legal foundation for recreational marijuana in Colorado. In the same month, voters in Washington State passed Initiative 502, which established a similar statewide legal framework for recreational marijuana. The differences between the regulatory systems in the two states are significant regarding implementation as well as administration. For example, Colorado established a Marijuana Enforcement Division to conduct oversight, while Washington's system is administered by the Liquor Control Board. Another significant difference pertains to licensing requirements. Established medical dispensaries in Colorado have first rights to retail dispensary licenses, while Washington requires separate licenses for retail and medical marijuana. This difference permitted licensed medical dispensaries in Colorado to immediately begin sales on January 1, 2014, while Washington entrepreneurs had to begin the license application process from the beginning.

In 2010, California voters rejected similar measures to legalize recreational marijuana by a thin margin, but support has since grown into a majority, according to the Public Policy Institute of California (PPIC). According to PPIC, 55 percent of likely California voters would support such an initiative.³ While there is still significant debate regarding the regulatory and legal foundations that will govern the recreational marijuana industry in the Golden State, an initiative is expected to appear on the 2016 ballot in California.

The remainder of this analysis demonstrates the economic activity that could be supported by medical and recreational marijuana sales in California if recreational marijuana is legalized. Section 2 presents the methodology we use to estimate the demand for marijuana by residents of California and visitors to the state as well as the resulting sales and tax revenue. Section 3 presents ranges of the potential economic impacts on employment, labor income, value added, and industry activity. Section 4 discusses potential next steps for research.

2. Estimating the Demand for Marijuana in California

To estimate the demand and associated sales revenue for marijuana in California, we follow a methodology similar to that used by the Marijuana Policy Group (MPG) in a study for the Colorado

² California Department of Public Health, Medical Marijuana Program.

<https://www.cdph.ca.gov/programs/MMP/Pages/default.aspx>

³ Public Policy Institute of California, Statewide Surveys May 2010–March 2015, "Californians' Attitude to Marijuana Legalization." http://www.ppic.org/main/publication_show.asp?i=1150



Department of Revenue.⁴ If legalized, the California retail marijuana industry may take a different form than that of Colorado; however, our analysis assumes that the trends associated with the market demand for marijuana will be comparable between states. For more information about the Colorado study, please see [Appendix A](#).

First, we estimate the number of residents who use marijuana and their frequency of use based on data from National Survey on Drug Use and Health (NSDUH), which is conducted by the Substance Abuse and Mental Health Services Administration under the United States Department of Health and Human Services. The survey collects information about the number of California residents reporting marijuana usage in the past 30 days (from the date of the survey).⁵ The survey results represent both medical and nonmedical marijuana use. The data also provide information about the frequency of use in terms of days per month. We rely on the 4-year Restricted-Use Data Analysis System (R-DAS) data for 2010–2013 to estimate resident demand.

To estimate resident demand, we use the following equation:

$$Resident\ Demand = 12 \left(\sum_{c=1}^6 days_c * g_c * n_c \right)$$

Where:

- Resident Demand = total annual demand for recreational and medical marijuana by individuals over the age of 21 in California
- c = user-frequency category (categorized by the number of days of marijuana use per month)
- $days_c$ = number of use days per month (between 1 and 31)
- g_c = number of grams consumed per day
- n_c = user-frequency category population

2.1. Population of Marijuana Users

We apply several adjustments to the R-DAS data to better represent the population of legal marijuana users residing in California. First, we adjust the data to represent only the population of marijuana users over the age of 21. While the current illegal (i.e., black) and informal (i.e., grey) markets in California may be accessible for individuals under the age of 21, these users would not be able to access the legal retail market; thus, we restrict the population of users and the resulting economic impacts to only those benefits stemming from marijuana users 21 years or older. To perform this adjustment, we multiply the number of respondents in each frequency-of-use category by 84.1 percent, which is the fraction of the California population surveyed by NSDUH that is 21 years or older.⁶ We also update the data using a growth rate of 1.8 percent in California between January 2013 and

⁴ M. Light, A. Orens, B. Lewandowski, and T. Pickton, "Market Size and Demand for Marijuana in Colorado," 2014. Prepared by the Marijuana Policy Group for the Colorado Department of Revenue.

⁵ ICPSR, National Survey on Drug Use and Health Series. <http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/64>

⁶ United States Census Bureau, American Fact Finder, Profile of General Population and Housing Characteristics: 2010, 2010 Demographic Profile Data, State of California. http://factfinder.census.gov/bkmk/table/1.0/en/DEC/10_DP/DPDP1/0400000US06

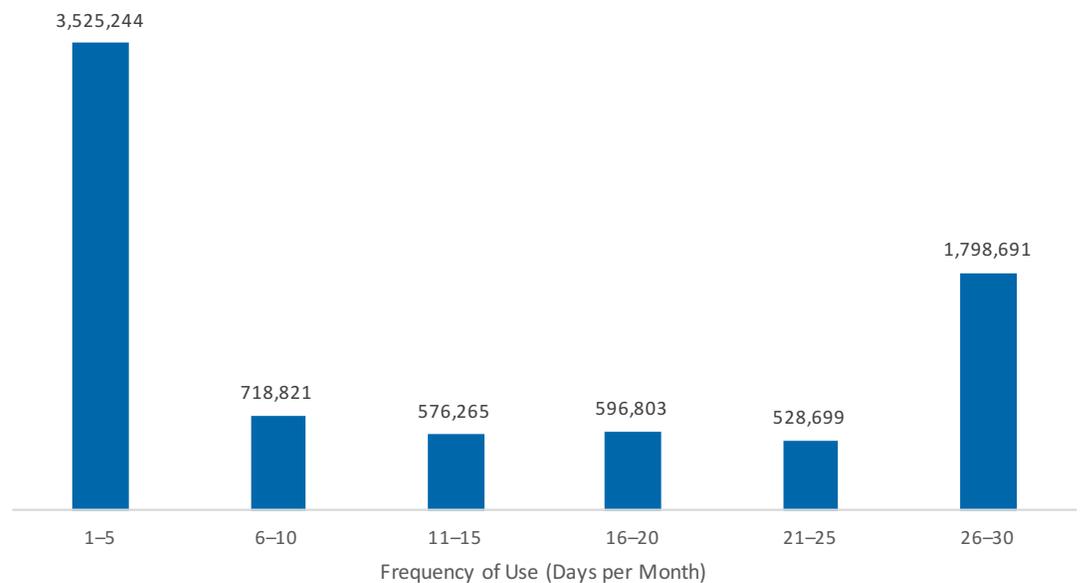


January 2015 to account for population growth since the survey data were collected.⁷ It is likely that the legalization of marijuana for recreational purposes may increase the population of users above current levels. Due to data limitations and uncertainty regarding the magnitude to which the population may increase, however, we take the conservative approach and assume that the user population will remain consistent with pre-legalization levels.

We also apply an adjustment to account for underreporting. In the 2014 MPG analysis, the authors cite a number of studies that have applied an underreporting adjustment to NSDUH data in order to account for reporting issues associated with survey responses about illegal activities.⁸ Assuming that the California population underreported in a similar manner, we apply the same underreporting adjustments: 22.2 percent for users consuming marijuana less than 21 days per month, and 11.1 percent for users consuming marijuana 21 days or more per month.

We estimate a total of 7.7 million users across all frequency-of-use categories. Approximately 45.5 percent of these users are in the lowest frequency-of-use category and consume marijuana between one and five days per month, while 23.2 percent are in the highest frequency-of-use category and consume marijuana more than 26 days per month. The remaining 31.3 percent are distributed approximately equally (i.e., between 7 and 9 percent of the total) among the intermediate frequency-of-use categories. Figure 1 presents the estimates of marijuana users by consumption frequency.

Figure 1. California Marijuana Users by Consumption Frequency, Age 21



Source: SAMHSA NSDUH R-DAS, 2010-2013; ICF International

⁷ State of California, Department of Finance, “E-4 Population Estimates for Cities, Counties, and the State, 2011–2015, with 2010 Census Benchmark.” Sacramento, California, May 2015. <http://www.dof.ca.gov/research/demographic/reports/estimates/e-4/2011-20/view.php>

⁸ The authors argue that underreporting is associated with “...unwillingness to admit to using a federally illegal substance, presence of user population outside the sampling frame, and purposeful or mistaken representation of marijuana use,” Light et al., “Market Size and Demand for Marijuana in Colorado” 2014.



2.2. Quantity Demanded by Residents

A 2013 study by Kilmer et al. found that heavy users consume between 1.3 and 1.9 grams of marijuana per day, which yields a point estimate of approximately 1.6 grams per day.⁹ To extrapolate monthly consumption amounts analogous to the MPG study, we assume that heavy users (i.e., those who use marijuana 21 or more days per month) consume 1.6 grams per day and that regular users (i.e., those who use marijuana fewer than 21 days per month) consume 0.67 grams per day.¹⁰ Unlike the MPG study, however, we do not include a demand estimate for individuals who use marijuana less than one day per month. We do not have sufficiently reliable data to approximate the demand for this user-frequency category; thus, we take the conservative approach and exclude that user-frequency category from the estimation of aggregate demand.

We estimate low-, medium-, and high-demand scenarios to demonstrate ranges of potential economic impacts using the ranges of the frequency-of-use categories. For the low-demand scenario, we assume that users in each frequency category use marijuana the fewest number of days in that category. For example, for the 11–15 days-per-month category, we assume users consume marijuana 11 days per month. For the high-demand scenario, we assume that users in each frequency category consume marijuana the greater number of days in that category. For example, we assume that users in the 11–15 category consume marijuana 15 days per month. For the medium-demand scenario, we estimate the average of the low- and high-demand scenarios. Table 1 presents these calculations and monthly resident demand estimates for the low-, medium-, and high-demand scenarios.

Table 1. Monthly Resident Demand

Frequency of Use (Days per Month)	Adjusted Resident Population	Quantity Demanded (grams/day)	Low Demand (grams/month)	Medium Demand (grams/month)	High Demand (grams/month)
1–5	3,525,244	0.67	2,361,914	7,085,741	11,809,568
6–10	718,821	0.67	2,889,661	3,852,882	4,816,102
11–15	576,265	0.67	4,247,073	5,019,269	5,791,464
16–20	596,803	0.67	6,397,726	7,197,442	7,997,157
21–25	528,699	1.6	17,764,301	19,456,139	21,147,977
26–30	1,798,691	1.6	74,825,549	80,581,361	86,337,172
Total	7,744,523		108,486,224	123,192,834	137,899,440

Source: SAMHSA NSDUH R-DAS, 2010–2013; ICF International.

⁹ B. Kilmer, J. Caulkins, G. Midgette, L. Dahlkemper, R. MacCoun, and R. Pacula, “Before the Grand Opening: Measuring Washington State’s Marijuana Market in the Last Year Before Legalized Commercial Sales,” 2013. http://www.rand.org/pubs/research_reports/RR466.html

¹⁰ The analysis bases the usage estimates on a study conducted by Kilmer et al. for the Washington State Liquor Control Board showing that heavy users consume between 1.3 and 1.9 grams per day, which yields a point estimate of 1.6 grams per day. Kilmer et al., “Before the Grand Opening,” 2013. http://www.rand.org/pubs/research_reports/RR466.html



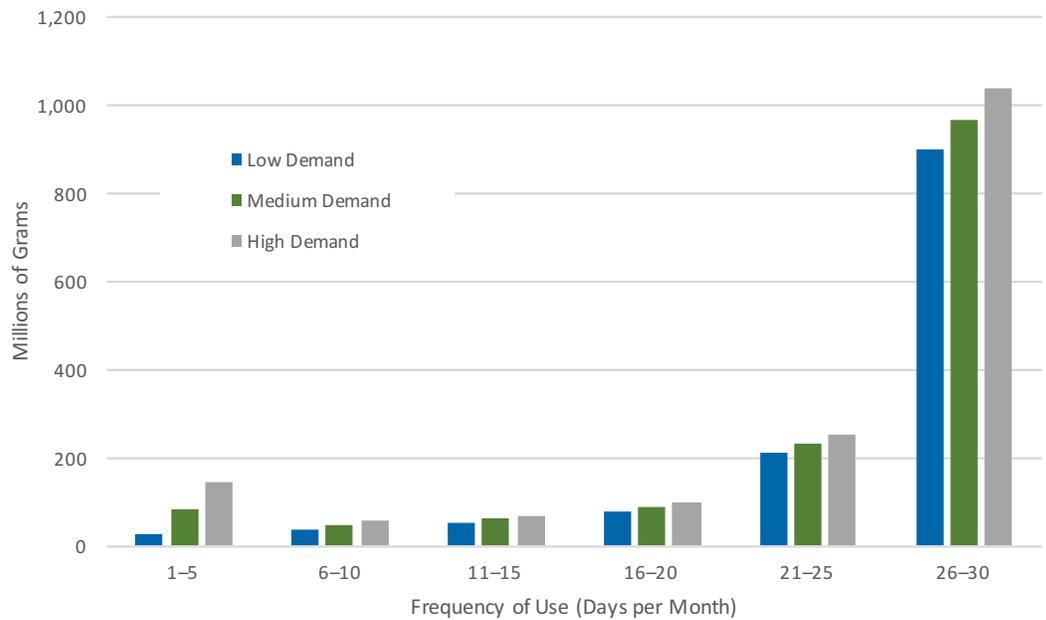
We then annualize these values by multiplying the monthly demand estimates by 12. Table 2 and Figure 2 present the annual resident demand for marijuana in California by frequency of use.

Table 2. Annual Resident Demand Ranges

Use Frequency (Days per Month)	Low Demand (grams/year)	Medium Demand (grams/year)	High Demand (grams/year)
1–5	28,342,962	85,028,887	141,714,811
6–10	34,675,934	46,234,579	57,793,223
11–15	50,964,881	60,231,223	69,497,565
16–20	76,772,712	86,369,301	95,965,890
21–25	213,171,607	233,473,665	253,775,723
26–30	897,906,590	966,976,328	1,036,046,066
Total	1,301,834,686	1,478,313,983	1,654,793,278

Source: SAMHSA NSDUH R-DAS, 2010-2013; ICF International.

Figure 2. Annual Resident Demand by Frequency of Use (Millions of Grams)



Source: SAMHSA NSDUH R-DAS, 2010-2013; ICF International.



2.3. Quantity Demanded by Visitors

We use 2014 marijuana consumption data from the MPG study to estimate the potential quantity of marijuana demanded by visitors to California. According to the MPG study, visitors accounted for an estimated 7.3 percent of annual resident marijuana sales. We multiply our estimated resident demand for California by this value to estimate the potential visitor demand. This is a conservative estimate, however, due to higher volume of tourism and tourism spending in California relative to Colorado. California is the most popular state to visit for travelers originating in the United States, while Colorado ranked 16th.¹¹ According to the tourism agencies for each state, \$117.5 billion was spent by tourists in California in 2014, compared to \$18.6 billion in Colorado during the same year.^{12, 13} Given the larger tourism and tourism-related spending in California relative to Colorado, it is reasonable to assume an analogous level of visitor-related spending on recreational marijuana. Assuming an analogous level of visitor spending on recreational marijuana, we estimate annual visitor demand of 95.4 million grams under the low-demand scenario, 108.4 million grams under the medium-demand scenario, and 121.3 million grams under the high-demand scenario.

2.4. Revenue Estimates

We estimate the revenue accrued from the sales of marijuana by multiplying the aggregate demand estimates discussed above by the cost per gram. Note that we include dried marijuana sales only, which does not include the sales associated with marijuana-infused products. There has been significant volatility in marijuana prices in Colorado resulting from fluctuations in supply—in particular, decreases in price due to excess supply and increased competition as dispensaries and cultivation facilities start operations. According to The Economist, the average price for legal retail sales in Colorado was \$11.80 per gram during 2015, while the price for legal medical and illegal sales in California were \$15.40 and \$7.33 per gram, respectively. Table 3 presents these cost and sales data for California in more detail.¹⁴

Table 3. California Sales Data

California Data	
Illegal Cost per Gram (2015)	\$7.33
Legal Cost per Gram* (2015)	\$15.40
Legal Sales 2013* (\$ millions)	\$980.20
Legal Sales 2014* (\$ millions)	\$1,127.00

* Medical sales only

These values imply an average cost per gram of \$11.37, which is relatively close to the legal retail sale price estimate in Colorado. We multiply the \$11.37 cost-per-gram estimate by the total demand estimate to calculate the total sales revenues accrued from resident and visitor expenditures on marijuana. Table 4 and Figure 3 present the sales revenue estimates for the low-, medium-, and high-demand scenarios.

¹¹ Business Insider, "A Detailed Look at how Americans Travel within the U.S.," October 2014. <http://www.businessinsider.com/the-most-popular-us-states-for-tourism-2014-10>

¹² Visit California, California Statistics and Trends. <http://industry.visitcalifornia.com/find-research/california-statistics-trends/>

¹³ The Denver Post, "Colorado Tourism Numbers Set Record in 2014," June 2015. http://www.denverpost.com/business/ci_28368011/2014-record-colorado-tourism

¹⁴ The Economist, "Mapping Marijuana," January 20, 2015. <http://www.economist.com/blogs/graphicdetail/2015/01/daily-chart-11>



Table 4. Sales Revenue Estimates

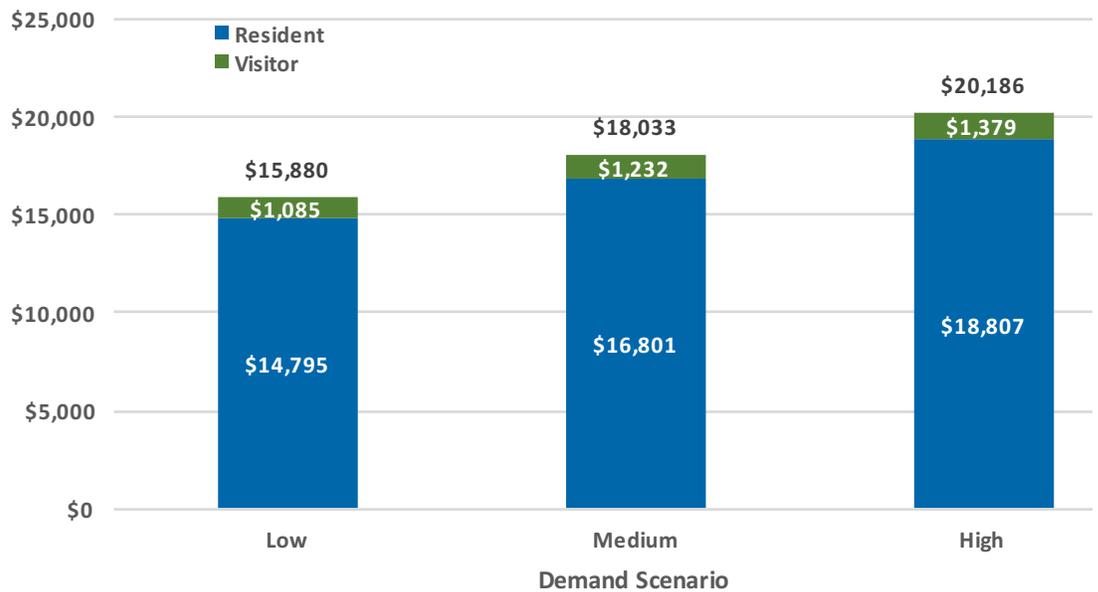
Revenue Category	Range of Estimates	Revenue (\$ millions)**
Revenue from Resident Demand*	Low	\$14,795
	Medium	\$16,801
	High	\$18,807
Revenue from Visitor Demand*	Low	\$1,085
	Medium	\$1,232
	High	\$1,379
Total Revenue*	Low	\$15,880
	Medium	\$18,033
	High	\$20,186

Source: SAMHSA NSDUH R-DAS, 2010-2013; ICF International.

* Revenue estimates above do not include tax revenue—only revenue from sales.

** Revenue estimates are inclusive of all user frequency categories.

Figure 3. Sales Revenue Estimates (\$ millions)



Source: SAMHSA NSDUH R-DAS, 2010-2013; ICF International.



2.5. Tax Revenue Estimates

We also estimate the sales tax revenue accrued from resident and visitor expenditure on marijuana, but we do not include those values in the input parameters for the economic impact analysis. We use the conservative value of 7.5 percent to represent the statewide minimum sales tax, but the final tax rate on marijuana sales will likely be higher due to the inclusion of additional local taxes.¹⁵ In addition, Senate Bill 987 (known as the Marijuana Value Tax Act) was introduced on February 10, 2016, and would impose a 15 percent excise tax on medical marijuana purchased from any retailer.¹⁶ To demonstrate the potential tax revenue under this higher tax scenario, we also estimate the results using a sales tax of 15 percent. Table 5 presents the results of this analysis.

Table 5. Tax Revenue Estimates

Revenue Category	Tax Rate	Range of Demand Estimates	Annual Tax Revenue (\$ millions)*
Tax Revenue from Resident Demand*	7.5% Tax	Low	\$1,110
		Medium	\$1,260
		High	\$1,411
	15.0% Tax	Low	\$2,219
Medium		\$2,520	
High		\$2,821	
Tax Revenue from Visitor Demand*	7.5% Tax	Low	\$81
		Medium	\$92
		High	\$103
	15.0% Tax	Low	\$163
Medium		\$185	
High		\$207	
Total Tax Revenue*	7.5% Tax	Low	\$1,191
		Medium	\$1,352
		High	\$1,514
	15.0% Tax	Low	\$2,382
Medium		\$2,705	
High		\$3,028	

* Revenue estimates include all user-frequency categories.

The analysis implies that tax revenues could range from almost \$1.191 billion to approximately \$3.028 billion, depending on the tax rate and demand estimates used. Of these amounts, between \$1.110 billion and \$2.821 billion would be from resident demand, while between \$81 million and \$207 million would be from visitor demand. Regardless of the tax rate and demand assumptions used to generate the tax revenue estimates, the tax revenues accrued to state and local governments will be substantial.

¹⁵ California State Board of Equalization, California City & County Sales & Use Tax Rates. <http://www.boe.ca.gov/sutax/pam71.htm>

¹⁶ California Senate Bill 987 (2016). http://www.leginfo.ca.gov/pub/15-16/bill/sen/sb_0951-1000/sb_987_bill_20160210_introduced.pdf



3. Secondary Economic Impacts

This section presents the results of the economic impact analysis. Section 3.1 provides an overview of IMPLAN, the economic impact model we use to conduct the analysis. Section 3.2 presents our estimates of the impacts of legal marijuana sales on employment, labor income, value added, and industry activity.

3.1. Introduction to the Economic Impact Model

To estimate the secondary economic impacts of legal marijuana sales on the statewide economy, we use the economic impact modeling software IMPLAN, which was developed by the Minnesota IMPLAN Group and is widely used throughout the United States. The IMPLAN model is a static input-output framework used to analyze the effects of an economic stimulus on pre-specified economic regions—in this case, the entire state of California. The IMPLAN model is based on input-output data from the U.S. National Income and Product Accounts from the Bureau of Economic Analysis. The model includes 536 sectors based on the North American Industry Classification System and uses state-specific multipliers to trace and calculate the flow of dollars from the industries that originate the impact to supplier industries. These multipliers are effectively coefficients that numerically represent the economic response to a change in final demand or production. There are three types of impacts generated by IMPLAN:

- **Direct impacts**, which are impacts in the primary industries where spending by consumers would be focused. In this analysis, we use the grocery and beverage store sector. Justification for the use of this sector is discussed in more detail below.
- **Indirect impacts**, which are impacts in the industries that supply or interact with the primary industry or industries. For example, when marijuana retail stores spend money on security and janitorial services, laboratory testing, or lighting manufacturers, impacts are felt in those sectors.
- **Induced impacts**, which represent increased spending by workers who earn money due to the increased industry activity, such as when marijuana dispensary staff use their wages to purchase goods and services from local shops.

IMPLAN then uses the sum of direct, indirect, and induced impacts to calculate the resulting economic impacts, such as total jobs created and impacts on industry activity. Expenditures that leave the defined study region “leak out” and are not included in the estimated impacts. The expenditures that leak out of the region are a function of local purchase coefficients included in the model. These local purchase coefficients measure what fraction of industry inputs are supplied by the region relative to the inputs supplied from outside the region. The IMPLAN model does not include a sector for marijuana so we modeled all inputs in the food and beverage retail store industry. According to an analysis conducted by BOTEC Analysis Corp., the profit margins in the food and beverage store sector are very similar to profit margins of marijuana retail stores in states that have legalized recreational marijuana use.¹⁷ Within the California IMPLAN model, the local purchase coefficient associated with the food and beverage store sector is 100 percent. This implies that all of the industry inputs come from California. Note that the marijuana industry may operate differently than other similar retail sectors because of the prohibition of marijuana at the federal level. For example, federal law effectively prohibits the banking system from doing business with marijuana-related firms because marijuana remains a scheduled and prohibited substance under federal law. This prohibition may impair the ability of marijuana firms to access capital, negatively impacting their overall economic impact.

The IMPLAN model we use in this analysis is based on input-output data from 2013, the most recent dataset available at the time of this analysis.

¹⁷ L. Zamarrá, “Modeling Marijuana Businesses and Costs of Legal Compliance,” BOTEC Analysis Corp, I-502, Project #430-5b, Final, August 10, 2013. <http://liq.wa.gov/publications/Marijuana/BOTEC%20reports/5b-Modelling-Marijuana-Businesses-Final.pdf>



3.2. Results

Table 6 presents the results of our economic impact analysis. The results of our analysis demonstrate that legal sales of marijuana to California residents and visitors could support between 81,000 and 103,000 total jobs and between \$3.57 and \$4.52 billion in labor income. Our estimates indicate that the marijuana industry may support between \$8.37 billion and \$10.64 billion in total industry activity, of which \$5.51 billion to \$7.01 billion would be new value added to the economy, respectively.

Table 6. IMPLAN Results—Low and High Demand Estimates

Impact Category	Impact Type	Resident Demand		Visitor Demand		Total Demand	
		Low	High	Low	High	Low	High
Employment	Direct	52,308	66,490	3,835	4,875	56,143	71,365
	Indirect	8,797	11,182	645	820	9,442	12,002
	Induced	14,497	18,427	1,063	1,351	15,559	19,778
	Total	75,602	96,099	5,543	7,046	81,144	103,145
Labor Income (\$ billions)	Direct	\$2.06	\$2.61	\$0.15	\$0.19	\$2.21	\$2.80
	Indirect	\$0.50	\$0.63	\$0.04	\$0.05	\$0.54	\$0.68
	Induced	\$0.76	\$0.97	\$0.06	\$0.07	\$0.82	\$1.04
	Total	\$3.32	\$4.21	\$0.25	\$0.31	\$3.57	\$4.52
Value Added (\$ billions)	Direct	\$2.95	\$3.75	\$0.22	\$0.27	\$3.16	\$4.02
	Indirect	\$0.91	\$1.15	\$0.07	\$0.08	\$0.97	\$1.24
	Induced	\$1.28	\$1.63	\$0.09	\$0.12	\$1.38	\$1.75
	Total	\$5.14	\$6.53	\$0.38	\$0.47	\$5.51	\$7.01
Industry Activity (\$ billions)	Direct	\$4.13	\$5.25	\$0.30	\$0.38	\$4.43	\$5.63
	Indirect	\$1.48	\$1.88	\$0.11	\$0.14	\$1.59	\$2.02
	Induced	\$2.19	\$2.79	\$0.16	\$0.20	\$2.35	\$2.99
	Total	\$7.80	\$9.91	\$0.57	\$0.72	\$8.37	\$10.64

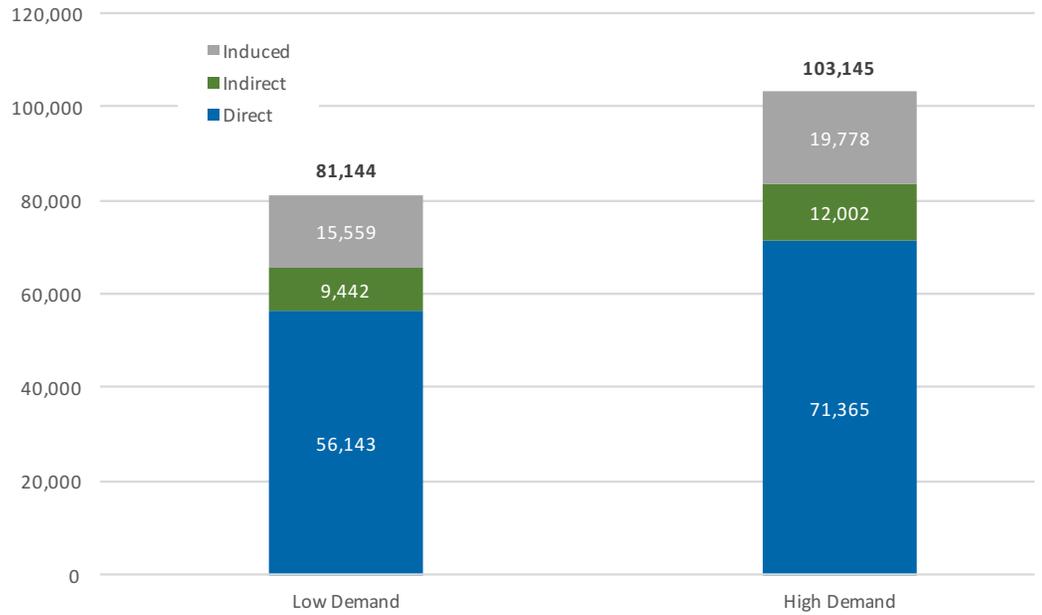
Source: ICF International.

An important result of this analysis is the magnitude to which marijuana sales impact other industries beyond the primary industry. Recall that indirect impacts are those experienced by industries that supply or interact with the primary industry—such as security and janitorial services, laboratory testing, lighting manufacturers—while induced impacts are those realized when workers in the primary and indirect industries spend their increased earnings. The results presented in Table 6 indicate that almost 31 percent of the job impacts are indirect and induced, meaning they occur in supplier industries or industries indirectly impacted by increased expenditures by workers in these industries. This relationship also holds true for industry activity but to a greater extent where more than 47 percent of the total impacts on industry activity are indirect and induced.



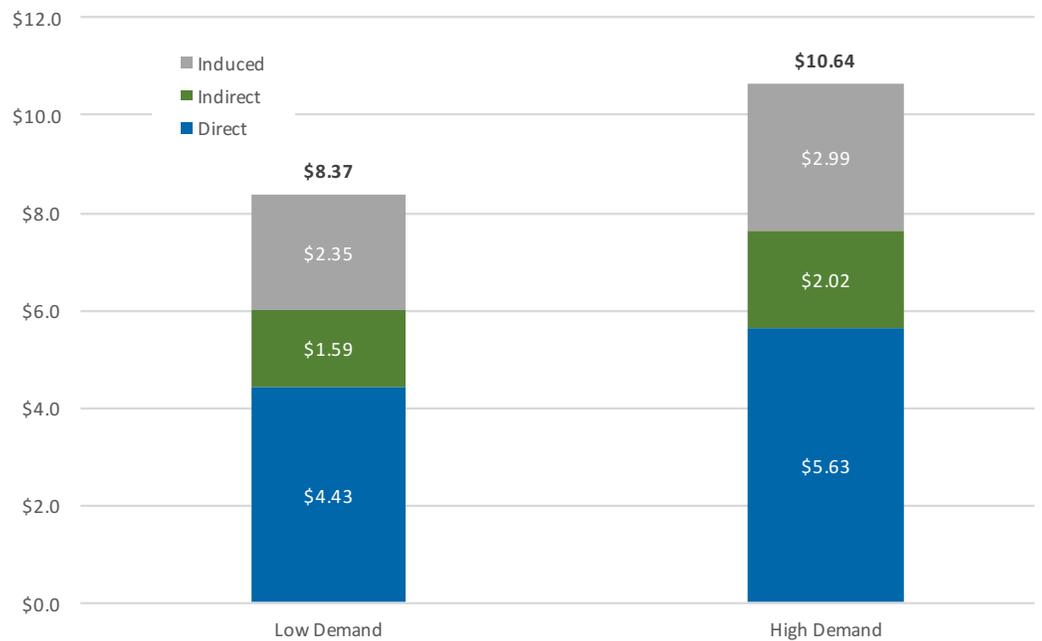
Figures 4 and 5 present the results of the economic impact analysis on employment and industry activity.

Figure 4. Employment Impacts (Jobs)



Source: ICF International.

Figure 5. Impacts on Industry Activity (\$ billions)



Source: ICF International.



4. Conclusion and Next Steps

This analysis demonstrates that the legalization of marijuana in California has the potential to significantly benefit the state's economy. Using low- and high-consumption demand scenarios to account for uncertainty, we estimate that California residents could consume between 1,302 million and 1,654 million grams of marijuana per year if recreational marijuana use is legalized, which amounts to between 1,435 and 1,824 tons, respectively. These resident demand estimates correspond to visitor demand estimates of 95 million and 121 million grams per year, which amounts to between 105 and 133 tons, respectively. We use the average cost of illegal and legal medical marijuana sales in California (\$11.37 per gram) to convert these demand estimates to annual sales revenue. We estimate sales revenue between \$15.9 billion and \$20.2 billion per year. Using the California sales tax base rate of 7.5 percent, these sales revenue estimates amount to tax revenue between \$1.2 billion and \$1.5 billion per year. If the Marijuana Value Tax Act passes, these tax revenue estimates would double to at least between \$2.4 billion and \$3.0 billion per year.¹⁸

We use the sales revenue estimates to calculate the potential economic benefits of marijuana sales using the IMPLAN input-output modeling framework. Our estimates indicate that legal sales of marijuana to California residents and visitors could support between 81,000 and 103,000 total jobs and between \$8.4 billion and \$10.6 billion in total industry activity, of which \$5.5 billion to \$7.0 billion would be new value added to the economy. Our analytical approach can be replicated at the national, state, and local levels to estimate how changes in federal, state, and local rules and regulations may impact economic activity and employment.

This analysis is limited because of the short time frame of data available since the legalization of recreational marijuana in Colorado. The determinants of marijuana demand include price, income, and duration of stay (for visitors), among others. While we use the Colorado experience to frame this analysis, variances in these determinants between states may yield different estimates of consumer demand. There has been significant volatility in marijuana prices in Colorado resulting from fluctuations in supply—in particular, there have been decreases in price due to excess supply and increased competition as dispensaries and cultivation facilities start operations. In addition, it is unclear to what extent consumers in California will respond to changes in price that may occur due to the legalization of recreational marijuana. Research indicates that the price elasticity of demand ranges from -0.3 to -0.6, implying a decrease in demand in response to an increase in price.¹⁹ Due to data limitations, we do not incorporate these uncertainties into our analysis but take the conservative approach where possible.

For example, we calculate the economic impacts resulting from dried marijuana flower sales only, which does not include the sales associated with marijuana-infused products and associated paraphernalia, which often make up a substantial component of store revenue.

Additional research may shed light on other potential negative economic impacts created by the legalization of marijuana. For example, there may be a relationship between driving-while-intoxicated incidents and the legalization of marijuana. It is also unclear what the long-term impact will be of recreational marijuana on violent crime rates. Finally, this analysis does not include health impacts incurred because of increased marijuana consumption, such as cancer rates or birth defects, among many others. These important areas of research should be explored once the requisite data become available.

¹⁸ This assumes that recreational marijuana sales would be subject to an excise tax of at least 15 percent.

¹⁹ A. Davis, and M. Nichols, "The Price Elasticity of Marijuana Demand," Working Paper, 2013. <http://econpapers.repec.org/paper/unrwpaper/13-004.htm>



About the Authors

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Eliza Johnston has over 10 years of experience conducting financial analysis, regulatory evaluation, and economic impact analysis for federal, state, and local clients. She was the deputy project manager on medical marijuana application programs in San Leandro, California and Massachusetts. On both efforts, she also served as the subject matter expert responsible for evaluating applicant responses on questions related to business plan, financial analysis, business operations, and workforce training. Ms. Johnston has a Masters of City and Regional Planning from the University of California, Berkeley, and a Bachelor of Arts in Geography from Middlebury College, and she is a Certified Project Management Professional (PMP).

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Appendix A: Colorado Analysis Methodology

An analysis conducted by the MPG for the Colorado Department of Revenue serves as a reference point for our demand estimation methodology.²⁰ If legalized, the California retail marijuana industry may take a different form than that of Colorado; however, our analysis assumes that the trends associated with the market demand for marijuana will be comparable between states.

The MPG study estimated Colorado's demand for marijuana in metric tons for both adult residents and visitors to the state. The study combines a supply-side approach and a demand-side approach to estimate the number of marijuana users residing in Colorado and their frequency of marijuana use. Unlike a supply side approach, the demand side approach allows for the estimation of the illegal market as well as the legal market. The amount used per day varies by the number of days used per month so the demand estimation methodology must account for variations in frequency of use as well as amount used per day. The study defines "heavy users" as adults consuming marijuana 21 days or more per month; individuals consuming marijuana between 1 and 20 days per month are considered "regular users." After adjusting the survey results to account for underreporting and population growth, the study estimated the quantity of marijuana consumed in each user-frequency category. Table A1 presents the adjusted 2014 population of marijuana users in Colorado subdivided by frequency of use.

²⁰ Light et al., "Market Size and Demand for Marijuana in Colorado," 2014.



Table A1. Marijuana Users by Consumption Frequency

Frequency of Use (Days per Month)	2010/2011 NSDUH	Population Adjustment (%)	Underreporting Adjustment (%)	Adjusted Population
< 1	156,000	5.3	22.2	200,795
1–5	131,000	5.3	22.2	168,616
6–10	40,000	5.3	22.2	51,486
11–15	17,000	5.3	22.2	21,882
16–20	31,000	5.3	22.2	39,902
21–25	47,000	5.3	11.1	54,996
26–31	127,000	5.3	11.1	148,607
Yearly User Total	549,000			686,284
Monthly User Total	393,000			485,489

Source: Marijuana Policy Group; SAMHSA NSDUH R-DAS, 2010–2011.

The results indicate a total annual marijuana user population of approximately 686,284, which amounts to more than 18 percent of Colorado’s total population 21 years and older.²¹

The analysis then used the adjusted populations for each user-frequency category to calculate estimates of consumption amounts. To extrapolate monthly consumption amounts for each user-frequency category, the analysis assumes that heavy users (i.e., those who use marijuana 21 or more days per month) consume 1.6 grams per day and that regular users (i.e., those who use marijuana fewer than 21 days per month) consume 0.67 grams per day.²² Table A2 presents the monthly consumption estimates for Colorado residents over the age of 21.

²¹ According to the U.S. Census Bureau, the population 21 years or older in Colorado was 3,748,125 million in 2014. <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk#>

²² The analysis bases the usage estimates on a study conducted by Kilmer et al. for the Washington State Liquor Control Board showing that heavy users consume between 1.3 and 1.9 grams per day, which yields a point estimate of 1.6 grams per day. “Before the Grand Opening,” 2013. http://www.rand.org/pubs/research_reports/RR466.html



Table A2. Consumption Amounts by Frequency of Use

Frequency of Use (Days per Month)	Usage Amounts (Millions of grams)		
	Low	Medium	High
< 1	240	361	721
1-5	2,625	4,039	5,756
6-10	2,138	3,289	4,686
11-15	1,476	2,271	3,237
16-20	3,728	5,735	8,172
21-25	19,888	24,478	29,067
26-31	66,007	81,240	96,472
Total	96,102	121,413	148,111

Source: Marijuana Policy Group calculations.

Comparing the frequency-of-use data and quantity demanded data demonstrates a concentration of demand by heavy users. Almost 30 percent of all users are heavy users and consume 87 percent of the total marijuana consumed. The remaining 70 percent of users consume less than 13 percent of marijuana consumed. Figure A1 presents the percent of total users and total demand subdivided by frequency of use.



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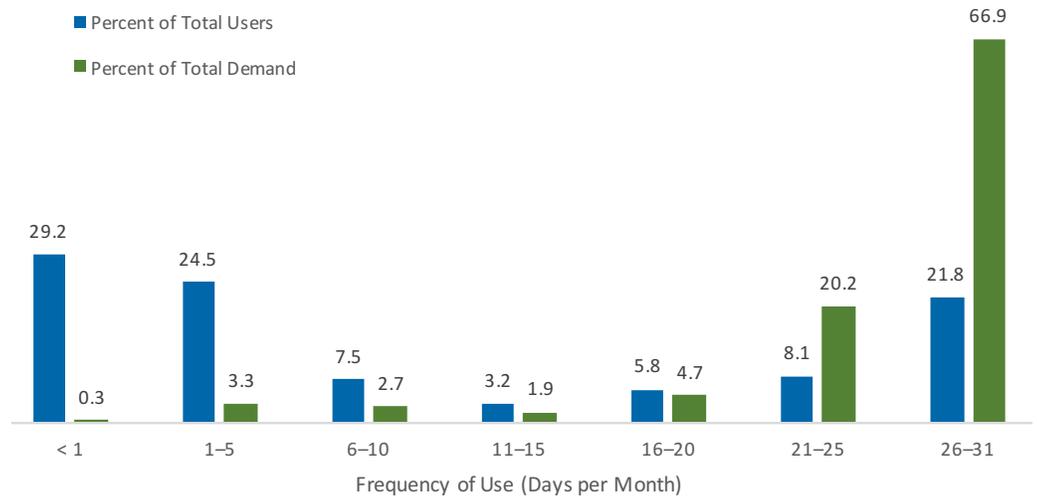
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Figure A1. Percent of Total User and Total Demand by Frequency of Use



Source: Marijuana Policy Group; SAMHSA NSDUH R-DAS, 2010–2011.

To account for visitor demand in Colorado, the study relied on point-of-sale information (such as the fraction of purchases made with out-of-state identification cards) and sales tax information. These data are not available for California; thus, our visitor demand estimates rely on the proportion of visitor sales relative to total sales in Colorado.

The study found that the demand for marijuana in Colorado is much larger than other studies had estimated—31 percent higher than a previous report from the Colorado Department of Revenue, 89 percent higher than a report from the Colorado Futures Center, and 111 percent higher than the estimate presented by the Colorado Center for Law and Policy. The authors note that "...the primary difference is caused by much heavier dosage amounts consumed by the state's 'heavy user' population—those who consume marijuana on a daily basis."²³

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²³ Light et al., "Market Size and Demand for Marijuana in Colorado," 2014.