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MARKET SIZE AND DEMAND FOR MARIJUANA IN ALASKA

Prepared by:

The Marijuana Policy Group

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Prepared for:

The Voters of Alaska

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The Marijuana Policy Group (MPG) was formed in 2014 as a collaborative effort between Colorado university researchers and BBC Research & Consulting in Denver. Both entities have offered custom economic, market, financial and policy research and consulting services for over 40 years. The MPG mission is to apply research methods rooted in economic theory and statistical applications to inform regulatory policy decisions in the rapidly growing legal medical and recreational marijuana markets.

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Executive Summary

- This report is supplied by Colorado's Marijuana Policy Group ("MPG"), a consortium of University researchers and economic consultants specializing in marijuana market design and policy. The MPG provides market analysis for the Colorado *Marijuana Enforcement Division*, the state regulatory agency that controls and monitors the Colorado market for legal marijuana production, distribution and sales.

- The report was compiled because no official assessment has been developed to help Alaska voters understand potential sales and tax revenues under a legal marijuana regime. The MPG was not paid to conduct this study. The Marijuana Policy Group does not support or oppose the Alaska Ballot Measure 2 for 2014.

- The MPG estimates that aggregate **demand for marijuana in Alaska equals 17.8 metric tons**. This represents total demand for marijuana by adults over the age of 21 years, and only Alaska residents. Tourist demand has not been included. Alaskan marijuana demand is currently supplied through a variety of channels: medical caregiver networks; the black market; the "grey market", where excess caregiver supply is sold to non-patients; home-grow activities; and direct imports from Canada and the lower 48 states.

- If a legal retail market is approved, the MPG estimates that **22.4% of total demand**, -- **an amount of 4.0 metric tons** -- would be supplied through legal retail stores during the first year. The state-wide value of first-year sales would **be $55.6 million**, assuming the pre-tax retail price is similar to Colorado during their first year ($14 per gram).

- If the State of Alaska levies a **$50 per ounce unit tax** upon the sale of marijuana as specified in the ballot measure, total tax revenues would equal **$7.1 million** during the first year of sales.

- The MPG projects total sales in Alaska over a five-year time horizon. Retail prices are expected to decline as competition and volume increase, and sales margins decline. If retail prices decline over time, then a much larger share of users will shift into the retail market. For example, if the retail price declines from $14 per gram to $8 per gram between 2016 and 2020, then the retail market penetration rate would increase from 22.4% of state demand in the first year, to 75.3% of state demand in 2020.

- A higher rate of sales migration from the black market into the legal market would increase tax revenues. The following table shows expected sales values and tax revenues between 2016-2020:

Table 1. Expected Sales Values and Tax Revenues, 2016-2020

Year	2016	2017	2018	2019	2020
Price per Gram	$14	$12	$10	$9	$8
Retail Sales Value ($)	$55,565,228	$64,835,925	$79,908,625	$91,270,074	$106,916,870
Tax Revenues ($)	$7,064,722	$9,617,329	$14,223,735	$18,051,192	$23,789,003

Note: Units in 2014 dollars.

Source. MPG calculation as described in report.

Overview

Ballot measure 2 in Alaska asks residents to decide whether or not to legalize marijuana use for recreational purposes. Due to Alaskan legislative policy, the state government is not allowed to fund studies related to the fiscal effects that may be caused by approval of Ballot Measure #2.

The Marijuana Policy Group (MPG), a consortium of academics and consultants from Colorado, decided that a preliminary estimate of state demand for marijuana, and the estimated marijuana tax yield, would help focus the debate more accurately upon the benefits and costs associated with passage of the Measure. The figures included herein provide demand and tax estimates for the period between 2016 and 2020. In practice, the measure may not be enacted until a later date if approved. The analysis allows voters to get a sense of potential tax revenue if the legal market if the legislation is enacted one year following voter approval.

To estimate state potential tax revenues accurately, the MPG first conducted an estimate of total state demand for marijuana products using the most recent state-level National Survey on Drug Use and Health (NSDUH) usage and prevalence data (2010-2011) by the Substance Abuse and Mental Health Services Administration (SAMHSA).[1] The procedures used for Alaska follow similar steps as those used by the MPG to estimate Colorado state demand, while working for the Colorado Department of Revenue-Marijuana Enforcement Division (the MED).[2]

In order to estimate Alaska state demand for retail-based marijuana products, it must be noted that only a portion of total state demand will be purchased from legalized retail outlets. There are several reasons why consumers would choose not to purchase from legal retail outlets, especially during the early phases of legalization. Price is the most significant deterrent, but other factors include: distance (or effort) to a legal outlet, relative quality of retail supplies compared to illegal supplies, and relative supply from licensed medical marijuana caregivers and collectives.

The MPG has applied conversion factors that are similar to what was experienced in Colorado, during the first year of legalization, in order to estimate the first-year conversion factor. A proprietary MPG demand model is also used to estimate first year conversion to the retail market, as well as a five-year estimate for conversion and demand. Over time, the relative price for retail marijuana is expected to decline compared to illegal marijuana. This will lead to higher conversion rates over time. The MPG demand model also incorporates individual user type demand structures, which increases the accuracy of the conversion factors.

Summary results are provided in Table 2 on the following page.

Table 2: Marijuana Demand, Sales, and Tax Revenue Estimates, 2016

	Low	Central	High	Units
Overall Estimated State Demand (Alaska)	14.1	17.8	21.6	Metric Tons
First-Year Estimated Retail Demand	3.1	4.0	4.8	Metric Tons
First-Year Estimated Retail Sales	$44,022,894	$55,565,228	$67,729,892	USD
First-Year Estimated Tax Revenues	$5,597,197	$7,064,722	$8,611,372	USD

Note: 1. Retail demand assumes a flat, 22.4% conversion factor from total demand in 2016.
2. Retail sales values assume an average price of $14.00 per gram, or $392 per ounce (@28 grams).
3. Tax revenues assume a flat, unit-based tax of $50 per ounce sold.

Source: Marijuana Policy Group.

We estimate that 17.8 metric tons of marijuana flower[3] will be demanded by Alaska state residents in 2016. Of this, 4.0 metric tons would be purchased through recreational retail outlets, if Ballot Measure 2 were approved. State tax revenues, if applied as described in the Measure 2 ($50 per ounce unit tax), would be equal to $7.1 million dollars in the first year. Revenues may be as low as $5.6 million, or as high as $8.6 million. These figures are substantially lower than other estimates obtained from an advocacy group[4] because conversion factors were not considered in their analysis.

Tax revenues will increase after the first year, if they are taxed on a unit basis, as more users convert to buying from retail outlets. If the tax were applied using an *ad-valorem* basis, then the revenues would depend upon the combination of sales volumes, and the price. As time passes, the volume is expected to increase, because the retail price is expected to decline. The net revenue yield would depend upon the relative price and volume changes, respectively. MPG provides five-year projections of marijuana demand, sales and state tax revenue that reflect these market characteristics in this report.

Methodology

User Prevalence: The most recent and comprehensive data for Alaska marijuana use come from the National Survey on Drug Use and Health (NSDUH). The NSDUH is a nationwide survey that collects state-level representative samples on a wide variety of substance abuse, addiction, and mental health issues. The survey is administered by the Substance Abuse and Mental Health Services Administration (SAMHSA) of the U.S. Department of Health and Human Services.

In order to obtain our specific prevalence dataset, the NSDUH offers their "restricted-use data analysis system" (R-DAS). This system provides access to the most detailed cross-tabulations of marijuana use frequency and age groups. The R-DAS data allowed MPG researchers to make distinctions between the over-21 user age group, which has access to the regulated retail market, and those under 21 whom do not have access to retail marijuana outlets.

Using a combination of NSDUH survey data and physical use metrics obtained in Colorado and Washington states, the MPG estimates that there are 72,426 residents who use marijuana at least monthly. A total of 103,123 residents have consumed marijuana in the past year, including monthly

users. We estimate that 653,628 residents are non-users, based upon data from the Alaska Department of Labor and Workforce Development.[5]

User Demand: A key driver for marijuana demand is the state's user profile. Heavy users typically consume three times as much marijuana in a single day as do occasional users. A recent and important revelation is that heavy users account for most of a region's demand, and that infrequent users have a very small impact upon demand. Marijuana Policy Group (2014), Kilmer et al. (2013),[6] and Caulkins (2011)[7] are recent studies that highlight this effect and its importance for aggregate market size estimates.

Thus, a careful depiction of the Alaska state user profile is needed to estimate demand. MPG constructed a user profile by obtaining the Alaska age 21 and over population of past-month and past-year marijuana users from the NSDUH and applying a frequency distribution obtained from the recent MPG Colorado study.[8] Adjustments for state population growth and NSDUH survey respondent underreporting were also applied.[9] This profile is shown in Table 3.

Table 3.
Alaska Marijuana Users
Over 21 Years Old
by Frequency of Use, 2016

Source:
NSDUH R-DAS;
Alaska Department of Labor
and Workforce Development;
MPG Estimates.

State of Alaska Use Frequency	Adjusted Population
Less than once per month	30,697
1-5 days per month	25,154
6-10 days per month	7,681
11-15 days per month	3,264
16-20 days per month	5,953
21-25 days per month	8,204
26-31 days per month	22,169
Yearly User Total	**103,123**
Monthly User Total	**72,426**

In Washington State, and in Colorado (and elsewhere), user demand was shown to be highly-correlated to frequency of use. Using a combination of user demand statistics from the RAND group,[10] as well as Colorado-specific data,[11] we apply the following demand characteristics to each user frequency cohort in the same manner as done in Colorado. Heavy users in Alaska, like heavy users in Colorado and Washington, are estimated to demand between 1.3 – 1.9 grams of marijuana per use day, with a central estimate of 1.6 grams. Less frequent users (20 days or fewer per month), consume between 0.43 – 0.95 grams, with a central estimate of 0.67 grams per user day.[12]

User prevalence is combined with demand quantities to calculate marijuana demand by Alaska residents, shown in the table on the following page.

Table 4. Marijuana Demand by Alaska Residents, 2016 (in Grams)

User Cohort	Estimate Range			Share of Demand	Share of Users
	Low	Mean	High		
<1	36,836	55,254	110,509	0%	30%
1-5	327,007	503,088	716,900	3%	24%
6-10	299,549	460,844	656,703	3%	7%
11-15	220,667	339,488	483,771	2%	3%
16-20	557,160	857,170	1,221,467	5%	6%
21-25	2,943,746	3,623,071	4,302,397	20%	8%
26-31	9,683,588	11,918,263	14,152,937	67%	21%
Total (Metric Tons)	**14.1**	**17.8**	**21.6**	**100%**	**100%**

Source: Estimates are based upon previous findings and upon the Colorado Marijuana Use Survey.

The result here, as found in Colorado and Washington, is that the heaviest marijuana users in the state account for a significant majority of the marijuana demand. This demand profile has important implications for the level of retail sales adoption within the state. The heaviest users are also the most price-sensitive. This means that if retail prices are high, compared to black market prices, the heaviest users are unlikely to convert to retail, and that tax revenues would be lower.

Retail Purchases

It would be naïve to assume that all users will simply stop using their existing marijuana supplier, and would all switch to retail marijuana outlets. Instead, each cohort would have a different propensity to change suppliers between their existing street provider or friend, and a retail outlet. The heaviest users, some of whom are medical users who have prescriptions for marijuana are almost certain to remain with their current supplier. The lessons learned in Colorado in 2014 are particularly important in tax estimation in other states as retail conversion has lagged behind expectations in the nascent market.

The MPG estimates a first year "conversion" propensity as shown in Table 5.

Table 5.
Retail Conversion Factor by Use Frequency, Alaska, 2016

Source:
Marijuana Policy Group.

User Cohort	Factor	Retail Demand
<1	74%	40,888
1-5	74%	372,285
6-10	68%	313,374
11-15	68%	230,852
16-20	45%	385,726
21-25	33%	1,195,614
26-31	12%	1,430,192
Retail Demand (Advanced Conversion)		**3,968,931**
Weighted Average Conversion Factor		22%

The least frequent users will have the highest propensity to switch to retail suppliers, because they are the least price-sensitive[13], and because they are infrequent buyers, so they do not have established relationships with current suppliers (either medical or black market).

Five-Year Sales and Tax Revenue Projections

The MPG retail marijuana demand model is used to identify sales and revenue projections over a five year time horizon, between 2016 and 2020. Table 6 shows these values.

Table 6: Estimated Retail Sales and Revenue Values for Alaska

Year	2016	2017	2018	2019	2020
Price per Gram	$14	$12	$10	$9	$8
Retail Sales Value ($)	$55,565,228	$64,835,925	$79,908,625	$91,270,074	$106,916,870
Tax Revenues ($)	$7,064,722	$9,617,329	$14,223,735	$18,051,192	$23,789,003

Note: Units in 2014 dollars.

Source: Marijuana Policy Group.

Retail sales demand in 2016 is based upon a conversion factor of 22.4%, which reflects the retail demand conversion rates from Colorado. The conversion rate assumed in Alaska is higher than the rate from Colorado, because Colorado had a large, pre-existing medical marijuana dispensary network. These dispensaries offered relatively low-cost marijuana in convenient storefront locations to many of the state's heaviest users.

Since Alaska does not have a deep network of pre-existing medical dispensaries, but instead a loose network of marijuana care-givers, we expect the initial conversion rate to be higher, at 22.4%, rather than approximately 18%, which is the estimated conversion rate to this date in Colorado.[14]

Conversion Rates and Elasticity of Demand

Over time, the most important factor that will drive retail demand in Alaska is relative price. If retail prices are high, then heavy users, who account for 75% of the state demand, will continue to choose lower-cost black and grey market sources. If the price of retail marijuana declines, then each user type (user cohort) will begin to convert from black and grey market suppliers, toward legal retail suppliers. The rate of conversion depends upon each user cohort's cross-price elasticity of demand.

The cross-price elasticity of demand represents the percentage change in demand for a given percentage change in relative price between retail marijuana and black or grey market marijuana. For the Alaska projections, the MPG assumes a fixed price for black and grey marijuana and uses an initial benchmark conversion factor, based upon the Colorado first-year experience. This simplifies the mathematical formula that is used for demand from a cross-price elasticity formula, into an own-price elasticity of demand formula.[15]

The own price demand formula, is then written as:

$$D_C = D_0 \left[\frac{P}{\overline{P}}\right]^{\sigma}$$

Where:

- D_C equals the number of grams demand from retail suppliers by cohort *C.*
- D_0 equals the reference year estimate of demand by cohort C

- P-bar is the reference year price of one gram of marijuana flower
- P is the current price of one gram of marijuana flower
- σ is the elasticity of demand between the reference price and the current price of marijuana (where the reference price could also refer to the black or grey market price).

Each user cohort has a different elasticity of demand. For irregular and rare users, the elasticity of demand is low. For those cohorts, occasional marijuana purchases represent a small portion of total income. The savings from finding lower-cost marijuana in one- or two-gram amounts is too small to justify extensive price shopping. Those users therefore have a higher propensity to pay relatively high prices, in order to obtain the product quickly and easily.

For the heaviest users, the price elasticity of demand is the highest. For these users, the budget share for marijuana is large, and because they are regular consumers, it makes sense to shop carefully in order to find low-cost marijuana. This makes the heaviest users the most price-sensitive. Table 7 lists the MPG estimate for price elasticity of demand by cohort. As the number of user days increases, the average monthly budget for marijuana increases, and consequently the sensitivity to marijuana pricing.

Table 7.
Price Sensitivity Estimates for Marijuana Users, Based upon Frequency of Use

Source:
Marijuana Policy Group.

User Cohort (Use - Days per Month)	Price Elasticity of Demand
<1	0.2
1-5	0.5
6-10	0.7
11-15	0.8
16-20	1.0
21-25	2.0
26-31	3.0

In order to project Alaska marijuana sales and state tax revenue, the price elasticity of demand is combined with projected marijuana prices. Most economists who study the market for legal marijuana believe that marijuana prices will decline significantly. For example, in a California study, economists at the RAND Corporation state:

> *"The pretax retail price of marijuana will substantially decline, likely by more than 80 percent. The price that consumers face will depend heavily on taxes, the structure of the regulatory regime, and how taxes and regulations are enforced."*[16]

The precipitous decline in retail prices is expected because the cost of marijuana production (cultivation) is low, relative to current retail or street prices. A study for the Washington State Liquor Control Board estimated that tax-compliant growing operations would enjoy a 53 percent net margin on production.[17]

While the MPG agrees that production costs are quite low, we disagree that prices will approach marginal cost with certainty. Our experience in Colorado is more subtle and complex. After analyzing detailed sales transactions by medical marijuana dispensaries and recreational sales outlets, we found a segmented market, where 'bulk' buyers, who purchase in units of one ounce, received significant discounts compared to retail customers, who purchased in units of one gram. The bulk buyers paid on average $5 per gram (pre-tax), when buying in bulk (one ounce per transaction). On the other hand,

retail store transactions, where the average transaction size was 3-5 grams (often sold in "eighths" which are 3.5 grams). For these transactions, the average retail price was $14.50.[18]

For the purposes of this analysis we begin with a first-year reference price of $14 per gram. This price is similar to the Colorado first year retail price. It does not reflect the relative cost of living differential that exists in Alaska.[19] The MPG then estimates that retail marijuana prices will decline by 43 percent over the next five years, when measured in 2014 dollars, from $14 per gram in 2016, to $8 per gram in 2020. Finally, the price dynamics can be combined with each user type's demand characteristics, to project retail sales between 2016 and 2020. Table 8 shows the results. Demand is shown for each user type, for each year. Total quantity demanded and total sales and tax revenues are shown at the bottom of the table.

Table 8: Retail Demand Projection, Alaska, 2016-2020.

		Year and Price for One Gram of Marijuana				
User Cohort	Demand Elasticity	2016 $14	2017 $12	2018 $10	2019 $9	2020 $8
		Quantity of Marijuana Demand - By User Type and Year				
<1	0.2	40,888	42,168	43,735	44,666	45,731
1-5	0.5	372,285	402,114	440,494	464,321	492,487
6-10	0.7	313,374	349,080	396,600	426,956	463,649
11-15	0.8	230,852	261,151	302,160	328,732	361,214
16-20	1.0	385,726	450,014	540,017	600,019	675,021
21-25	2.0	1,195,614	1,627,363	2,343,403	2,893,090	3,661,567
26-31	3.0	1,430,192	2,271,091	3,924,446	5,383,327	7,664,933
Total Retail Sales (Grams)		**3,968,945**	**5,402,994**	**7,990,862**	**10,141,119**	**13,364,609**
Share of 2016 Demand		**22.4%**	**30.4%**	**45.0%**	**57.1%**	**75.3%**

Year	2016	2017	2018	2019	2020
Price per Gram	$14	$12	$10	$9	$8
Retail Sales Value ($)	$55,565,228	$64,835,925	$79,908,625	$91,270,074	$106,916,870
Tax Revenues ($)	$7,064,722	$9,617,329	$14,223,735	$18,051,192	$23,789,003

Note: Units in 2014 dollars.

Source: Marijuana Policy Group.

During the first year of legalization, we estimate that 22.4% of state demand will be supplied through retail outlets. Over time, if prices decline, the share of legal marijuana sales will increase, as a share of total marijuana demand. By 2020, MPG expects retail marijuana prices decline to $8, total demand increases to 13.4 metric tons, and retail sales equal $106.9 million. If the state continues to levy a unit-based tax upon marijuana, equal to $50 per ounce, then state tax revenues would equal $23.8 million in 2020.

The MPG would like to emphasize that demand for retail marijuana is dependent on the relative price, compared to alternative supply channels. If retail prices increase significantly, then most heavy users will avoid this supply mode and buy marijuana from black or grey market sources as possible.

Notes

[1] The 2010-2011 are the most recent estimates published by SAMHSA that can be customized by age group. See http://www.icpsr.umich.edu/icpsrweb/content/SAMHDA/rdas.html

[2] MPG Colorado report is available at https://www.colorado.gov/pacific/enforcement/forms-publications-marijuana-enforcement-division

[3] Our estimates cite marijuana flower, which is assumed to include marijuana flower as well as trim equivalent for edibles and concentrates as part of the total.

[4] http://alaskacannabisinstitute.com/wp-content/uploads/2014/07/ACI_Alaska-Marijuana-Market1.pdf

[5] http://laborstats.alaska.gov/pop/estimates/data/TotalPopulationBCA.xls

[6] Kilmer, Beau, Jonathan P. Caulkins, Gregory Midgette, Linden Dahlkemper, Robert J. MacCoun, and Rosalie Liccardo Pacula. 2013. Before the Grand Opening: Measuring Washington State's Marijuana Market in the Last Year Before Legalized Commercial Sales. RAND Drug Policy Research Center.

[7] Kilmer, B., Jonathan Caulkins, Rosalie Pacula, & Peter Reuter 2011. Bringing perspective to illicit markets: Estimating the size of the U.S. marijuana market. Drug and Alcohol Dependence, 119, 153–160.

[8] The appropriate NSDUH R-DAS prevalence distribution for Alaska was unavailable due to privacy restrictions. Colorado's larger cohort by frequency populations were large enough to provide a useful benchmark.

[9] See page 13-15 of the MPG Colorado report.

[10] Kilmer, et. al., 2013

[11] MPG, 2014.

[12] For reference, a regular sized "joint" contains approximately 0.5 grams of marijuana flower.

[13] Infrequent users are less price sensitive because they buy small quantities, which represent a very small share of their monthly discretionary budget. Heavy users are highly price sensitive because marijuana often represents a large share of their monthly discretionary budget.

[14] Note that the Colorado conversion rate applies only to Colorado residents. Total retail sales, when tourists and visitors are included, is a higher percentage of state demand. In their report to the State of Colorado, the MPG estimated that 22% of total demand would be supplied through the recreational retail modality, and another 30% would continue to be supplied through the medical marijuana dispensary modality.

[15] We could continue to call the formula a cross-price demand formula, assuming that the alternative price is equal to the base-year price. In either case, the reference price, P-bar, equals $14 per gram.

[16] Executive Summary, page 2, in "Altered State? - Assessing How Marijuana Legalization in California Could Influence Marijuana Consumption and Public Budgets", RAND Occasional Paper, 2010.

[17] See: Zamarra (2013), "Modeling Marijuana Businesses and Costs of Legal Compliance," BOTEC Corporation, I-502 Project, August 10, 2013.

[18] See: Marijuana Policy Group (2014), "*Average Market Rate Methodology for Colorado Wholesale Marijuana Sales*", Colorado State Department of Revenue. June, 2014.

[19] For example, the Fairbanks Council for Community and Economic Research, claims that it costs 25 percent more to live in Fairbanks, Alaska than in Tacoma, Washington.