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Dose of Reality

The Effect of State Marijuana Legalizations

By Angela Dills, Sietse Goffard, and Jeffrey Miron

EXECUTIVE SUMMARY

In November 2012 voters in the states of Colorado and Washington approved ballot initiatives that legalized marijuana for recreational use. Two years later, Alaska and Oregon followed suit. As many as 11 other states may consider similar measures in November 2016, through either ballot initiative or legislative action.

Supporters and opponents of such initiatives make numerous claims about state-level marijuana legalization. Advocates think legalization reduces crime, raises tax revenue, lowers criminal justice expenditures, improves public health, bolsters traffic safety, and stimulates the economy. Critics argue that legalization spurs marijuana and other drug or alcohol use, increases crime, diminishes traffic safety, harms public health, and lowers teen educational achievement. Systematic evaluation of these claims, however, has been largely absent.

This paper assesses recent marijuana legalizations and related policies in Colorado, Washington, Oregon, and Alaska.

Our conclusion is that state marijuana legalizations have had minimal effect on marijuana use and related outcomes. We cannot rule out small effects of legalization, and insufficient time has elapsed since the four initial legalizations to allow strong inference. On the basis of available data, however, we find little support for the stronger claims made by either opponents or advocates of legalization. The absence of significant adverse consequences is especially striking given the sometimes dire predictions made by legalization opponents.

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INTRODUCTION

In November 2012 the states of Colorado and Washington approved ballot initiatives that legalized marijuana for recreational use under state law. Two years later, Alaska and Oregon followed suit.[1] In November 2016 as many as 11 other states will likely consider similar measures, through either ballot initiative or state legislative action.[2]

Supporters and critics make numerous claims about the effects of state-level marijuana legalization. Advocates think that legalization reduces crime, raises revenue, lowers criminal justice expenditure, improves public health, improves traffic safety, and stimulates the economy.[3] Critics argue that legalization spurs marijuana and other drug or alcohol use, increases crime, diminishes traffic safety, harms public health, and lowers teen educational achievement.[4] Systematic evaluation of those claims after legalization, however, has been limited, particularly for Oregon and Alaska.[5]

This paper assesses the effect to date of marijuana legalization and related policies in Colorado, Washington, Oregon, and Alaska.

Each of those four legalizations occurred recently, and each rolled out gradually over several years. The data available for before and after comparisons are therefore limited, so our assessments of legalization's effect are tentative. Yet some post-legalization data are available, and considerable data exist regarding earlier marijuana policy changes—such as legalization for medical purposes—that plausibly have similar effects. Thus available information provides a useful if incomplete perspective on what other states should expect from legalization or related policies. Going forward, additional data may allow stronger conclusions.

Our analysis compares the pre- and post-policy-change paths of marijuana use, other drug or alcohol use, marijuana prices, crime, traffic accidents, teen educational outcomes, public health, tax revenues, criminal justice expenditures, and economic outcomes. These comparisons indicate whether the outcomes display obvious changes in trend around the time of changes in marijuana policy.

Our conclusion is that state-level marijuana legalizations to date have been associated with, at most, modest changes in marijuana use and related outcomes. Our estimates cannot rule out small changes, and related literature finds some effects from earlier marijuana policy changes such as medicalization. But the strong claims about legalization made by both opponents and supporters are not apparent in the data. The absence of significant adverse consequences is especially striking given the sometimes dire predictions made by legalization opponents.

The remainder of the paper proceeds as follows. The next section outlines the recent changes in marijuana policy in the four states of interest and discusses the timing of those changes. Subsequent sections examine the behavior of marijuana use and related outcomes before and after those policy changes. A final section summarizes and discusses implications for upcoming legalization debates.

HISTORY OF STATE-LEVEL MARIJUANA LEGALIZATIONS

Until 1913 marijuana was legal throughout the United States under both state and federal law.[6] Beginning with California in 1913 and Utah in 1914, however, states began outlawing marijuana, and by 1930, 30 states had adopted marijuana prohibition.[7] Those state-level prohibitions stemmed largely from anti-immigrant sentiment and in particular racial prejudice against Mexican migrant workers, who were often associated with use of the drug. Prohibition advocates attributed terrible crimes to marijuana and the Mexicans who smoked it, creating a stigma around marijuana and its purported "vices."[8] Meanwhile, film productions like *Reefer Madness* (1936) presented marijuana as "Public Enemy Number One" and suggested that its consumption could lead to insanity, death, and even homicidal tendencies.[9]

Starting in 1930, the Federal Bureau of Narcotics pushed states to adopt the Uniform State Narcotic Act and to enact their own measures to control marijuana distribution.[10] Following

the model of the National Firearms Act, in 1937 Congress passed the Marijuana Tax Act, which effectively outlawed marijuana under federal law by imposing a prohibitive tax; even stricter federal laws followed thereafter.[11] The 1952 Boggs Act and 1956 Narcotics Control Act established mandatory sentences for drug-related violations; a first-time offense for marijuana possession carried a minimum sentence of 2 to 10 years in prison and a fine of up to $20,000.[12] Those mandatory sentences were mostly repealed in the early 1970s but reinstated by the Anti-Drug Abuse Act under President Ronald Reagan. The current controlling federal legislation is the Controlled Substances Act, which classifies marijuana as Schedule I. This category is for drugs that, according to the Drug Enforcement Administration (DEA), have "no currently accepted medical use and a high potential for abuse" as well as a risk of "potentially severe psychological or physical dependence."[13]

Despite this history of increasing federal action against marijuana (and other drugs), individual states have been backing away from marijuana prohibition since the 1970s. Beginning with Oregon 11 states[14] decriminalized possession or use of limited amounts of marijuana between 1973 and 1978.[15] A second wave of decriminalization began with Nevada in 2001; nine more states and the District of Columbia have since joined the list.[16] Fully 25 states and the District of Columbia have gone further by legalizing marijuana for medical purposes. In some states, these medical regimes approximate de facto legalization.

The most dramatic cases of undoing state prohibitions and departing from federal policy have occurred in the four states (Colorado, Washington, Oregon, and Alaska) that have legalized marijuana for recreational as well as medical purposes. We next examine these four states in detail.

Colorado

In 1975 Colorado became one of the first states to decriminalize marijuana after a landmark report by the presidentially appointed Shafer Commission recommended lower penalties against marijuana use and suggested alternative methods to discourage heavy drug use. Decriminalization made possessing less than an ounce of marijuana a petty offense with a $100 fine.

In November 2000 Colorado legalized medical marijuana through a statewide ballot initiative. The proposal, known as Amendment 20 or the Medical Use of Marijuana Act, passed with 54 percent voter support. It authorized patients and their primary caregivers to possess up to two ounces of marijuana and up to six marijuana plants. Patients also needed a state-issued Medical Marijuana Registry Identification Card with a doctor's recommendation. State regulations limited caregivers to prescribing medical marijuana to no more than five patients each.

The number of licensed medical marijuana patients initially grew at a modest rate. Then, in 2009, after Colorado's Board of Health abandoned the caregiver-to-patient ratio rule, the medical marijuana industry took off.[17] That same year, in the so-called "Ogden Memo,"[18] the U.S. Department of Justice signaled it would shift resources away from state medical marijuana issues and refrain from targeting patients and caregivers.[19] Thus, although medical marijuana remained prohibited under federal law, the federal government would tend not to intervene in states where it was legal. Within months, medical marijuana dispensaries proliferated. Licensed patients rose from 4,800 in 2008 to 41,000 in 2009. More than 900 dispensaries operated by the end of 2009, according to law enforcement.[20]

In fall 2006 Colorado voters considered Amendment 44, a statewide ballot initiative to legalize the recreational possession of up to one ounce of marijuana by individuals aged 21 or older. Amendment 44 failed, with 58 percent of voters opposed.

In November 2012, however, Colorado voters passed Amendment 64 with 55 percent support, becoming one of the first two states to relegalize recreational marijuana. The ballot initiative authorized individuals aged 21 and older with valid government identification to grow up to six

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plants and to purchase, possess, and use up to one ounce of marijuana.[21] Colorado residents could now buy up to one ounce of marijuana in a single transaction, whereas out-of-state residents could purchase 0.25 ounces.[22]

In light of Amendment 64, Colorado's government passed new regulations and taxes to prepare for legalized recreational marijuana use. A ballot referendum dubbed Proposition AA that was passed in November 2013 imposed a 15 percent tax on sales of recreational marijuana from cultivators to retailers and a 10 percent tax on retail sales (in addition to the existing 2.9 percent state sales tax on all goods). Local governments in Colorado were permitted to impose additional taxes on retail marijuana.[23]

Following about a year of planning, Colorado's first retail marijuana businesses opened on January 1, 2014. Each business was required to pay licensing fees of several hundred dollars and adhere to other requirements.

Washington

In 1971 Washington's legislature began loosening its marijuana laws and decreed that possession of less than 40 grams would be charged as a misdemeanor. The state legalized medical marijuana in 1998 after a 1995 court case involving a terminal cancer patient being treated with marijuana brought extra attention to the issue and set the stage for a citizen-driven ballot initiative. In November 1998 state voters approved Initiative 692, known as the Washington State Medical Use of Marijuana Act, with 59 percent in favor. Use, possession, sale, and cultivation of marijuana became legal under state law for patients with certain medical conditions that had been verified by a licensed medical professional. Initiative 692 also imposed dosage limits on the drug's use. By 2009 an estimated 35,500 Washingtonians had prescriptions to buy medical marijuana legally.

In November 2012 Washington joined Colorado in legalizing recreational marijuana. Voters passed ballot Initiative 502 with 56 percent in support amid an 81 percent voter turnout at the polls. The proposal removed most state prohibitions on marijuana manufacture and commerce, permitted limited marijuana use for adults aged 21 and over, and established the need for a licensing and regulatory framework to govern the state's marijuana industry. Initiative 502 further imposed a 25 percent excise tax levied three times (on marijuana producers, processors, and retailers) and earmarked the revenue for research, education, healthcare, and substance-abuse prevention, among other purposes.[24]

Legal possession of marijuana took effect on December 6, 2012. A year and a half later, Washington's licensing board began accepting applications for recreational marijuana shops. After some backlog, the first four retail stores opened on July 8, 2014. As of June 2016, several hundred retail stores were open across the state.

Oregon

In October 1973 Oregon became the first state to decriminalize marijuana upon passage of the Oregon Decriminalization Bill. The bill eliminated criminal penalties for possession of up to an ounce of marijuana and downgraded the offense from a "crime" to a "violation" with a fine of $500 to $1,000.[25] State law continued to outlaw using marijuana in public, growing or selling marijuana, and driving under the influence. In 1997, state lawmakers attempted to recriminalize marijuana and restore jail sentences as punishment for possessing less than one ounce, and Oregon's governor signed the bill. Activists gathered swiftly against the new law, however, and forced a referendum; the attempt to recriminalize ended up failing by a margin of 2 to 1.[26]

Oregon medicalized marijuana by ballot initiative in November 1998, with 55 percent support. The Oregon Medical Marijuana Act legalized cultivation, possession, and use of marijuana by prescription for patients with specific medical conditions.[27] A new organization was set up to register patients and caregivers. In 2004 voters turned down a ballot proposal to increase to 6 pounds the amount of marijuana a patient could legally possess. Six years later, voters also rejected an effort to permit medical marijuana dispensaries, but the state legislature legalized them in 2013.[28] As of July 2016, Oregon's medical marijuana program counted

nearly 67,000 registered patients, the vast majority claiming to suffer severe pain, persistent muscle spasms, and nausea.[29]

Recreational marijuana suffered several defeats before eventual approval. In 1986 the Oregon Marijuana Legalization for Personal Use initiative failed with 74 percent of voters opposed.[30] In November 2012, a similar measure also failed, even as neighboring Washington passed its own legalization initiative. Oregon Ballot Measure 80 would have allowed personal marijuana cultivation and use without a license, plus unlimited possession for those over age 21. To oversee the new market, the measure would have established an industry-dominated board to regulate the sale of commercial marijuana. This proposal failed with more than 53 percent of the electorate voting against it.[31]

Full legalization in Oregon finally passed on November 4, 2014, when voters approved Measure 91, officially known as the Oregon Legalized Marijuana Initiative. This measure legalized recreational marijuana for individuals over age 21 and permitted possession of up to eight ounces of dried marijuana, along with four plants, with the Oregon Liquor Control Commission regulating sales of the drug. More than 56 percent of voters cast ballots in favor of the initiative, making Oregon the third state in the nation (along with Alaska) to legalize recreational marijuana.[32]

Oregon's legislature then adopted several laws to regulate the marijuana industry. Legislators passed a 17 percent state sales tax on marijuana retail sales and empowered local jurisdictions to charge their own additional 3 percent sales tax.[33] Later, the state legislature gave individual counties the option to ban marijuana sales if at least 55 percent of voters in those counties opposed Measure 91.[34]

Legal sales went into effect on October 1, 2015. As of June 2016, Oregon had 426 locations where consumers could legally purchase recreational marijuana.[35]

Alaska

Alaska's debate over marijuana policy began with a 1972 court case. Irwin Ravin, an attorney, was pulled over for a broken taillight and found to be in possession of marijuana. Ravin refused to sign the traffic ticket while he was in possession of marijuana so that he could challenge the law. Ultimately, the Alaska Supreme Court deemed marijuana possession in the privacy of one's home to be constitutionally protected, and *Ravin* v. *State* established legal precedent in Alaska for years to come.[36]

Alaska's legislature decriminalized marijuana in 1975, two years after Oregon. Persons possessing less than one ounce in public—or any amount in one's own home—could be fined no more than $100, a fine eliminated in 1982. Marijuana opponents, however, mobilized later in the decade as law enforcement busted a number of large, illegal cultivation sites hidden in residences. A voter initiative in November 1990 proposed to ban possession and use of marijuana even in one's own home, punishable by 90 days of jail time and a $1,000 fine. The initiative passed with 54 percent support.[37]

In 1998 Alaska citizens spearheaded an initiative to legalize medical marijuana, and 69 percent of voters supported it. Registered patients consuming marijuana for health conditions certified by a doctor could possess up to one ounce of marijuana or up to six plants.[38]

Advocates then turned to recreational legalization. A ballot initiative in 2000 proposed legalizing use for anyone 18 years and older and regulating the drug "like an alcoholic beverage." The initiative failed, with 59 percent of voters opposed. Voters considered a similar ballot measure in 2004 but again rejected it.

A third ballot initiative on recreational marijuana legalization passed in November 2014 with 53 percent of voters in support. It permitted adults aged 21 and over to possess, use, and grow marijuana. It also legalized manufacture and sale. The law further created a Marijuana Control Board to regulate the industry and establish excise taxes.

State regulators had originally planned to start issuing applications to growers, processors, and stores in early to mid-2016. At the time of this writing, retail marijuana shops are not yet open. This delay, along with data limi-

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tations, makes it difficult to evaluate post-legalization outcomes in Alaska.

KEY DATES

To determine the effect of marijuana legalization and similar policies on marijuana use and related outcomes, we examine the trends in use and outcomes before and after key policy changes. We focus mostly on recreational marijuana legalizations, because earlier work has covered other modifications of marijuana policy such as medicalization.[39] The specific dates we consider, derived from the discussion above, are as follows:

Colorado

- 2001, after legalization of medical marijuana
- 2009, after liberalization of the medical marijuana law
- 2012, after legalization of recreational marijuana
- 2014, after the first retail stores opened under state-level legalization

Washington

- 1998, after legalization of medical marijuana
- 2012, after legalization of recreational marijuana
- 2014, after the first retail stores opened under state-level legalization

Oregon

- 1998, after legalization of medical marijuana
- 2013, after the state legislature legalized medical marijuana dispensaries
- 2014, after legalization of recreational marijuana
- 2015, after the first retail stores opened under state-level legalization

Alaska

- 1990, after voters recriminalized marijuana
- 1998, after legalization of medical marijuana
- 2014, after legalization of recreational marijuana

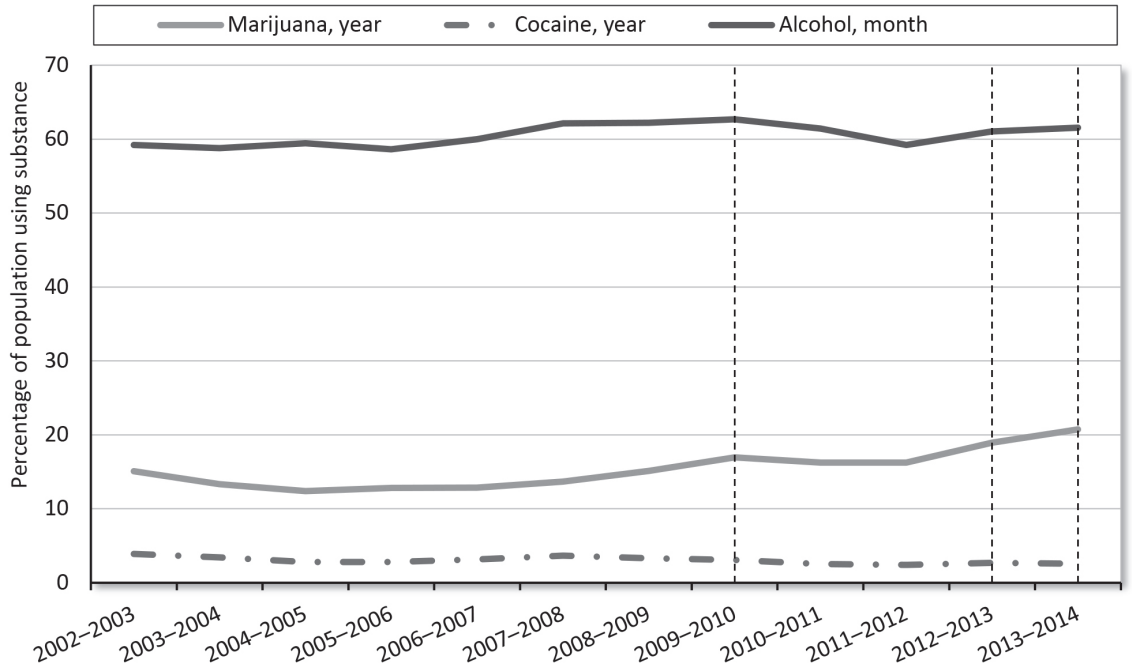
Our analysis examines whether the trends in marijuana use and related outcomes changed substantially after these dates. Observed changes do not necessarily implicate marijuana policy because other factors might have changed as well. Similarly, the absence of changes does not prove that policy changes had no effect; the abundance of potentially confounding variables makes it possible that, by coincidence, a policy change was approximately offset by some other factor operating in the opposite direction. Thus, our analysis focuses on the factual outcomes of marijuana legalization, rather than on causal inferences.

DRUG USE

Arguably the most important potential effect of marijuana legalization is on marijuana use or other drug or alcohol use. Opinions differ on whether increased use is problematic or desirable, but because other outcomes depend on use, a key step is to determine how much policy affects use. If such effects are small, then other effects of legalization are also likely to be small.

Figure 1 shows past-year use rates in Colorado for marijuana and cocaine, along with past-month use rates for alcohol.[40] The key fact is that marijuana use rates were increasing modestly for several years before 2009, when medical marijuana became readily available in dispensaries, and continued this upward trend through legalization in 2012. Post-legalization use rates deviate from this overall trend, but only to a minor degree. The data do not show dramatic changes in use rates corresponding to either the expansion of medical marijuana or legalization. Similarly, cocaine exhibits a mild downward trend over the time period but shows no obvious change after marijuana policy changes. Alcohol use shows a pattern similar to marijuana: a gradual upward trend but no obvious evidence of a response to marijuana policy.

Figure 1
Colorado National Survey on Use and Health Results (all respondents, aged 12+)



Source: National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration (SAMHSA), http://www.samhsa.gov/data/population-data-nsduh/reports?tab=33.

Figure 2 graphs the same variables in Washington State. As in Colorado, marijuana, cocaine, and alcohol use proceed along preexisting trends after changes in marijuana policy.

Figure 3 presents analogous data for Oregon.[41] Legalization only took effect in 2015 (i.e., after the end of currently available substance use data), inhibiting any measurement of the effect of policy on data observed thus far. However, as in other legalizing states, past-year marijuana use has been rising since the mid-2000s.

Figure 4 presents data on current (past-month) marijuana use by youth from the Youth Risk Behavior Survey, a survey of health behaviors conducted in middle schools and high schools. Data are unfortunately unavailable for Washington and Oregon. The limited available data for Colorado and Alaska show no obvious effect of legalization on youth marijuana use.

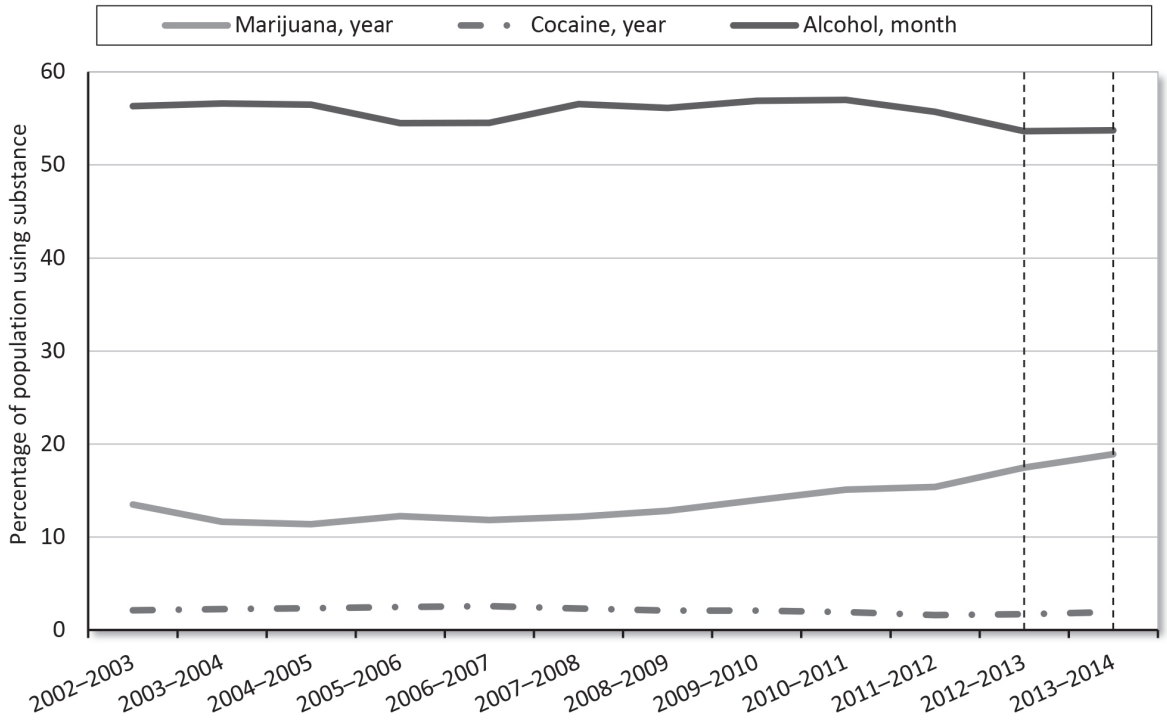
All those observed patterns in marijuana use might provide evidence for a cultural explanation behind legalization: as marijuana becomes more commonplace and less stigmatized, residents and legislators become less opposed to legalization. In essence, rising marijuana use may not be a consequence of legalization, but a cause of it.

Consistent with this possibility, Figure 5 plots, for all four legalizing states, data on perceptions of "great risk" from smoking marijuana monthly.[42] All four states exhibit a steady downward trend, indicating that fewer people associate monthly marijuana use with high risk. These downward trends predate legalization, consistent with the view that changing attitudes toward marijuana fostered both policy changes and increasing use rates. Interestingly, risk perceptions rose in Colorado in 2012–2013, immediately following legalization. This rise may have resulted from public safety and anti-legalization campaigns that cautioned residents about the dangers of marijuana use.

Data on marijuana prices may also shed light on marijuana use. One hypothesis before legalization was that use might soar because prices would plunge. For example, Dale Gieringer, director of California's NORML (National Organization for Reform of Marijuana Laws) branch, testified in 2009 that in a "totally unregulated market, the

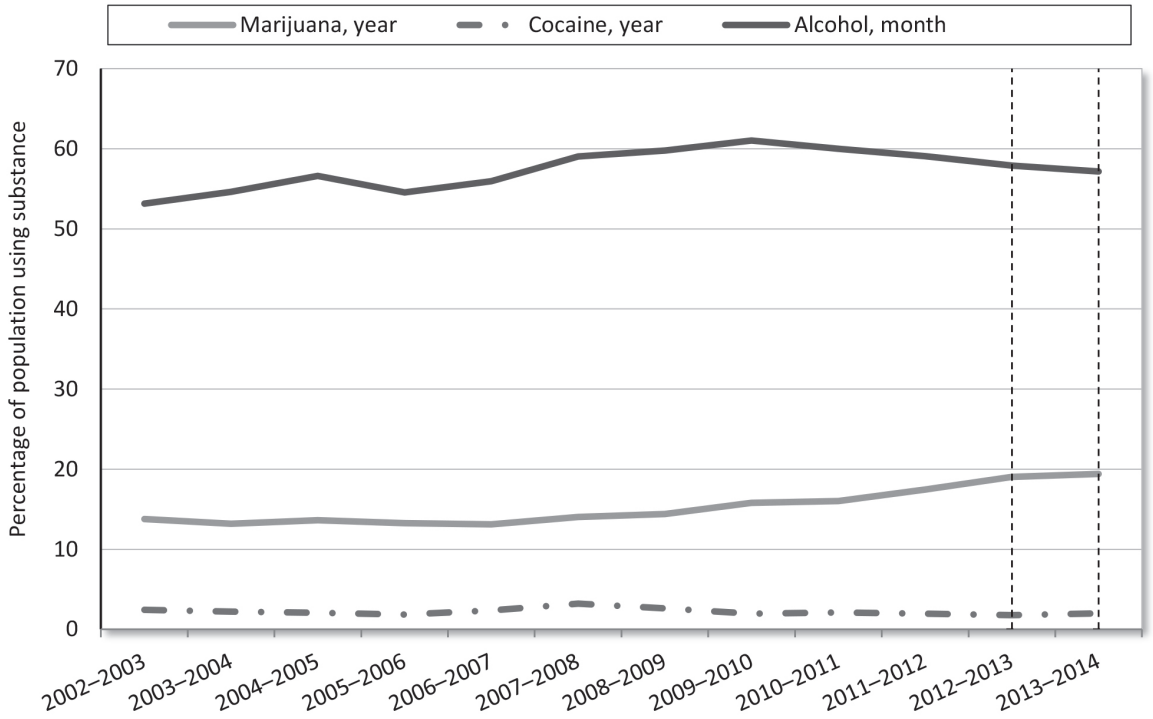
"The limited available data for Colorado and Alaska show no obvious effect of legalization on youth marijuana use."

Figure 2
Washington State National Survey on Drug Use and Health Results (all respondents, aged 12+)



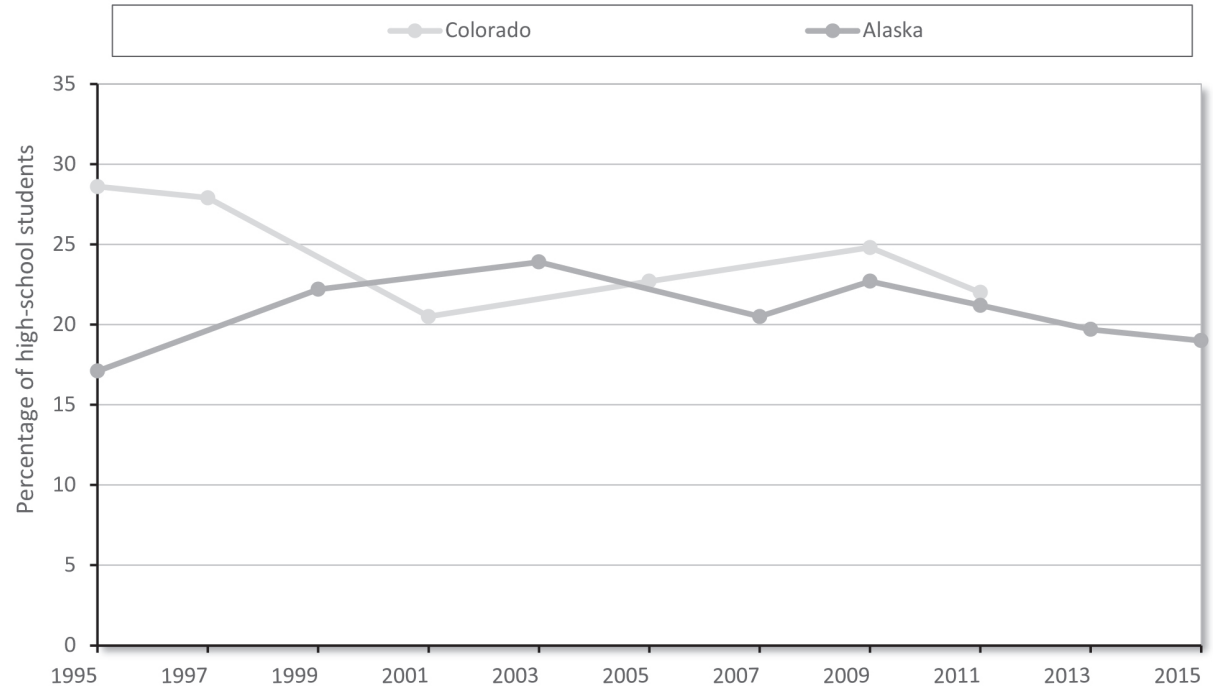
Source: National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration (SAMHSA), http://www.samhsa.gov/data/population-data-nsduh/reports?tab=33.

Figure 3
Oregon National Survey on Drug Use and Health Results (all respondents, aged 12+)



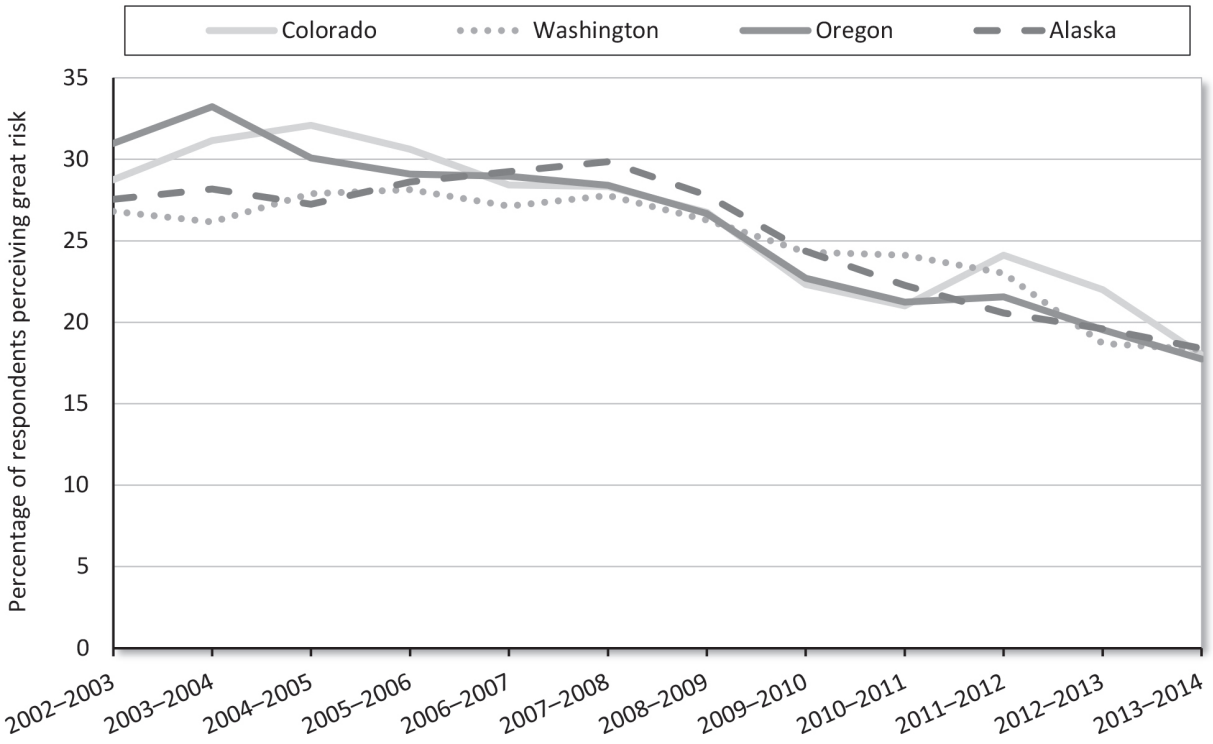
Source: National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration (SAMHSA), http://www.samhsa.gov/data/population-data-nsduh/reports?tab=33.

Figure 4
Youth Risk Behavior Survey Past Month Marijuana Use



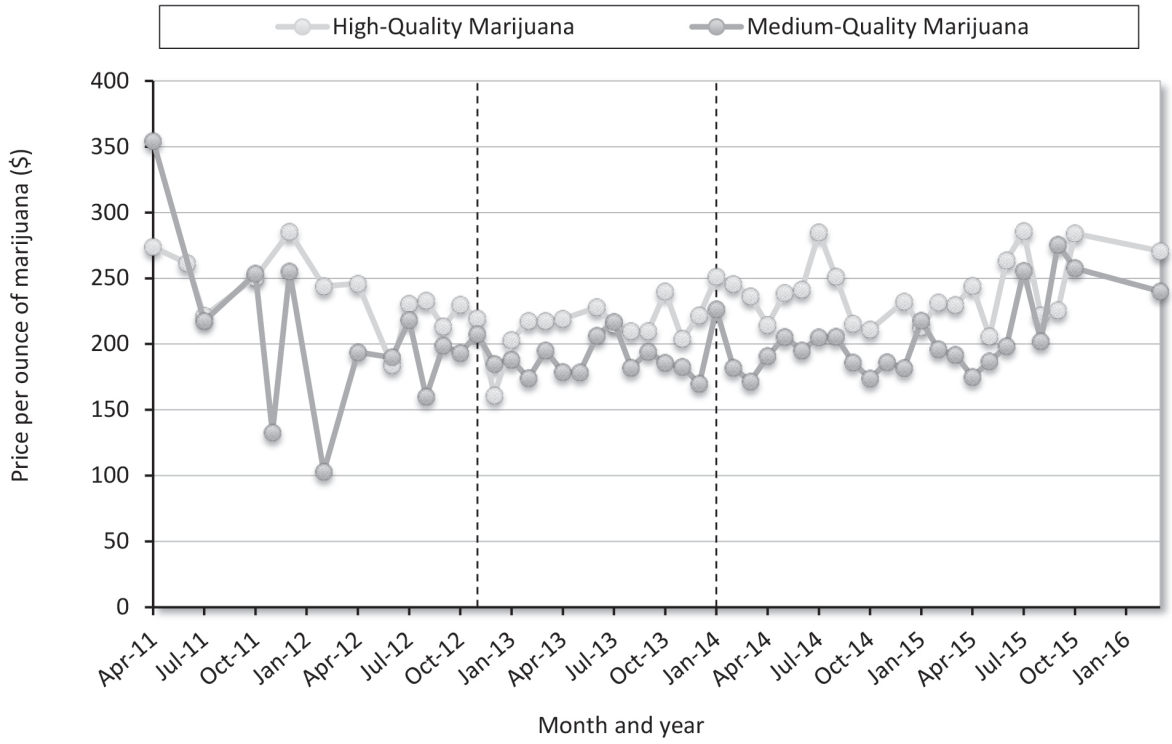
Source: Youth Risk Behavior Survey, Centers for Disease Control and Prevention, http://www.cdc.gov/healthyyouth/data/yrbs/data.htm.

Figure 5
Perception of Risk



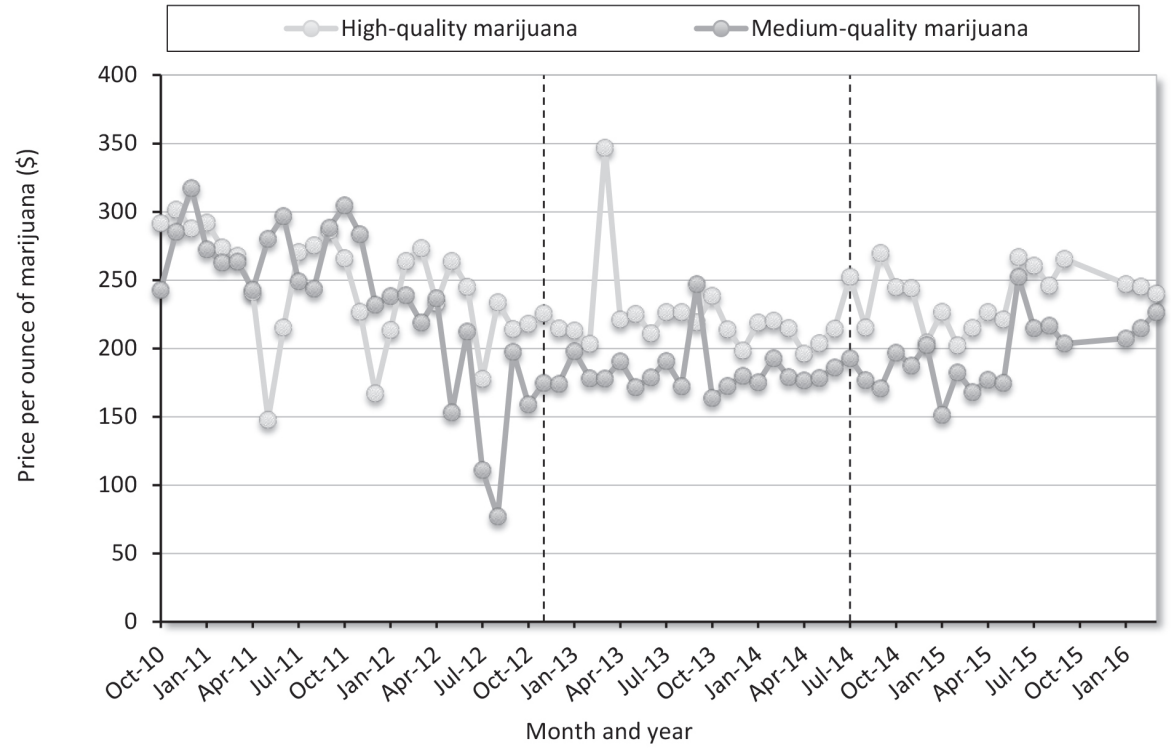
Source: National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration (SAMHSA), http://www.samhsa.gov/data/population-data-nsduh/reports?tab=33.

Figure 6
Colorado Marijuana Prices



Source: Priceofweed.com, http://www.priceofweed.com/prices/United-States/Colorado.html.

Figure 7
Washington Marijuana Prices



Source: Priceofweed.com, http://www.priceofweed.com/prices/United-States/Washington.html.

price of marijuana would presumably drop as low as that of other legal herbs such as tea or tobacco—on the order of a few dollars per ounce—100 times lower than the current prevailing price of $300 per ounce."[43] A separate study by the Rand Corporation[44] estimated that marijuana prices in California would fall by 80 percent after legalization.[45] Using data from Price of Weed (priceofweed.com), which crowdsources real-time information from thousands of marijuana buyers in each state, we derive monthly average prices of marijuana in Colorado, Washington, and Oregon.[46] See Figures 6, 7, and 8.

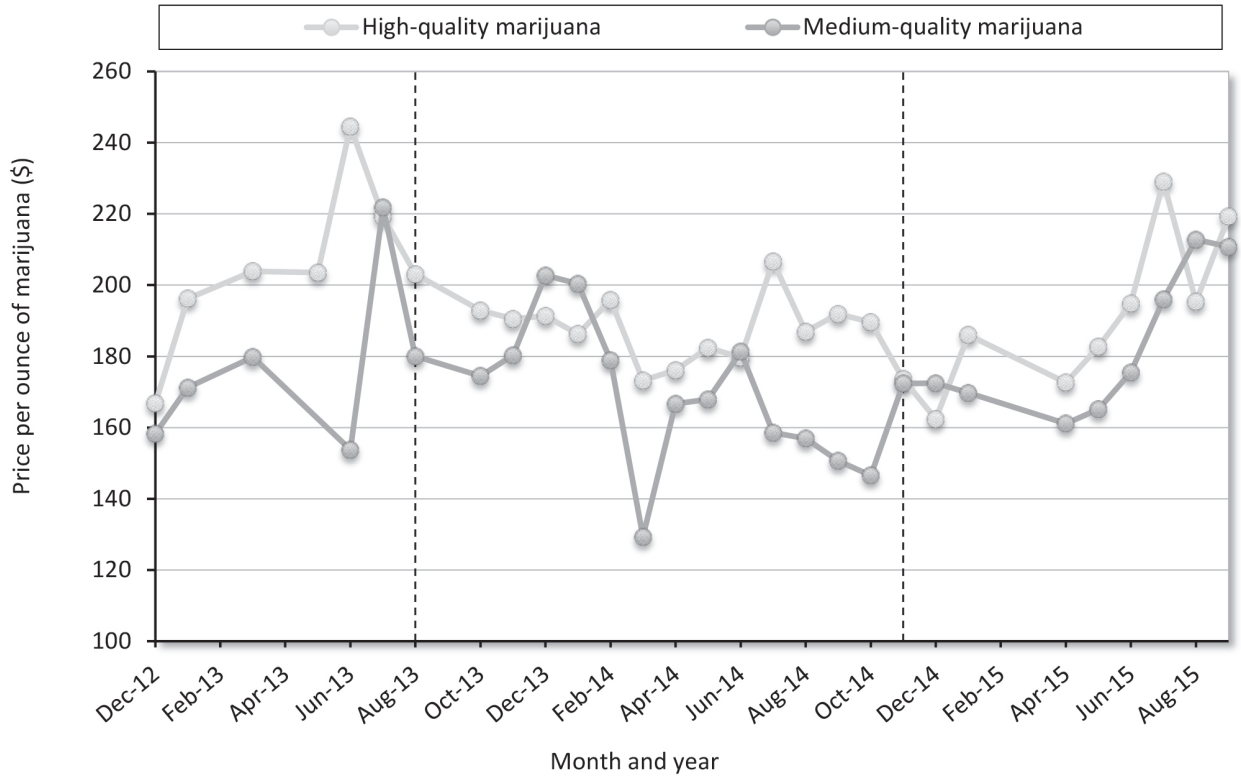
In Colorado, monthly average prices were declining even before legalization and have remained fairly steady since. The cost of high-quality marijuana hovers around $230 per ounce while that of medium-quality marijuana remains around $190. The opening of shops in January 2015 seems to have had little effect. In Washington State, marijuana prices have been similarly steady and have converged almost exactly to Colorado prices—roughly $230 for high-quality marijuana and $200 for medium-quality marijuana. Oregon prices show a rise after legalization, catching up to Colorado and Washington levels. Although we cannot draw a conclusive picture on the basis of consumer-reported data, the convergence of prices across states makes sense. This convergence is also consistent with the idea that legalization helped divert marijuana commerce from the black market to legalized retail shops.[47] Overall, these data suggest no major drop in marijuana prices after legalization and consequently less likelihood of soaring use because of cheaper marijuana.

HEALTH AND SUICIDES

Previous studies have suggested a link between medicalization of marijuana and a lower overall suicide rate, particularly among demographics most likely to use marijuana in general (males ages 20 to 39).[48] In fact, supporters believe that marijuana can be an effective treatment for

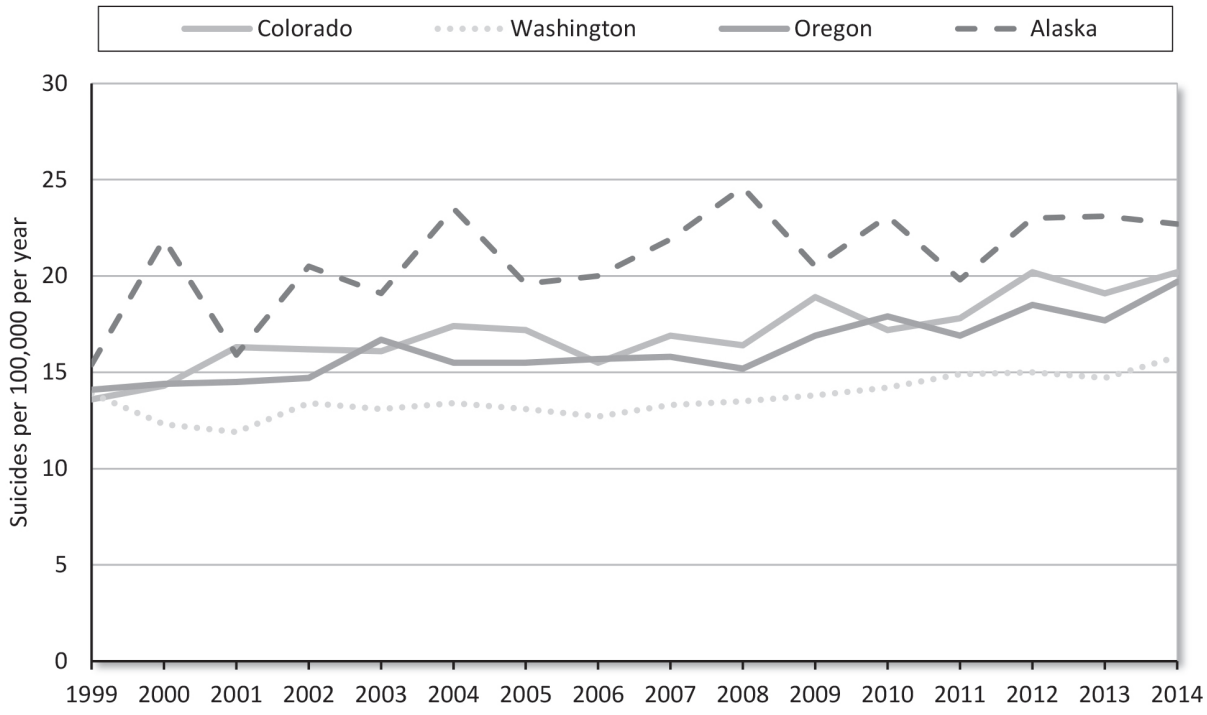
"Overall, these data suggest no major drop in marijuana prices after legalization and consequently less likelihood of soaring use because of cheaper marijuana."

Figure 8
Oregon Marijuana Prices



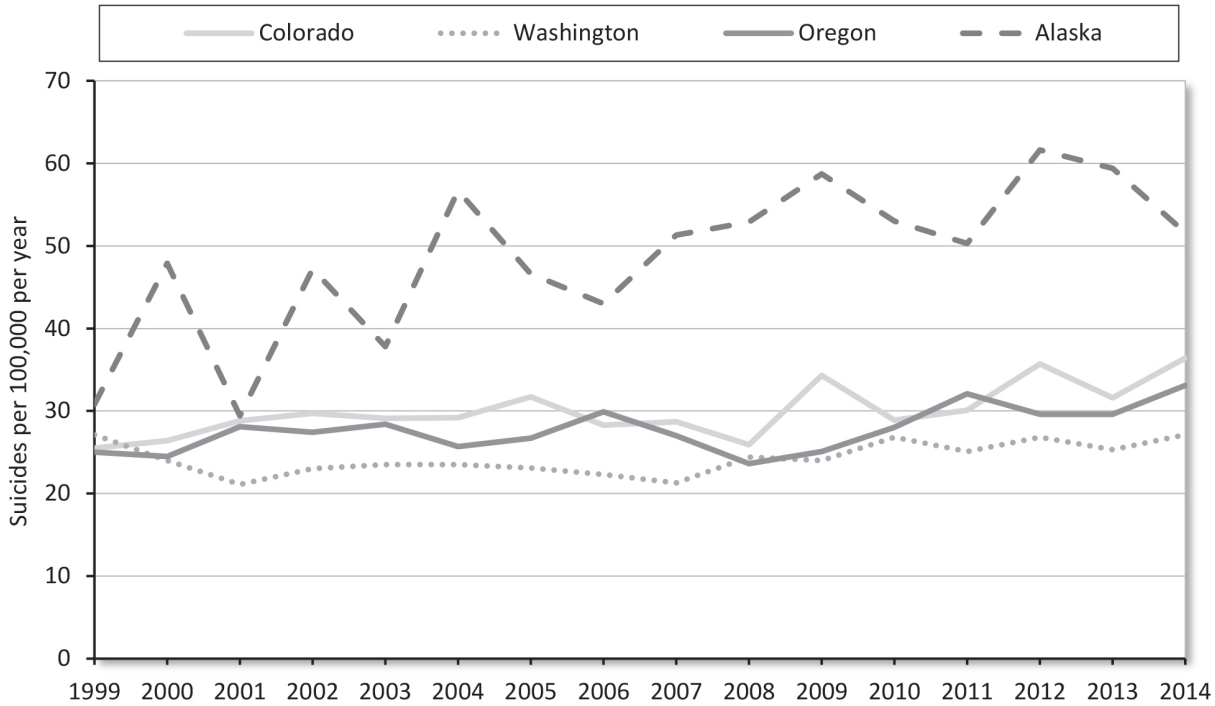
Source: Priceofweed.com, http://www.priceofweed.com/prices/United-States/Oregon.html.

Figure 9
Annual Suicide Rates (per 100,000 people)



Source: Centers for Disease Control and Prevention, CDC Wonder Portal, http://wonder.cdc.gov/.

Figure 10
Suicide Rates for Males 20–39 Years Old



Source: Centers for Disease Control and Prevention, CDC Wonder Portal, http://wonder.cdc.gov/.

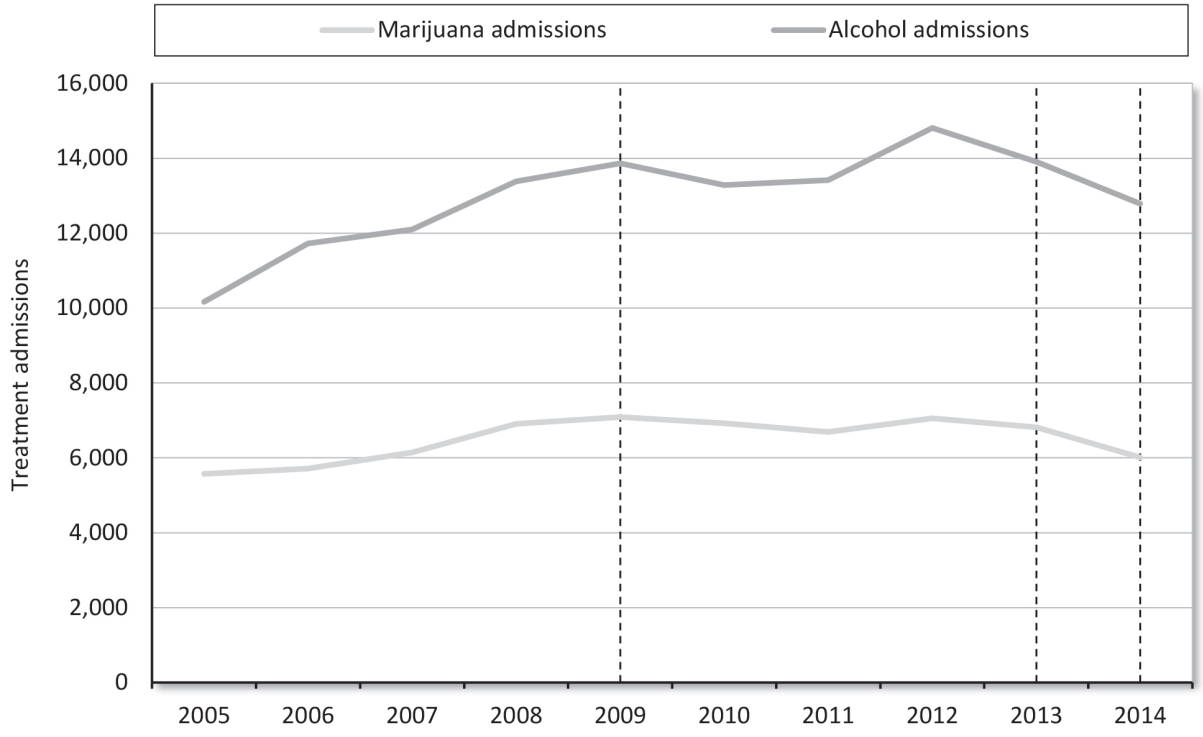
bipolar disorder, depression, and other mood disorders—not to mention a safer alternative to alcohol. Moreover, the pain-relieving element of medical marijuana may help patients avoid more harmful prescription painkillers and tranquilizers.[49] Conversely, certain studies suggest excessive marijuana use may increase the risk of depression, schizophrenia, unhealthy drug abuse, and anxiety.[50] Some research also warns about long-lasting cognitive damage if marijuana is consumed regularly, especially at a young age.[51]

Figure 9 displays the overall yearly suicide rate per 100,000 people in each of the four legalizing states between 1999 and 2014.[52] Figure 10 presents the analogous suicide rate for males aged 20 through 39 years.[53] Suicide rates in all four states trend slightly upward during the 15-year-long period, but it is difficult to see any association between marijuana legalization and any changes in these trends. These findings contrast with many previous studies, so it is possible that any effects will take longer to appear. In addition, previous research has suggested a link between medical marijuana and a lower suicide rate; it is not obvious that recreational marijuana would lead to the same result, or that legalization of recreational marijuana after medical marijuana is already legalized would have much of an extra effect.[54]

Data on treatment center admissions provide a proxy for drug abuse and other health hazards associated with misuse. Figures 11 and 12 plot rates of annual admissions involving marijuana and alcohol to publicly funded treatment centers in Colorado[55] and King County, Washington (which encompasses Seattle).[56] Marijuana admissions in Colorado were fairly steady over the past decade but began falling in 2013 and 2014, just as legalization took effect. Alcohol admissions began declining around the same time. In King County, admissions for marijuana and alcohol continued their downward trends after legalization. These patterns suggest that extreme growth in marijuana abuse has not materialized, as some critics had warned before legalization.

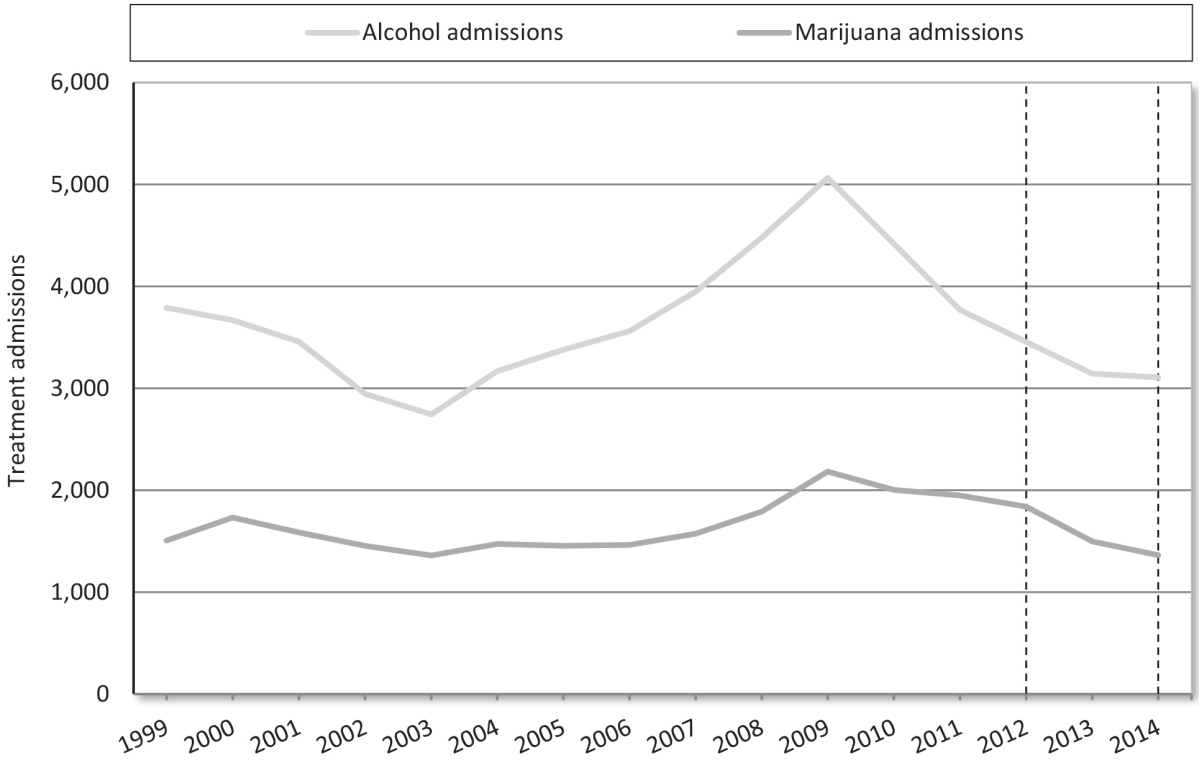
"Suicide rates in all four states trend slightly upward, but it is difficult to see any association between marijuana legalization and any changes in these trends."

Figure 11
Colorado Treatment Admissions



Source: Rocky Mountain High Intensity Drug Trafficking Area (RMHIDTA) report, "The Legalization of Marijuana in Colorado: The Impact" (Vol. 3, September 2015), http://www.rmhidta.org/html/2015%20final%20legalization%20of%20marijuana%20in%20colorado%20the%20impact.pdf.

Figure 12
Treatment Admissions by Drug—King County, Washington



Source: University of Washington Alcohol and Drug Abuse Institute, http://adai.washington.edu/pubs/cewg/Drug%20Trends_2014_final.pdf.

CRIME

In addition to substance use and health outcomes, legalization might affect crime. Opponents think these substances cause crime through psychopharmacological and other mechanisms, and they note that such substances have long been associated with crime, social deviancy, and other undesirable aspects of society.[57] Although those perspectives first emerged in the 1920s and 1930s, marijuana's perceived associations with crime and deviancy persist today.[58]

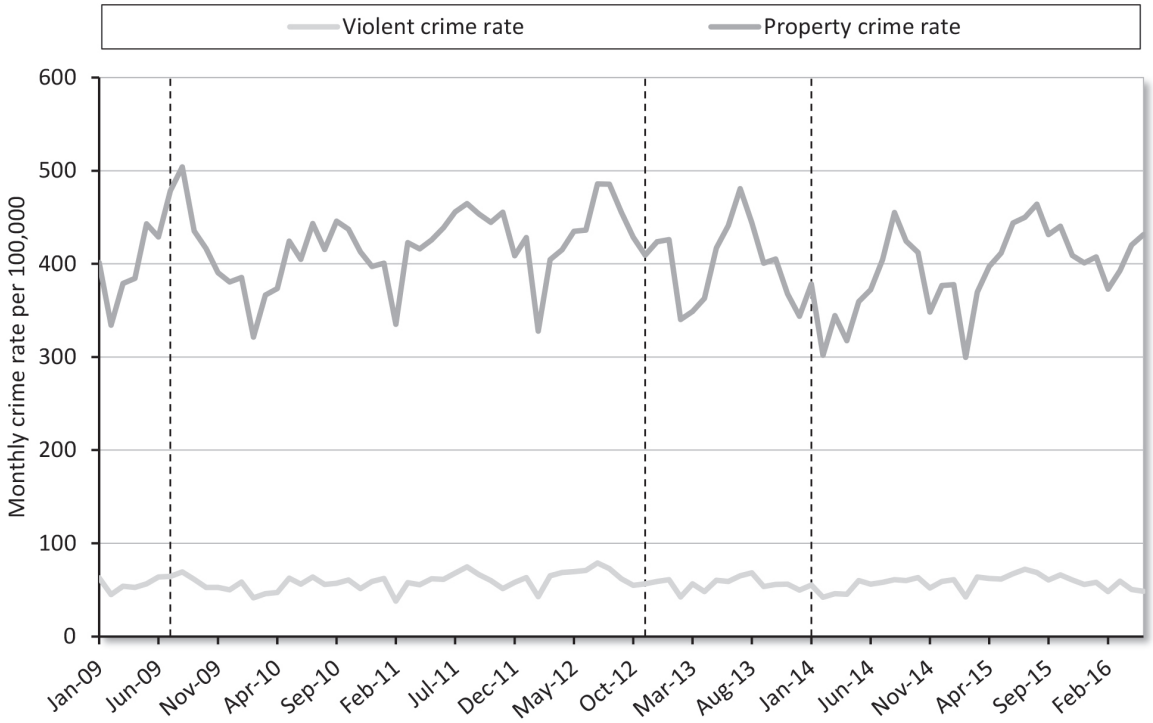
Before referendums in 2012, police chiefs, governors, policymakers, and concerned citizens spoke up against marijuana and its purported links to crime.[59] They also argued that expanding drug commerce could increase marijuana commerce in violent underground markets and that legalization would make it easy to smuggle the substance across borders where it remained prohibited, thus causing negative spillover effects.[60]

Proponents argue that legalization reduces crime by diverting marijuana production and sale from the black market to legal venues. This shift may be incomplete if high tax rates or significant regulation keeps some marijuana activity in gray or black markets, but this merely underscores that more legalization means less crime. At the same time, legalization may reduce the burden on law enforcement to patrol for drug offenses, thereby freeing budgets and manpower to address larger crimes. Legalization supporters also dispute the claim that marijuana increases neurological tendencies toward violence or aggression.[61]

Figure 13 presents monthly crime rates from Denver, Colorado, for all reported violent crimes and property crimes.[62] Both metrics remain essentially constant after 2012 and 2014; we do not observe substantial deviations from the illustrated cyclical crime pattern. Other cities in Colorado mirror those findings. Analogous monthly crime data for Fort Collins, for example, reveal no increase in violent or property crime.[63]

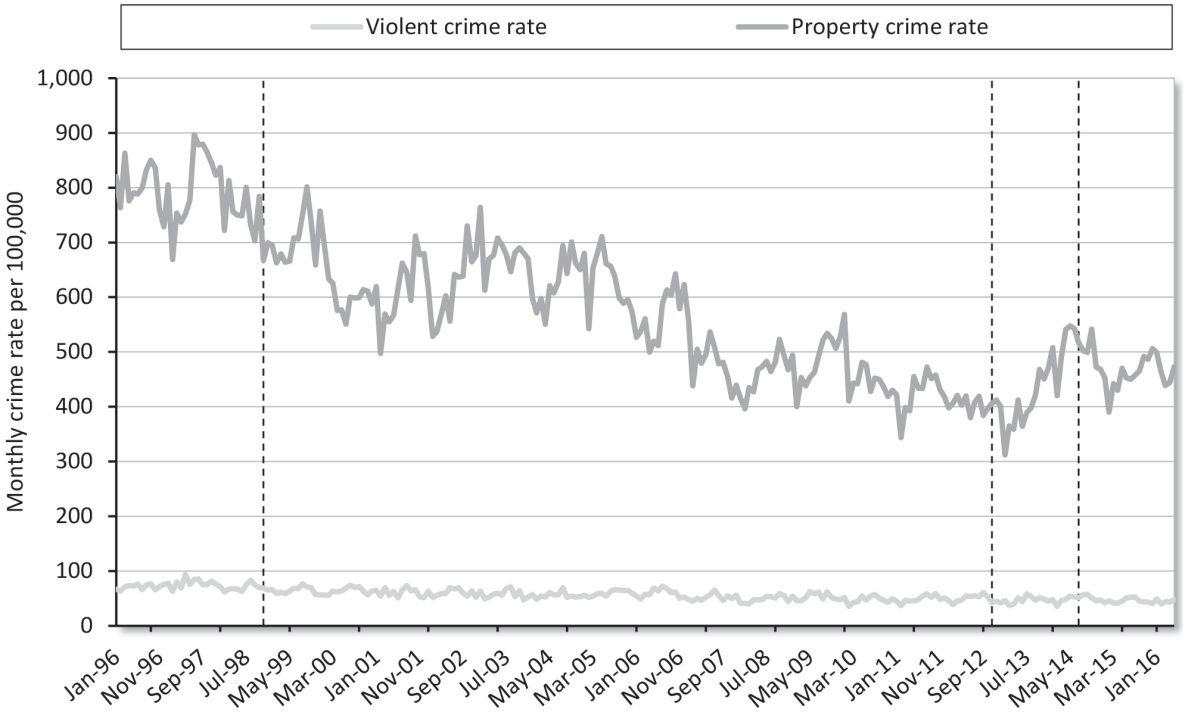
Figure 14 shows monthly violent and property crime rates as reported by the Seattle Police Department.[64] Both categories of crime

Figure 13
Denver Monthly Crime Rate (violent and property crime rates per 100,000 residents)



Source: Denver Police Department, Monthly Crime Reports, https://www.denvergov.org/content/denvergov/en/police-department/crime-information/crime-statistics-maps.html. Population data source: U.S. Census Bureau Estimates, http://www.census.gov/popest/data/intercensal/index.html.

Figure 14
Seattle Monthly Crime Rate



Source: Seattle Police Department, Online Crime Dashboard, http://www.seattle.gov/seattle-police-department/crime-data/crime-dashboard. Population data source: U.S. Census Bureau Estimates. http://www.census.gov/popest/data/intercensal/index.html.

> "All told, crime in Seattle has neither soared nor plummeted in the wake of legalization."

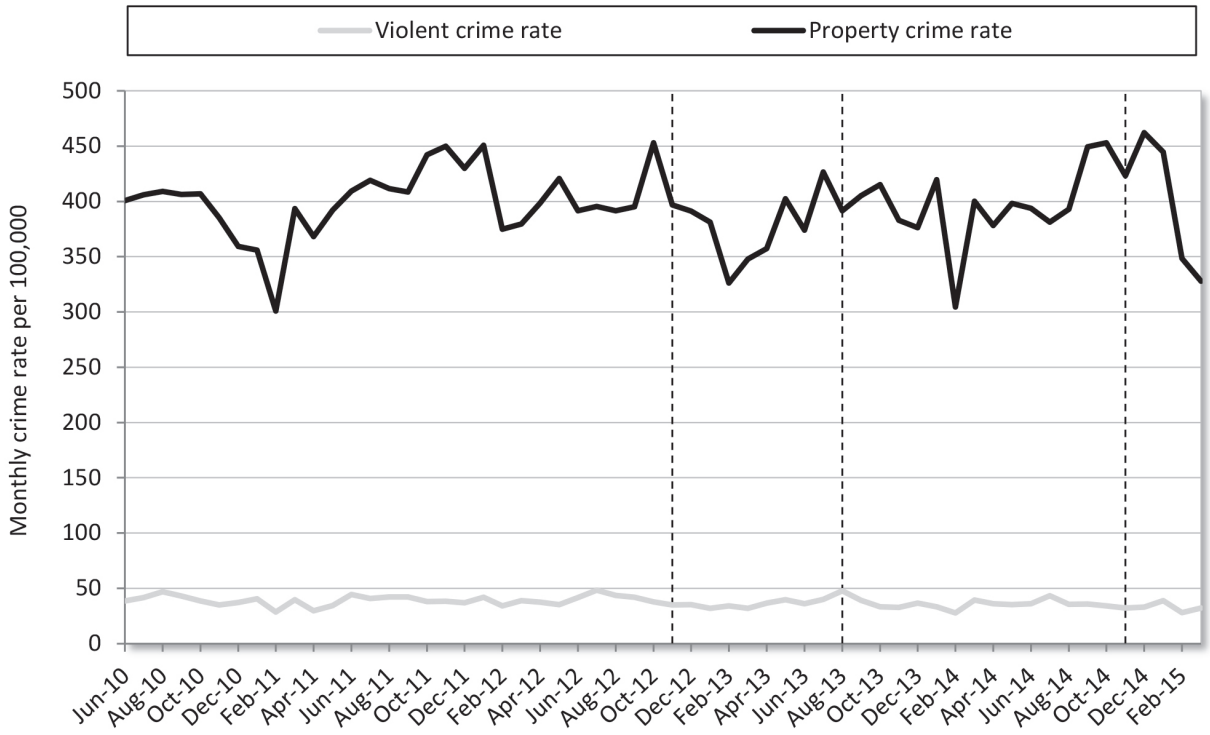
declined steadily over the past 20 years, with no major deviations after marijuana liberalization. Property crime does appear to spike in 2013 and early 2014, and some commentators have posited that legalization drove this increase.[65] That connection is not convincing, however, since property crime starts to fall again after the opening of marijuana shops in mid-2014. All told, crime in Seattle has neither soared nor plummeted in the wake of legalization.[66]

Monthly violent and property crime remained steady after legalization in Portland, Oregon, as seen in Figure 15.[67] Portland provides an interesting case because of its border with Washington. Between 2012 and 2014, Portland (and the rest of Oregon) prohibited the recreational use of marijuana, while marijuana sales and consumption were fully legal in neighboring Washingtonian towns just to the north. This situation creates a natural experiment that allows us to look for spillover effects in Oregon. Figure 15 suggests that legalization in Washington and the opening of stores there did not produce rising crime rates across the border. Elsewhere in Oregon, we see no discernible changes in crime trends before and after legalization or medical marijuana liberalization.[68]

ROAD SAFETY

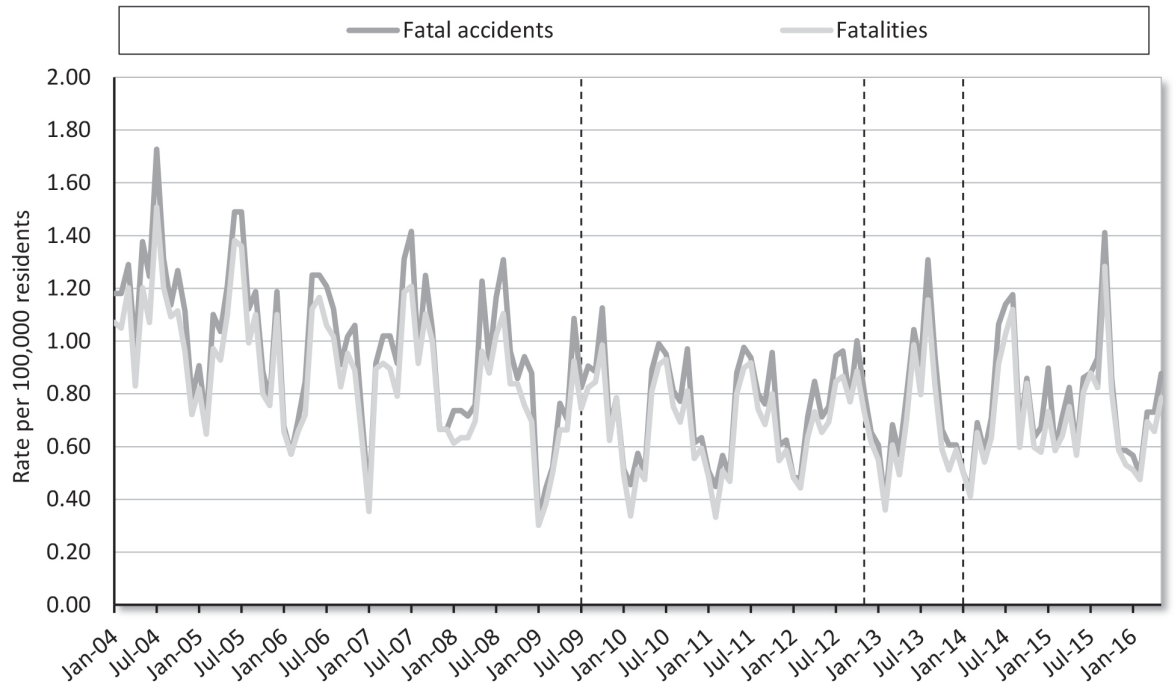
We next evaluate how the incidence of traffic accidents may have changed in response to marijuana policy changes. Previous literature and political rhetoric suggest two contrasting hypotheses. One holds that legalization increases traffic accidents by spurring drug use and thereby driving under the influence. This hypothesis presumes that marijuana impairs driving ability.[69] The opposing theory argues legalization improves traffic safety because marijuana substitutes for alcohol, which some studies say impairs driving ability even more.[70] Moreover, some consumers may be able to drive better if marijuana serves to relieve their pain.

Figure 15
Portland Monthly Crime Rate



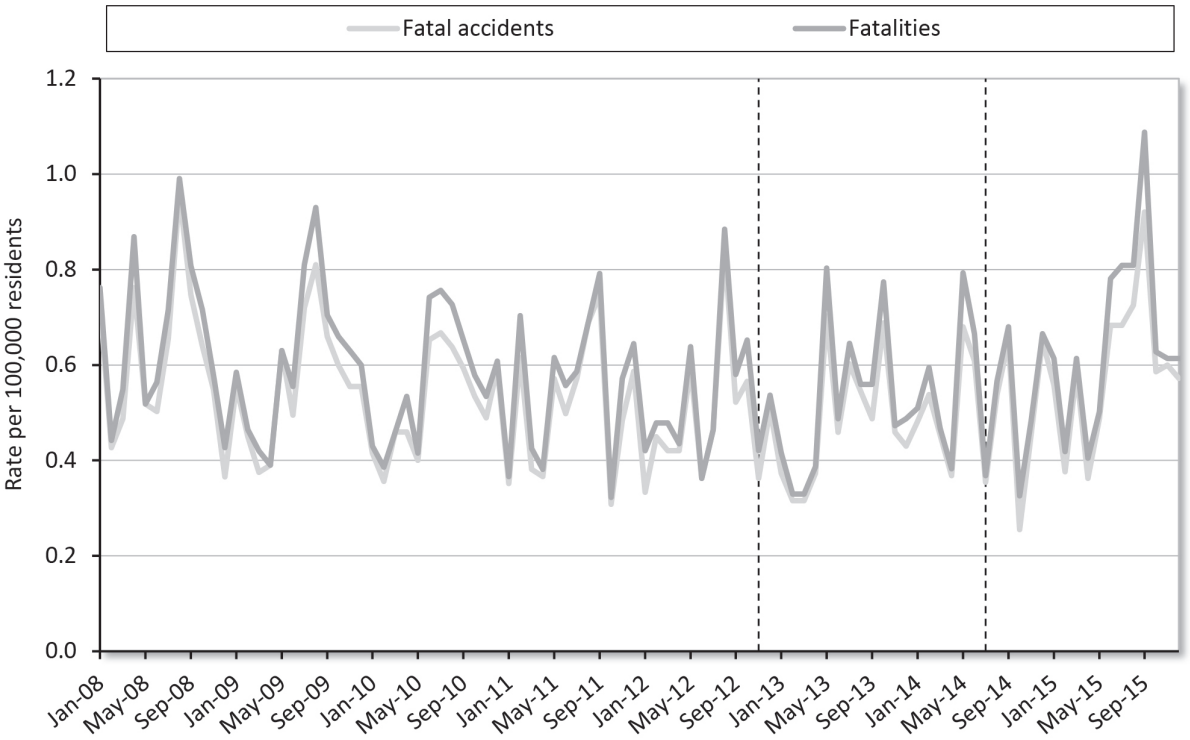
Source: Portland Police Bureau Neighborhood Statistics, http://www.portlandonline.com/police/crimestats/. Population data source: U.S. Census Bureau Estimates, http://www.census.gov/popest/data/intercensal/index.html.

Figure 16
Colorado Car Crashes and Fatality Rate



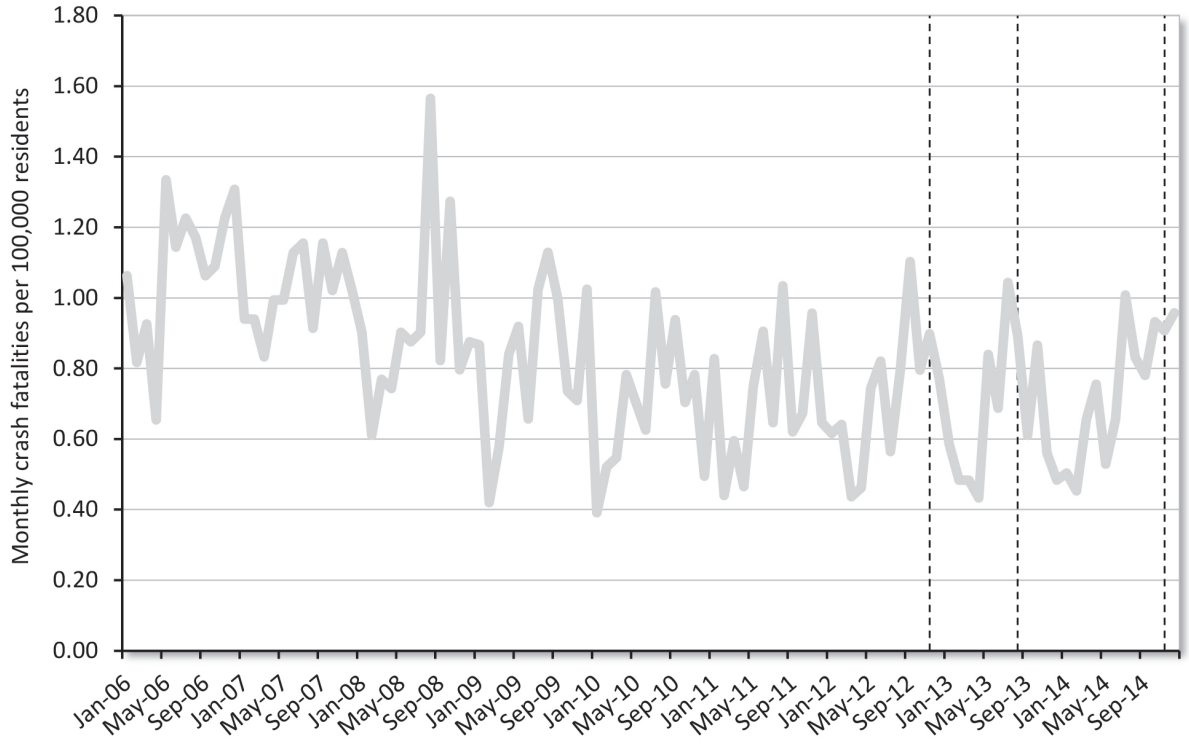
Source: Colorado Department of Transportation, http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/safety-crash-data/fatal-crash-data-city-county/fatal-crashes-by-city-and-county/.

Figure 17
Washington Car Crashes and Fatality Rate



Source: Washington Traffic Safety Commission, Quarterly Target Zero Reports, http://wtsc.wa.gov/research-data/quarterly-target-zero-data/.

Figure 18
Oregon Car Crash Fatality Rate



Source: Oregon Department of Transportation, online Crash Summary Reports and in-person data request. Special thanks to Theresa Heyn and Coleen O'Hogan, http://www.oregon.gov/ODOT/TD/TDATA/pages/car/car_publications.aspx.

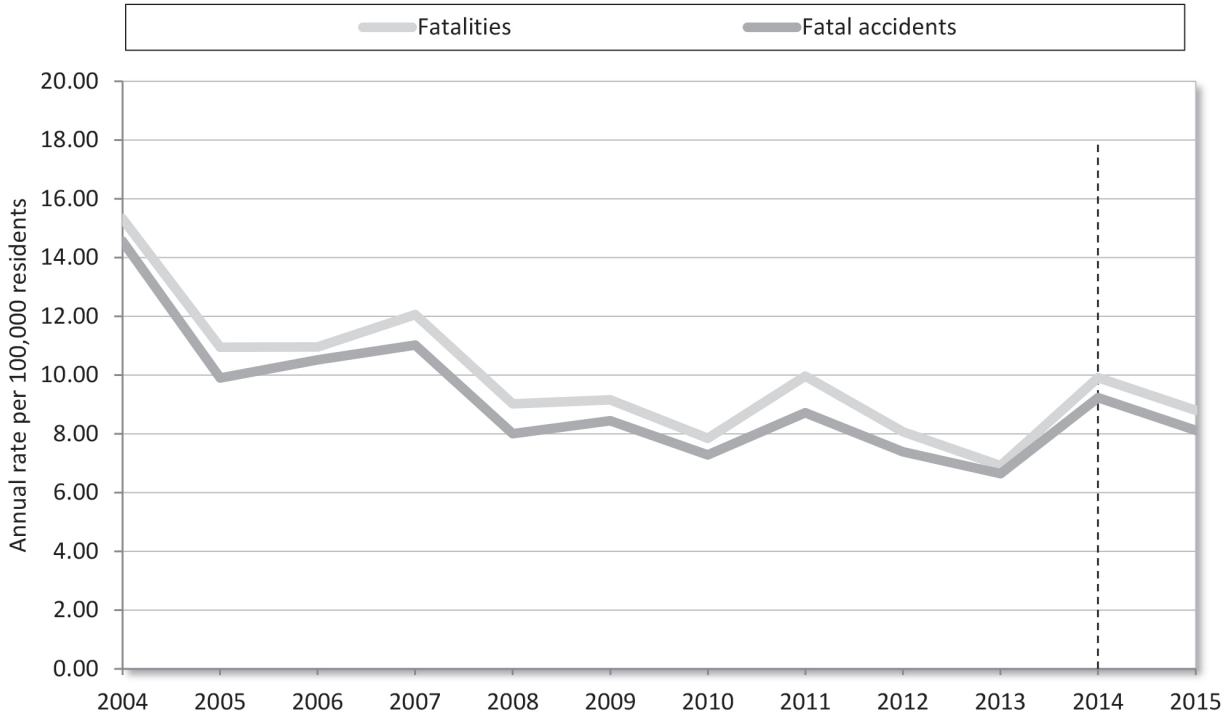
Rhetoric from experts and government officials has been equally divided. Kevin Sabet, a former senior White House drug policy adviser, warned that potential consequences of Colorado's legalization could include large increases in traffic accidents.[71] A recent Associated Press article noted that "fatal crashes involving marijuana doubled in Washington after legalization."[72] Yet Coloradan law enforcement agents are themselves unsure whether legal marijuana has led to an increase in accidents.[73] Research by Radley Balko, an opinion blogger for the *Washington Post* and an author on drug policy, claims that, overall, "highway fatalities in Colorado are at near-historic lows" in the wake of legalization.[74]

Figure 16 presents the monthly rate of fatal accidents and fatalities per 100,000 residents in Colorado.[75] No spike in fatal traffic accidents or fatalities followed the liberalization of medical marijuana in 2009.[76] Although fatality rates have reached slightly higher peaks in recent summers, no obvious jump occurs after either legalization in 2012 or the opening of stores in 2014.[77] Likewise, neither marijuana milestone in Washington State appears to have substantially affected the fatal crash or fatality rate, as illustrated in Figure 17.[78] In fact, more granular statistics reveal that the fatality rate for drug-related crashes was virtually unchanged after legalization.[79]

Figure 18 depicts the crash fatality rate in Oregon.[80] Although few post-legalization data were available at the time of publication, we observe no signs of deviations in trend after the opening of medical marijuana dispensaries in 2013. We can also test for possible spillover effects from neighboring Washington. Legalization there in 2012 and the opening of marijuana shops in 2014 do not seem to materially affect road fatalities in Oregon in either direction.

Finally, Figure 19 presents annual data on crash fatality rates in Alaska; these show no discernible increase after legalization and may even decline slightly.

Figure 19
Alaska Car Crashes and Fatalities



Source: Alaska Highway Safety Office, http://www.dot.state.ak.us/stwdplng/hwysafety/fars.shtml.

YOUTH OUTCOMES

Much of the concern surrounding marijuana legalization relates to its possible effect on youths. Many observers, for example, fear that expanded legal access—even if officially limited to adults age 21 and over—might increase use by teenagers, with negative effects on intelligence, educational outcomes, or other youth behaviors.[81, 82]

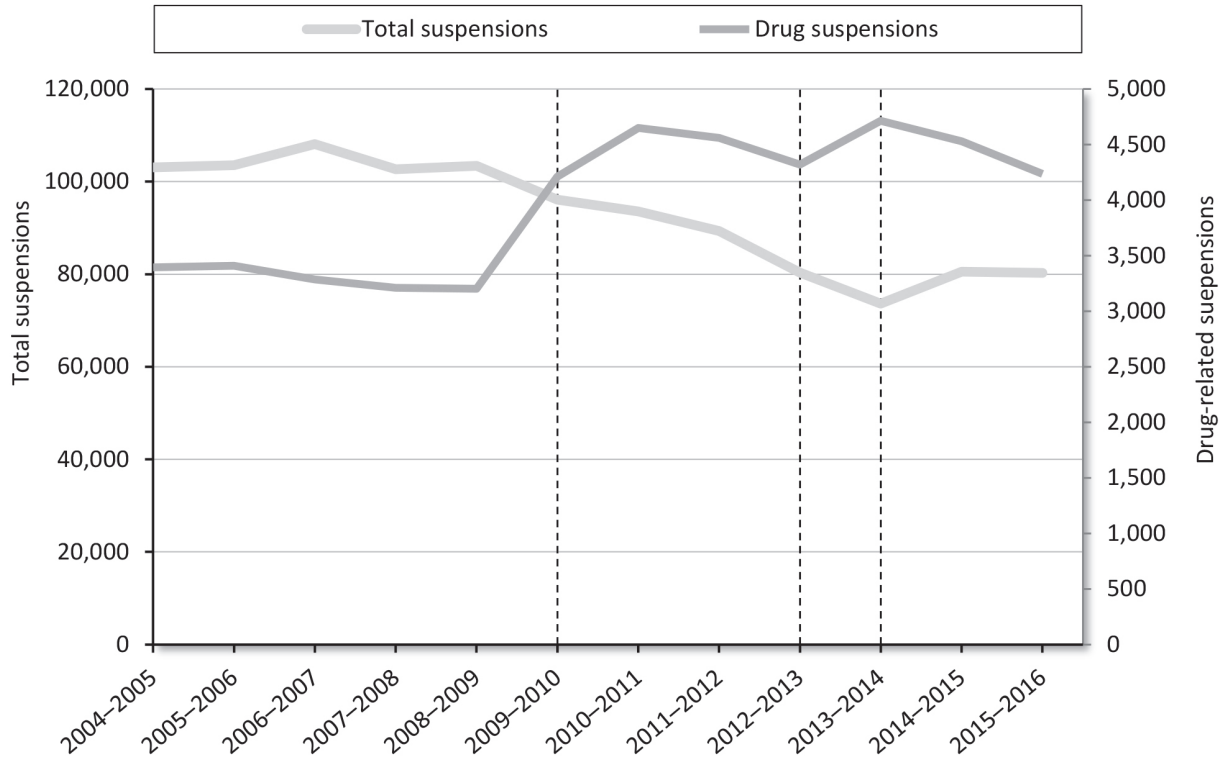
Figure 20 displays the total number of school suspensions and drug-related suspensions in Colorado public high schools during each academic year.[83] Total suspensions trend downward over time, with a slight bump after 2014, but that bump was not one driven by drug-related causes. Drug-related suspensions appear to rise after medical marijuana commercialization in 2009 but stay level after full legalization and the opening of retail shops. Figure 21 shows public high school expulsions, both overall and drug-related. It reveals a parallel bump in drug-related expulsions right after marijuana liberalization in 2009, but expulsions drop steeply thereafter. In fact, by 2014, expulsions drop back to their previous levels.

We also consider potential effects on academic performance. Standardized test scores measuring the reading proficiency of 8th and 10th graders in Washington State show no indication of significant positive or negative changes caused by legalization, as illustrated in Figure 22.[84] Although some studies have found that frequent marijuana use impedes teen cognitive development, our results do not suggest a major change in use, thereby implying no major changes in testing performance.

ECONOMIC OUTCOMES

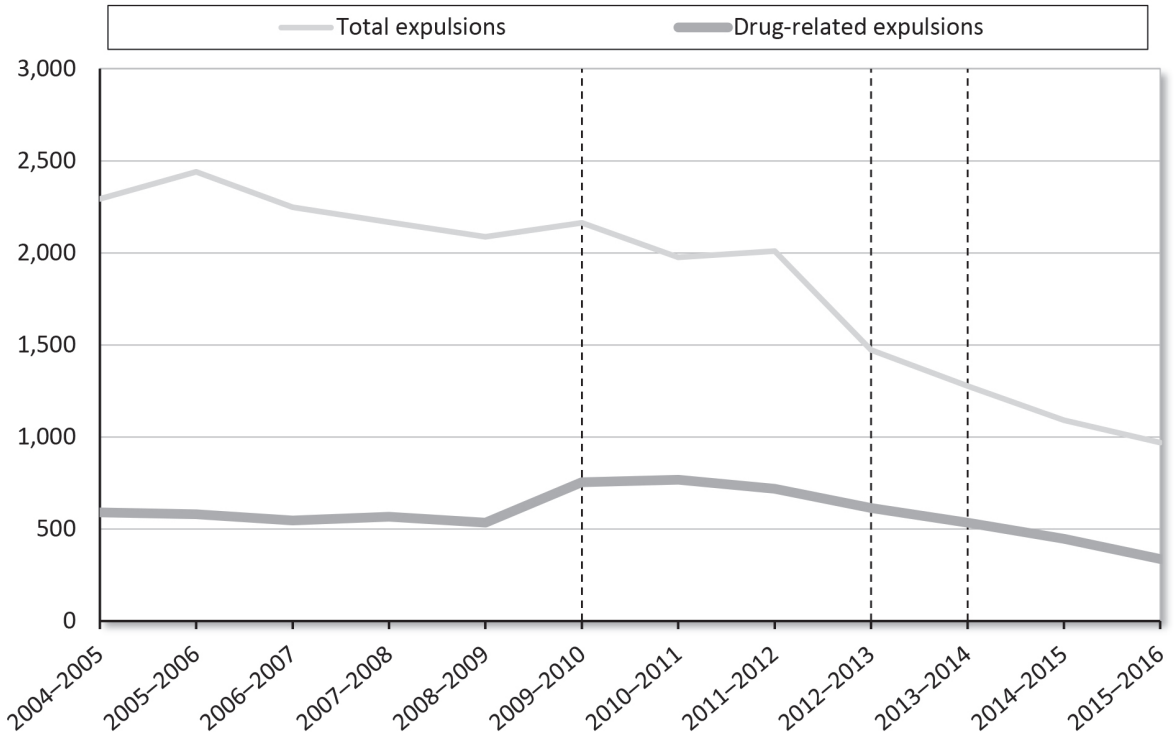
Changing economic and demographic outcomes are unlikely to be significant effects of marijuana legalization, simply because marijuana is a small part of the overall economy. Nevertheless, we consider this outcome for completeness. Before legalization, many advocates thought that legalization could drive a robust influx of residents, particularly young individuals enticed to move across state lines to take ad-

Figure 20
School Suspensions—Colorado



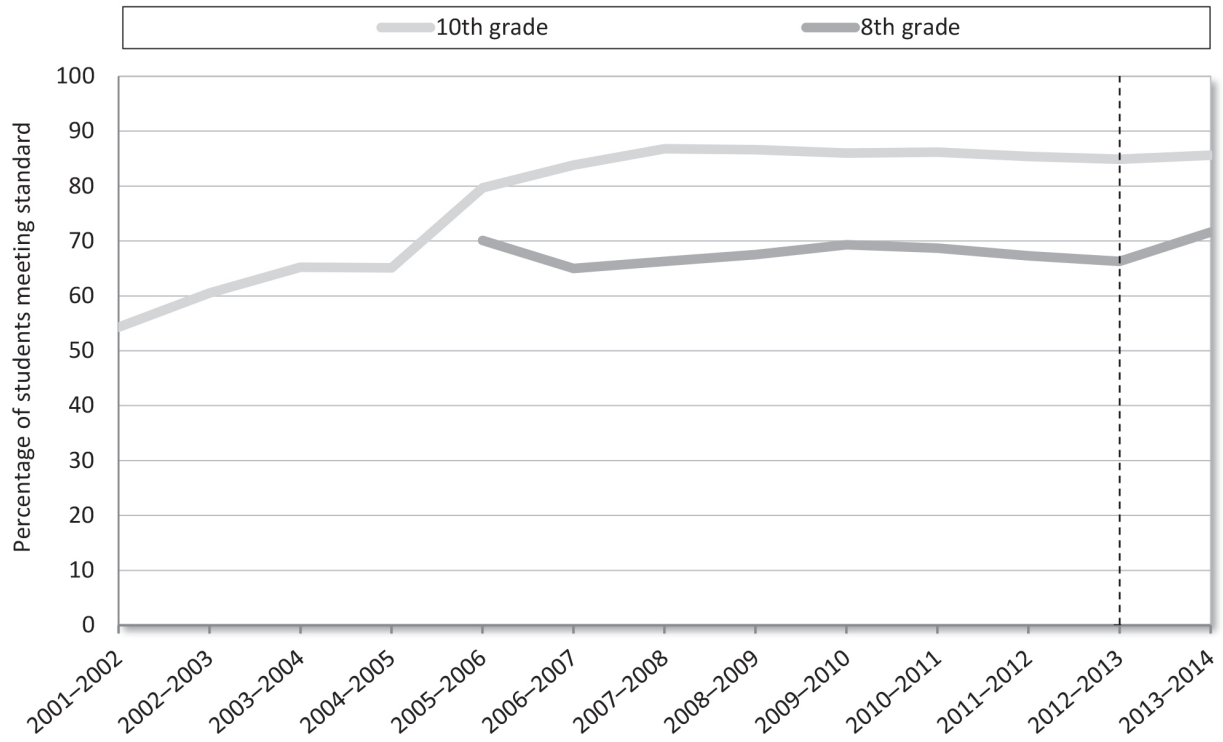
Source: Colorado Department of Education, 10-Year Trend Data, http://www.cde.state.co.us/cdereval/suspend-expelcurrent.

Figure 21
School Expulsions—Colorado



Source: Colorado Department of Education, http://www.cde.state.co.us/cdereval/suspend-expelcurrent.

Figure 22
Washington Standardized Test Scores



Source: Washington State Office of the Superintendent of Public Instruction, http://reportcard.ospi.k12.wa.us/.

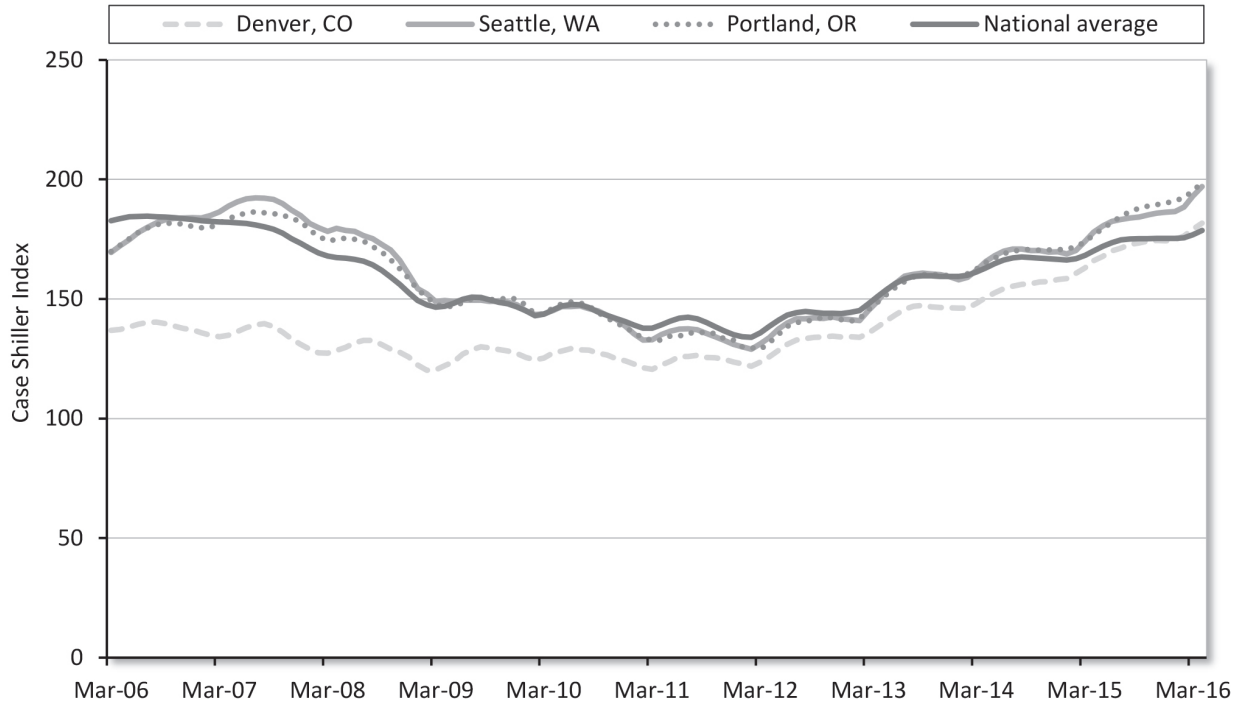
vantage of loose marijuana laws. More recently, various news articles say housing prices in Colorado (particularly around Denver) are soaring at growth rates far above the national average, perhaps as a consequence of marijuana legalization. One analyst went so far as to say that marijuana has essentially "kick-started the recovery of the industrial market in Denver" and led to record-high rent levels.[85]

Figure 23 sheds doubt on these extreme claims by presenting the Case-Shiller Home Price Index for Denver, Seattle, and Portland, along with the national average.[86] Data show that home prices in all three cities have been rising steadily since mid-2011, with no apparent booms after marijuana policy changes. Housing prices in Denver did rise at a robust rate after January 2014, when marijuana shops opened, but this increase was in step with the national average.

Furthermore, marijuana legalization in all four legalizing states had, at most, a trivial effect on population growth.[87] Whereas some people may have moved across states for marijuana purposes, any resulting growth in population has been small and unlikely to cause noticeable increases in housing prices or total economic output.

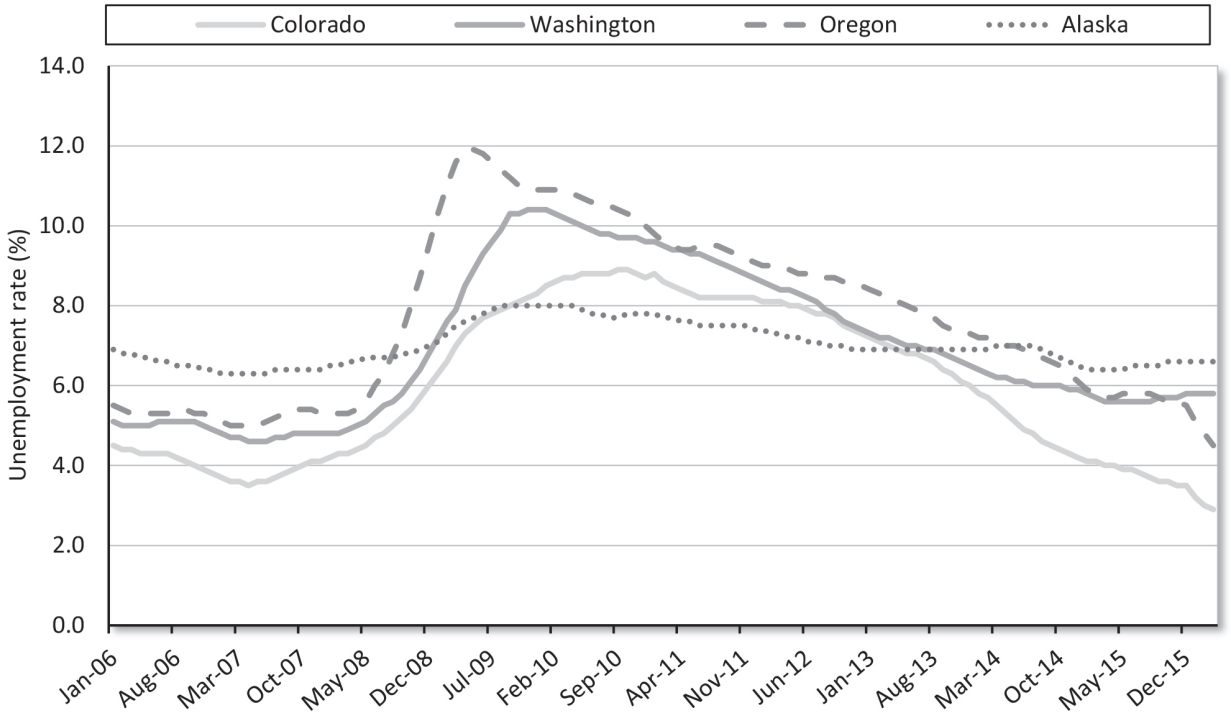
Advocates also argue that legalization boosts economic activity by creating jobs in the marijuana sector, including "marijuana tourism" and other support industries, thereby boosting economic output.[88] Marijuana production and commerce do employ many thousands of people, and Colorado data provide some hint of a measurable effect on employment. As Figure 24 indicates, the seasonally adjusted unemployment rate began to fall more dramatically after the start of 2014, which coincides with the opening of marijuana stores.[89] These gains, however, have yet to be seen in Washington, Oregon, and Alaska. One hypothesis may be that Colorado, as the first state to open retail shops, benefitted from a "first mover advantage." If more states legalize, any employment gains will become spread out more broadly, and marijuana tourism may diminish.

Figure 23
Case Shiller Home Price Index



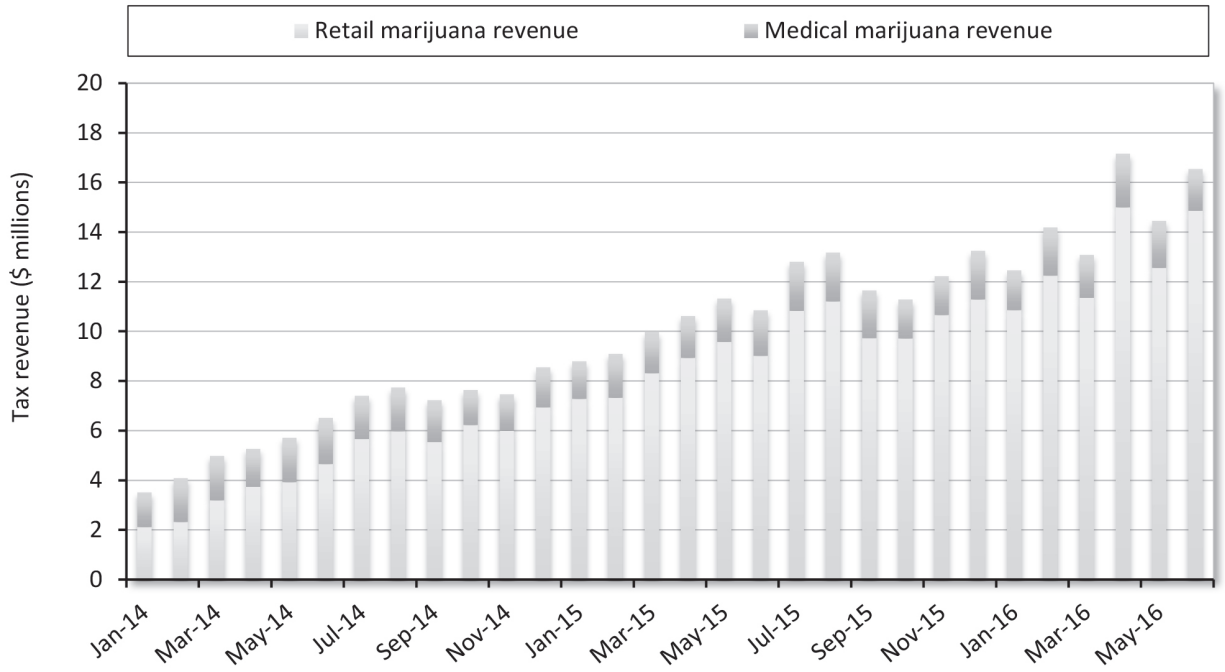
Source: S&P Core Logic Case-Shiller Home Price Indices, http://us.spindices.com/index-family/real-estate/sp-corelogic-case-shiller.

Figure 24
Unemployment Rates



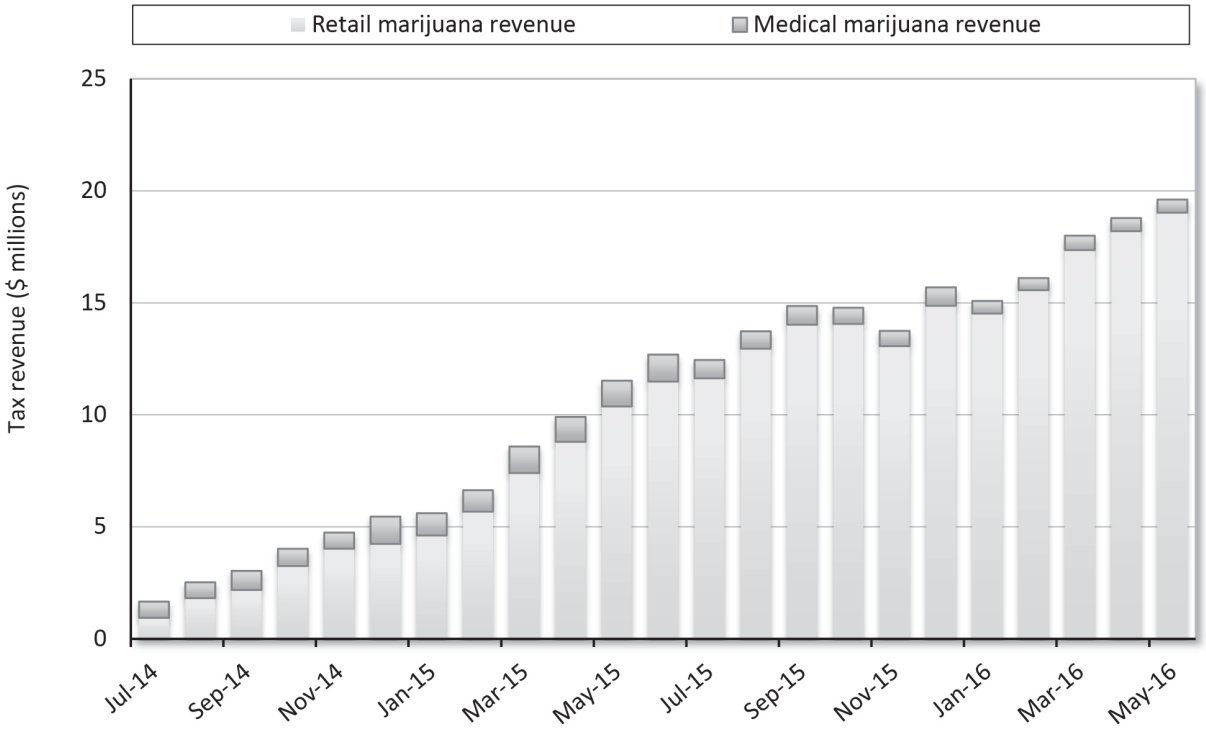
Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, http://www.bls.gov/lau/.
Note: Rates are seasonally adjusted.

Figure 25
Marijuana Tax Revenues—Colorado (all values are nominal)



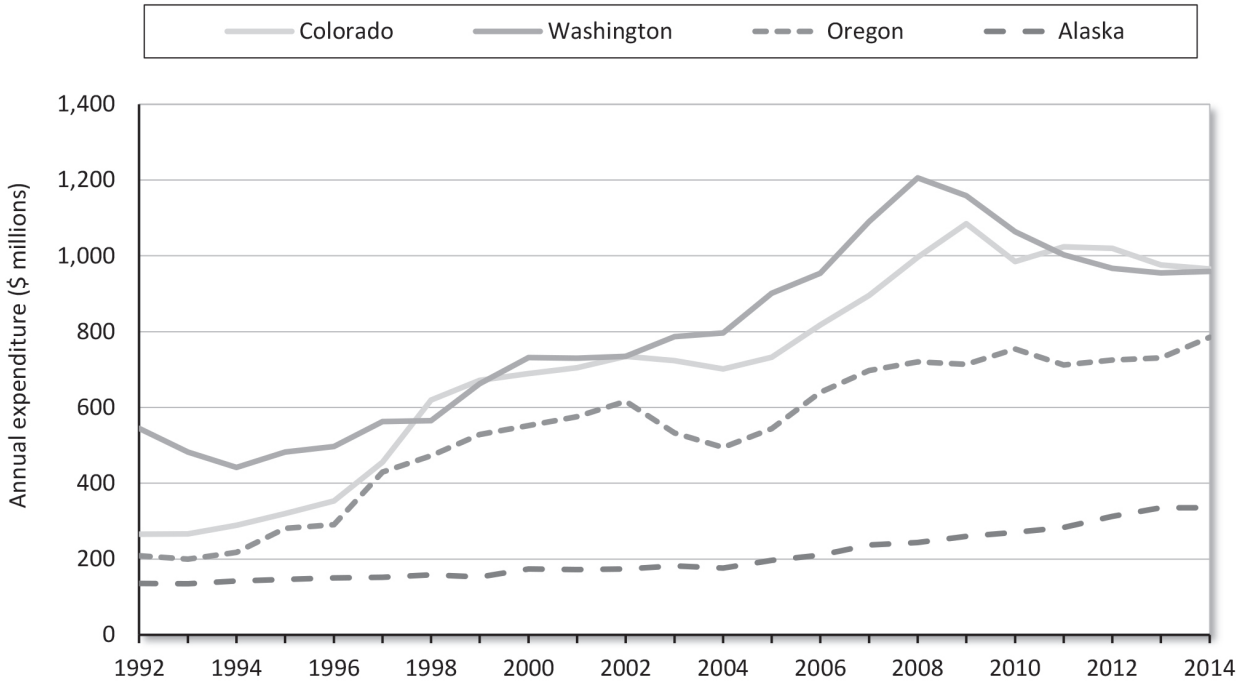
Source: Colorado Department of Revenue, https://www.colorado.gov/pacific/revenue/colorado-marijuana-tax-data.

Figure 26
Marijuana Tax Revenues—Washington (all values are nominal)



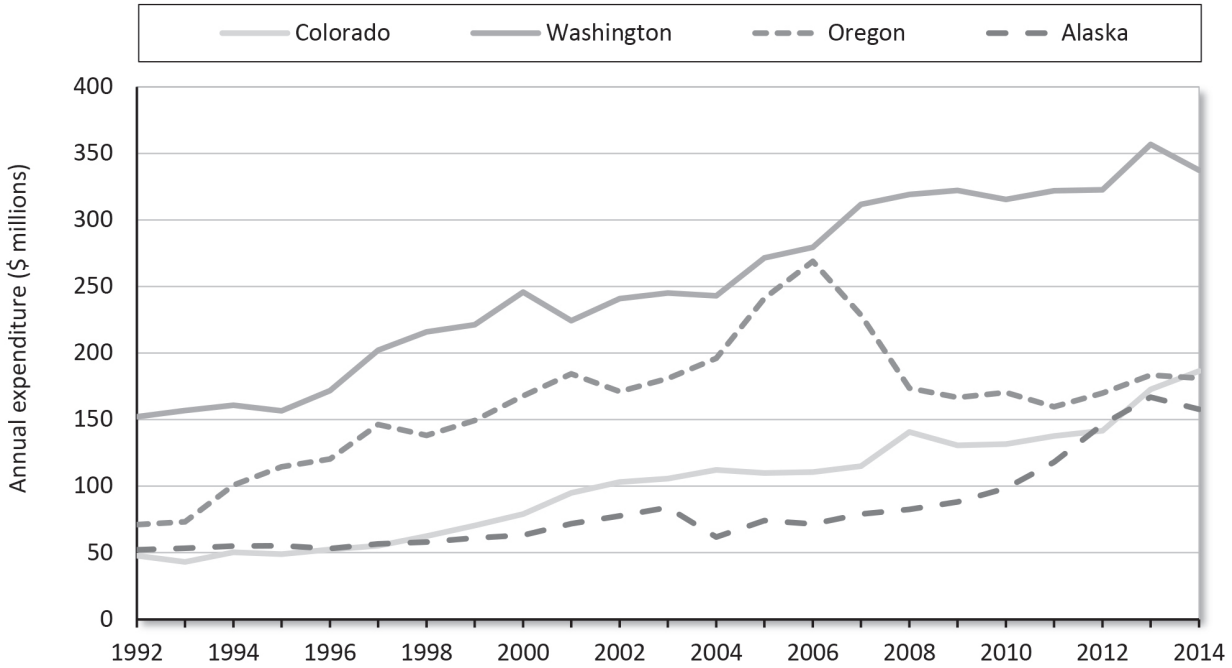
Source: Washington State Department of Revenue, http://dor.wa.gov/Content/AboutUs/StatisticsAndReports/stats_MMJTaxes.aspx; Initiative 502 Data, http://www.502data.com/.

Figure 27
State Correctional Expenditures (all values are nominal)



Source: United States Census Bureau, American FactFinder Database, http://factfinder.census.gov/.

Figure 28
State Police Protection Expenditures (all values are nominal)



Source: United States Census Bureau, American FactFinder Database, http://factfinder.census.gov/.

Data from the Bureau of Economic Analysis show little evidence of significant gross domestic product (GDP) increases after legalization in any state.[90] Although it is hard to disentangle marijuana-related economic activity from broader economic trends, the surges in economic output predicted by some proponents have not yet materialized. Similarly, no clear changes have occurred in GDP per capita.

One area where legal marijuana has reaped unexpectedly large benefits is state tax revenue. Colorado, Washington, and Oregon all impose significant excise taxes on recreational marijuana, along with standard state sales taxes, other local taxes, and licensing fees. As seen in Figure 25, Colorado collects well over $10 million per month from recreational marijuana alone.[91] In 2015 the state generated a total of $135 million in recreational marijuana revenue, $35 million of which was earmarked for school construction projects. These figures are above some pre-legalization forecasts, although revenue growth was disappointingly sluggish during the first few months of sales.[92] A similar story has unfolded in Washington, as illustrated in Figure 26, where recreational marijuana generated approximately $70 million in tax revenue in the first year of sales[93]—double the original revenue forecast.[94] Oregon only began taxing recreational marijuana in January 2016, so data are still preliminary; however, state officials report revenues of $14.9 million so far, well above the initial estimate of $2.0 million to $3.0 million for the entire calendar year.[95] The tax revenues in these states may decline.

Limited post-legalization data prevent us from ruling out small changes in marijuana use or other outcomes. As additional post-legalization data become available, expanding this analysis will continue to inform the debate. The data so far provide little support for the strong claims about legalization made by either opponents or supporters.

"One area where legal marijuana has reaped unexpectedly large benefits is state tax revenue."

NOTES

1. In November 2014, the District of Columbia voted overwhelmingly in favor of Initiative 71, which legalized the use, possession, and cultivation of limited amounts of marijuana in the privacy of one's home. It also permitted adults age 21 and over to "gift"—or transfer—up to two ounces of marijuana provided no payment or other exchange of goods or services occurred. Selling marijuana or consuming it in public, however, remain criminal violations. In addition, because of ongoing federal prohibition, marijuana remains illegal on federal land, which makes up 30 percent of the District. Therefore, we do not examine data for D.C. For more, see http://mpdc.dc.gov/marijuana.

2. In June 2016, the California secretary of state announced that a ballot referendum on marijuana legalization would occur in November, after a state campaign amassed enough signatures to put the question to a vote. Other likely candidates include Arizona, Florida, Maine, Massachusetts, Michigan, Missouri, Nevada, New York, Rhode Island, and Vermont. Organizations and private citizens in additional states have raised the idea of ballot initiatives but have not yet garnered the requisite signatures to hold a vote. See Jackie Salo, "Marijuana Legalization 2016: Which States Will Consider Cannabis This Year," *International Business Times*, December 30, 2015, http://www.ibtimes.com/marijuana-legalization-2016-which-states-will-consider-cannabis-year-2245024.

3. Ethan Nadelmann, for example, has asserted that legalization is a "smart" move that will help end mass incarceration and undermine illicit criminal organizations. See Nadelmann, "Marijuana Legalization: Not If, But When," *HuffingtonPost.com*, November 3, 2010, http://www.huffingtonpost.com/ethannadelmann/marijuana-legalization-no_b_778222.html.

Former New Mexico governor and current Libertarian Party presidential candidate Gary Johnson has also advocated marijuana legalization, predicting that the measure will lead to less overall substance abuse because individuals addicted to alcohol or other substances will find marijuana a safer alternative. See Kelsey Osterman, "Gary Johnson: Legalizing Marijuana Will Lead to Lower Overall Substance Abuse," *RedAlertPolitics.com*, April 24, 2013, http://redalertpolitics.com/2013/04/24/gary-johnson-legalizing-marijuana-will-lead-to-less-overall-substance-abuse/.

Denver Police Chief Robert White argues that violent crime dropped almost 9 percent in 2012. See Sadie Gurman, "Denver's Top Law Enforcement Officials Disagree: Is Crime Up or Down?" *Denver Post*, January 22, 2014, http://www.denverpost.com/2014/01/22/denvers-top-law-enforcement-officers-disagree-is-crime-up-or-down/.

4. Colorado governor John Hickenlooper (D) opposed initial efforts to legalize marijuana because he thought the policy would, among other things, increase the number of children using drugs. See Matt Ferner, "Gov. John Hickenlooper Opposes Legal Weed," *HuffingtonPost.com*, September 12, 2012, http://www.huffingtonpost.com/2012/09/12/gov-john-hickenlooper-opp_n_1879248.html.

Former U.S. attorney general Edwin Meese III, who is now the Heritage Foundation's Ronald Reagan Distinguished Fellow Emeritus, and Charles Stimson have argued that violent crime surges when marijuana is legally abundant and that the economic burden of legalization far outstrips the gain. See Meese and Stimson, "The Case against Legalizing Marijuana in California," Heritage Foundation, October 3, 2010, http://www.heritage.org/research/commentary/2010/10/the-case-against-legalizing-marijuana-in-california.

Kevin Sabet, a former senior White House drug policy adviser in the Obama administration, has called Colorado's marijuana legalization a mistake, warning that potential consequences may include high addiction rates, spikes in traffic accidents, and reductions in IQ. See Sabet, "Colorado Will Show Why Legalizing Marijuana Is a Mistake," *Washington Times*, January 17, 2014, http://www.washingtontimes.com/news/2014/jan/17/sabet-marijuana-legalizations-worst-enemy/.

The former director of the Drug Enforcement Administration, John Walters, claims that "what we [see] in Colorado has the markings of a drug use epidemic." He argues that there is now a thriving black market in marijuana in Colorado and that more research on marijuana's societal effects needs to be completed before legalization should be considered. See Walters, "The Devastation That's Really Happening in Colorado," *Weekly Standard*, July 10, 2014, http://www.weeklystandard.com/the-devastation-thats-really-happening-in-colorado/article/796308.

John Walsh, the U.S. attorney for Colorado, defended the targeted prosecution of medical marijuana dispensaries located near schools by citing figures from the Colorado Department of Education showing dramatic increases in drug-related school suspensions, expulsions, and law enforcement referrals between 2008 and 2011. See John Ingold, "U.S. Attorney John Walsh Justifies Federal Crackdown on Medical-Marijuana Shops," *Denver Post*, January 20, 2012, http://www.denverpost.com/2012/01/19/u-s-attorney-john-walsh-justifies-federal-crackdown-on-medical-marijuana-shops-2/.

Denver District Attorney Mitch Morrissey points to the 9 percent rise in felony cases submitted to his office during the 2008–11 period, after Colorado's marijuana laws had been partially liberalized, as evidence of marijuana's social effects. See Sadie Gurman, "Denver's Top Law Enforcement Officials Disagree: Is Crime Up or Down?" *Denver Post*, January 22, 2014, http://www.denverpost.com/2014/01/22/denvers-top-law-enforcement-officers-disagree-is-crime-up-or-down/.

Other recent news stories that report criticisms of marijuana liberalization include Jack Healy, "After 5 Months of Legal Sale, Colorado Sees the Downside of a Legal High," *New York Times*, May 31, 2014, http://www.nytimes.com/2014/06/01/us/after-5-months-of-sales-colorado-sees-the-downside-of-a-legal-high.html, and Josh Voorhees, "Going to Pot, *Slate.com*, May 21, 2014, http://www.slate.com/articles/news_and_politics/politics/2014/05/colorado_s_pot_experiment_the_unintended_consequences_of_marijuana_legalization.html.

Also, White House policy research indicates that marijuana is the drug most often linked to crime. See Rob Hotakainen, "Marijuana Is Drug Most Often Linked to Crime," McClatchy News Service, May 23, 2013, http://www.mcclatchydc.com/news/politics-government/article24749413.html.

5. MacCoun et al. (2009) review the decriminalization literature from the first wave of decriminalizations in the 1970s, noting a lack of response. See MacCoun et al., "Do Citizens Know Whether Their State Has Decriminalized Marijuana? Assessing the

Perceptual Component of Deterrence Theory." *Review of Law and Economics* 5 (2009): 347–71. Analysis of the recent U.S. state legalizations is more limited.

Some noteworthy studies include Jeffrey Miron, "Marijuana Policy in Colorado," Cato Institute Working Paper no. 24, 2014; Andrew A. Monte et al., "The Implications of Marijuana Legalization in Colorado," *Journal of the American Medical Association* 313, no. 3 (2015): 241–42; Stacy Salomonsen-Sautel et al., "Trends in Fatal Motor Vehicle Crashes Before and After Marijuana Commercialization in Colorado," *Drug and Alcohol Dependence* 140 (2014): 137–44, which found a statistically significant uptick in drivers involved in a fatal motor vehicle crash after commercialization of medical marijuana in Colorado; Beau Kilmer et al., "Altered State?: Assessing How Marijuana Legalization in California Could Influence Marijuana Consumption and Public Budgets," Occasional Paper, Rand Drug Policy Research Center, Santa Monica, CA, 2010; Angela Hawken et al., "Quasi-Legal Cannabis in Colorado and Washington: Local and National Implications," *Addiction* 108, no. 5 (2013): 837–38; and Howard S. Kim et al., "Marijuana Tourism and Emergency Department Visits in Colorado," *New England Journal of Medicine*, 374 (2016): 797–98.

For an analysis of whether Colorado has implemented its legalization in a manner consistent with the law, see John Hudak, "Colorado's Rollout of Legal Marijuana Is Succeeding," Governance Studies Series, Brookings Institution, Washington, D.C., July 31, 2014, http://www.brookings.edu/-/media/research/files/papers/2014/07/colorado-marijuana-legalization-succeeding/cepmmjcov2.pdf. International evidence from Portugal (Glenn Greenwald, "Drug Decriminalization in Portugal," Cato Institute White Paper, 2009, http://object.cato.org/sites/cato.org/files/pubs/pdf/greenwald_whitepaper.pdf), the Netherlands (Robert J. MacCoun, "What can we learn from the Dutch cannabis coffeeshop system," *Addiction* 2011: 1-12 and Ali Palali and Jan C. van Ours, "Distance to Cannabis Shops and Age of Onset of Cannabis Use," *Health Economics* 24, 11 (2015): 1482-1501, parts of Australia (Jenny Williams and Anne Line Bretteville-Jensen, "Does Liberalizing Cannabis Laws Increase Cannabis Use?" *Journal of Health Economics* 36 (2014): 20-32) and parts of London (Nils Braakman and Simon Jones, "Cannabis Depenalization, Drug Consumption and Crime–Evidence from the 2004 Cannabis Declassification in the UK," *Social Science and Medicine* 115(2014): 29-37) suggest little to no effects of these laws on drug use. Jérôme Adda et al., "Crime and the Depenalization of Cannabis Possession: Evidence from a Policing Experiment," *Journal of Political Economy*, 122, no. 5 (2014): 1130-1201 consider depenalization in a London borough, finding declines in crime caused by the police shifting enforcement to non-drug crime.

6. Opium, cocaine, coca leaves, and other derivatives of coca and opium had been essentially outlawed in 1914 by the Harrison Narcotic Act. See C. E. Terry, "The Harrison Anti-Narcotic Act," *American Journal of Public Health* 5, no. 6 (1915): 518, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1286619/?page=1.

7. "When and Why Was Marijuana Outlawed," Schaffer Library of Drug Policy, http://druglibrary.org/schaffer/library/mj_outlawed.htm.

8. Ibid.

9. Mathieu Deflem, ed., *Popular Culture, Crime, and Social Control*, vol. 14, *Sociology of Crime, Law and Deviance* (Bingley, UK: Emerald Group Publishing, 2010), p. 13, https://goo.gl/ioAoVY.

10. Kathleen Ferraiolo, "From Killer Weed to Popular Medicine: The Evolution of Drug Control Policy, 1937–2000," *The Journal of Policy History* 19 (2007): 147–79, https://muse.jhu.edu/article/ 217587.

11. David Musto, "Opium, Cocaine and Marijuana in American History," *Scientific American* 20-27 (July 1991), http://www.ncbi.nlm.nih.gov/pubmed/1882226.

12. United Nations Office on Drugs and Crime, "Traffic in Narcotics, Barbiturates and Amphetamines in the United States," https://www.unodc.org/unodc/en/data-and-analysis/bulletin/bulletin_1956-01-01_3_page005.html.

13. "Drug Schedules," U.S. Drug Enforcement

Administration, https://www.dea.gov/druginfo/ds.shtml.

14. The 11 states were Oregon (1973), Alaska (1975), California (1975), Colorado (1975), Maine (1975), Minnesota (1976), Ohio (1976), Mississippi (1977), New York (1977), North Carolina (1977), and Nevada (1978). See Rosalie Pacula et al., "Marijuana Decriminalization: What Does It Mean for the United States?" (National Bureau of Economic Research Working Paper no. 9690, NBER and RAND Corporation, Cambridge, MA, January 2004), http://www.rand.org/content/dam/rand/pubs/working_papers/2004/RAND_WR126.pdf.

15. Not all states followed such a straightforward path towards marijuana liberalization. Alaska, for example, decriminalized marijuana use and possession in one's home in 1975. In 1990, however, a voter initiative recriminalized possession and use of marijuana. See the section on Alaska for more details.

16. "States That Have Decriminalized," National Organization for the Reform of Marijuana Laws, http://norml.org/aboutmarijuana/item/states-that-have-decriminalized.

17. "The Legalization of Marijuana in Colorado: The Impact. A Preliminary Report," *Rocky Mountain HIDTA* 1 (August 2013): 3, http://www.rmhidta.org/html/final%20legalization%200f%20mj%20in%20colorado%20the%20impact.pdf.

18. David Ogden, the deputy attorney general at the time, issued a memorandum stating it would be unwise to "focus federal resources . . . on individuals whose actions are in clear and unambiguous compliance with existing state law providing for the medical use of marijuana." See "Memorandum for Selected United State Attorneys on Investigations and Prosecutions in States Authorizing the Medical Use of Marijuana," U.S. Department of Justice, October 19, 2009. https://www.justice.gov/opa/blog/memorandum-selected-united-state-attorneys-investigations-and-prosecutions-states.

19. The Ogden Memorandum did not permanently resolve confusion about the role of federal law in state marijuana policy. In 2011, the Department of Justice issued another memo entitled the "Cole Memo" which somewhat backpedaled on the Ogden Memo's position; it cautioned that "the Ogden Memorandum was never intended to shield such activities from federal enforcement action and prosecution, even where those activities purport to comply with state law." It was not until 2013 when those in the marijuana industry received a clear answer. A third memo unambiguously outlined the eight scenarios in which federal authorities would enforce marijuana laws in states where the substance was legal. Beyond those eight priorities, the federal government would leave marijuana law enforcement to local authorities. For more, see "Guidance Regarding the Ogden Memo in Jurisdictions Seeking to Authorize Marijuana for Medical Use," U.S. Department of Justice, June 29, 2011, https://www.justice.gov/sites/default/files/oip/legacy/2014/07/23/dag-guidance-2011-for-medical-marijuana-use.pdf. See also "Guidance Regarding Marijuana Enforcement," U.S. Department of Justice, August 29, 2013, https://www.justice.gov/iso/opa/resources/30520 138291327568574 67.pdf.

20. "The Legalization of Marijuana in Colorado: The Impact. A Preliminary Report," *Rocky Mountain HIDTA* 1 (August 2013): 4, http://www.rmhidta.org/html/final%20legalization%200f%20mj%20in%20colorado%20the%20impact.pdf.

21. "Amendment 64: Use and Regulation of Marijuana," City of Fort Collins, Colorado, http://www.fcgov.com/mmj/pdf/amendment64.pdf.

22. Ibid.

23. Numerous counties, including Denver County and others, have enacted local taxes on top of state taxes. In Denver, retail marijuana products are subject to a local sales tax of 3.65 percent in addition to a special marijuana tax of 3.5 percent. See "City and County of Denver, Colorado: Tax Guide, Topic No. 95," City of Denver (revised April 2015), https://www.denvergov.org/Portals/571/documents/TaxGuide/Marijuana-Medical_and_Retail.pdf.

24. This system of three separate taxes was eventu-

ally replaced by a single, 37 percent excise tax levied at the retail point of sale in July 2015. See "FAQs on Taxes," Washington State Liquor and Cannabis Board, http://www.liq.wa.gov/mj2015/faqs-on-taxes. See also Rachel La Corte, "Washington State Pot Law Overhaul: Marijuana Tax Reset at 37 Percent," Associated Press, *The Cannabist*, July 1, 2015, http://www.thecannabist.co/2015/07/01/washington-state-pot-law-overhaul-marijuana-tax-reset-at-37-percent/37238/.

25. "State by State Laws: Oregon," National Organization for the Reform of Marijuana Laws, 2006, http://norml.org/laws/item/oregon-penalties-2.

26. See "Oregon Legislature Ends 24 Years of Marijuana Decriminalization," National Organization for the Reform of Marijuana Laws, news release, July 3, 1997, http://norml.org/news/1997/07/03/oregon-legislature-ends-24-years-of-marijuana-decrimnalization/. See also "State by State Laws: Oregon," National Organization for the Reform of Marijuana Laws, 2006.

27. "Medical Marijuana Rules and Statutes: Oregon Medical Marijuana Act," Oregon Health Authority, June 2016, http://public.health.oregon.gov/DiseasesConditions/ChronicDisease/MedicalMarijuanaProgram/Pages/legal.aspx#ors.

28. "Oregon Medical Marijuana Allowance Measure 33 (2004)," *Ballotpedia*, https://ballotpedia.org/Oregon_Medical_Marijuana_Allowance_Measure_33_(2004).

29. "Oregon Medical Marijuana Program Statistics," Oregon Health Authority, July 2016, https://public.health.oregon.gov/diseasesconditions/chronicdisease/medicalmarijuanaprogram/pages/data.aspx.

30. "Oregon Marijuana Legalization for Personal Use, Ballot Measure 5 (1986)," *Ballotpedia*, https://ballotpedia.org/Oregon_Marijuana_Legalization_for_Personal_Use,_Ballot_Measure_5_(1986).

31. "Oregon Cannabis Tax Act Initiative, Measure 80 (2012)," *Ballotpedia*, https://ballotpedia.org/Oregon_Cannabis_Tax_Act_Initiative,_Measure_80_(2012).

32. "Measure 91," Oregon Liquor Control Commission, https://www.oregon.gov/olcc/marijuana/Documents/Measure91.pdf.

33. Several counties in Oregon have enacted their own local taxes.

34. As of June 2016, 87 municipalities and 19 counties in Oregon had prohibited recreational marijuana businesses or producers in their jurisdiction. See "Record of Cities/Counties Prohibiting Licensed Recreational Marijuana Facilities," Oregon Liquor Control Commission, https://www.oregon.gov/olcc/marijuana/Documents/Cities_Counties_RMJOptOut.pdf.

35. "Medical Marijuana Dispensary Directory," Oregon Health Authority http://www.oregon.gov/oha/mmj/Pages/directory.aspx.

36. *Ravin v. State*, 537 F.2d 494 (Alaska 1975).

37. "Alaska Marijuana Criminalization Initiative, Measure 2 (1990)," *Ballotpedia*, https://ballotpedia.org/Alaska_Marijuana_Criminalization_Initiative_Measure_2_(1990).

38. "Ballot Measure 8: Bill Allowing Medical Use of Marijuana," Alaska Division of Elections, http://www.elections.alaska.gov/doc/oep/1998/98bal8.htm.

39. Recent work includes the following: D. Mark Anderson et al., "Medical Marijuana Laws and Suicides by Gender and Age," *American Journal of Public Health* 104, no. 1 (December 2014): 2369–76; D. Mark Anderson et al., "Medical Marijuana Laws and Teen Marijuana Use," *American Law and Economic Review* 17, no. 2 (2015): 495–528; Choo, Esther K et al., "The Impact of State Medical Marijuana Legislation on Adolescent Marijuana Use," *Journal of Adolescent Health*, forthcoming.

Yu-Wei Luke Chu, "Do Medical Marijuana Laws Increase Hard-Drug Use?" *Journal of Law and Economics* 58, no. 2 (May 2015): 481–517; Gorman, Dennis M. and J. Charles Huber, Jr. "Do Medical Cannabis

Laws Encourage Cannabis Use?" *The International Journal of Drug Policy*, 18, no. 3 (Ma7 2007): 160–67; S. Harper et al., "Do Medical Marijuana Laws Increase Marijuana Use? Replication Study and Extension," *Annals of Epidemiology* 22(2012): 207-212; Sarah D. Lynne-Landsman et al., "Effects of State Medical Marijuana Laws on Adolescent Marijuana Use," *American Journal of Public Health*, 103(2013): 1500-1506; Karen O'Keefe and Mitch Earleywine, "Marijuana Use by Young People: The Impact of State Medical Marijuana Laws," manuscript, Marijuana Policy Project (2011) and Hefei Wen et al., "The Effect of Medical Marijuana Laws on Marijuana, Alcohol, and Hard Drug Use," NBER Working Paper no. 20085, National Bureau of Economic Research, Cambridge, MA, 2014, which found that medical marijuana laws led to a relatively small increase in marijuana use by adults over age 21 and did nothing to change use of hard drugs.

Rosalie Liccardo Pacula et al., "Assessing the Effects of Medical Marijuana Laws on Marijuana and Alcohol Use: The Devil Is in the Details," NBER Working Paper no. 19302, National Bureau of Economic Research, Cambridge, MA, 2015, found that legalizing home cultivation and medical marijuana dispensaries were associated with higher marijuana use, while other aspects of medical marijuana liberalization were not.

Choo et al., "The Impact of State Medical Marijuana Legislation on Adolescent Marijuana Use," *Journal of Adolescent Health* 55, no. 2 (2014): 160–66, found no statistically significant differences in adolescent marijuana use after state-level medical marijuana legalization.

40. Data are reported as two-year averages. Data are from "National Survey on Drug Use and Health 2002–2014," Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, http://www.icpsr.umich.edu/icpsrweb/content/SAMHDA/help/nsduh-estimates.html.

41. No post-legalization data were available for Alaska.

42. State-level data from "National Survey on Drug Use and Health, 2002–2014," Center for Behavioral Health Statistics and Quality.

43. Dale H. Gieringer, director, California NORML, "Testimony on the Legalization of Marijuana," Testimony before the California Assembly Committee on Public Safety, October 28, 2009, http://norml.org/pdf_files/AssPubSafety_Legalization.pdf.

44. Rand Corporation, "Legalizing Marijuana in California Would Sharply Lower the Price of the Drug," news release, July 7, 2007, http://www.rand.org/news/press/2010/07/07.html.

45. These analyses consider legalization at both the federal and state levels which would allow additional avenues for lower prices such as economies of scale, although also additional avenues for higher prices because of federal taxation and advertising.

46. The website Price of Weed allows anyone to submit anonymous data about the price, quantity, and quality of marijuana he or she purchases, as well as where the marijuana was purchased. Founded in 2010, the website has logged hundreds of thousands of entries across the country, and many analysts and journalists look to it as a source of marijuana price data. It has obvious limitations: the data are not a random sample; the consumer reports do not distinguish between marijuana bought through legal means and through the black market; self-reported data may not be accurate; and the data are probably from a self-selecting crowd of marijuana enthusiasts. Nevertheless, Price of Weed provides large samples of real-time data. To reduce the impact of inaccurate submissions, the website automatically removes the bottom and top 5 percent of outliers when calculating its average prices. We were not able to calculate meaningful marijuana price averages from Alaska because of a relatively low number of entries from that state.

47. One further trend we observe in all three states is a widening price gap between high-quality and medium-quality marijuana. Among other things, this gap may be the result of fewer information asymmetries in the marijuana market. On the black market, it can be hard to know the true

quality of a product. Marijuana trade is complex, with hundreds of different strains and varieties. Yet in the black market, consumers often have a difficult time differentiating between them and may end up paying similarly high prices for medium- and high-quality marijuana. In all three states, the gap between the prices rose after legalization, suggesting that consumers have had an easier time distinguishing between different qualities and strains of marijuana.

48. Anderson, Rees, and Sabia, "Medical Marijuana Laws and Suicides by Gender and Age."

49. D. Mark Anderson et al., "High on Life?: Medical Marijuana and Suicide," Cato Institute Research Briefs in Economic Policy, no. 17, January 2015, http://www.southerncannabis.org/wp-content/uploads/2015/01/marijuana-suicide-study.pdf.

David Powell et al., "Do Medical Marijuana Laws Reduce Addictions and Deaths Related to Pain Killers?" NBER Working Paper no. 21345, National Bureau of Economic Research, Cambridge, MA, July 2015.

50. See, for example, Zammit et al., "Self-reported Cannabis Use as a Risk Factor for Schizophrenia in Swedish Conscripts of 1969," *British Medical Journal* 325 (2002); Henquet et al., "Prospective Cohort Study of Cannabis Use, Predisposition for Psychosis, and Psychotic Symptoms in Young People," *British Medical Journal* (December 2004); Goldberg, "Studies Link Psychosis, Teenage Marijuana Use," *Boston Globe*, January 26, 2006; Shulman, "Marijuana Linked to Heart Disease and Depression," *U.S. News*, May 14, 2008.

See also Jan C. van Ours et al., "Cannabis Use and Suicidal Ideation," *Journal of Health Economics* 32, no. 3 (2013): 524–37; Jan C. van Ours and Jenny Williams, "The Effects of Cannabis Use on Physical and Mental Health," *Journal of Health Economics* 31, no. 4 (July 2012): 564–77; Jan C. van Ours and Jenny Williams, "Cannabis Use and Mental Health Problems," *Journal of Applied Econometrics* 26, no. 7 (November 2011): 1137–56; and Jenny Williams and Christopher L. Skeels, "The Impact of Cannabis Use on Health," *De Economist* 154, no. 4 (December 2006): 517–46.

51. National Institute on Drug Abuse, "What Are Marijuana's Long-Term Impacts on the Brain?" Research Report Series, March 2016, https://www.drugabuse.gov/publications/research-reports/marijuana/how-does-marijuana-use-affect-your-brain-body. Kelly and Rasul evaluate the depenalization of marijuana in a London borough and find large increases in hospital admissions related to hard drug use, particularly among younger men. See Elaine Kelly and Imran Rasul, "Policing Cannabis and Drug Related Hospital Admissions: Evidence from Administrative Records," *Journal of Public Economics* 112 (April 2014): 89–114.

52. "Detailed Mortality Statistics," Centers for Disease Control and Prevention, WONDER Online Databases, http://wonder.cdc.gov/.

53. Ibid.

54. The link between medical marijuana and lower suicide rates may stem partly from the fact that medical marijuana can substitute for other, more dangerous painkillers and opiates. Research by Anne Case and Angus Deaton found suicides and drug poisonings led to a marked increase in mortality rates of middle-aged white non-Hispanic men and women in the United States between 1999 and 2013. Other studies have linked opioid and painkiller overdoses to a recent surge in self-inflicted drug-related deaths and suicides. Medical marijuana, as a less risky pain reliever, may thus help lessen the rate of drug deaths and suicides. For more, see Case and Deaton, "Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century," *National Academy of Sciences* 112, no. 49 (November 2015), http://www.pnas.org/content/112/49/15078.

55. Kevin Wong and Chelsey Clarke, *The Legalization of Marijuana in Colorado: The Impact* Vol. 3 (Denver: Rocky Mountain High Intensity Drug Trafficking Area, September 2015), http://www.rmhidta.org/html/2015%20final%20legalization%20of%20marijuana%20in%20colorado%20the%20impact.pdf.

56. Caleb Banta-Green et al., "Drug Abuse

Trends in the Seattle-King Country Area: 2014," Report, University of Washington Alcohol and Drug Abuse Institute, Seattle, June 17, 2015, http://adai.washington.edu/pubs/cewg/Drug%20Trends_2014_final.pdf.

57. David Musto, "Opium, Cocaine and Marijuana in American History," *Scientific American*, no. 1 (July 1991): 40–47, http://www.ncbi.nlm.nih.gov/pubmed/1882226.

58. U.S. Drug Enforcement Administration, "The Dangers and Consequences of Marijuana Abuse," U.S. Department of Justice, Washington, May 2014, p. 24, https://www.dea.gov/docs/dangers-consequences-marijuana-abuse.pdf.

59. For example, Sheriff David Weaver of Douglas County, Colorado, warned in 2012, "Expect more crime, more kids using marijuana, and pot for sale everywhere." See Matt Ferner, "If Legalizing Marijuana Was Supposed to Cause More Crime, It's Not Doing a Very Good Job," *The Huffington Post*, July 17, 2014, http://www.huffingtonpost.com/2014/07/17/marijuana-crime-denver_n_5595742.html.

60. Jeffrey Miron, "Marijuana Policy in Colorado," Cato Institute Working Paper, October 23, 2014, http://object.cato.org/sites/cato.org/files/pubs/pdf/working-paper-24_2.pdf.

61. "Marijuana Is Safer Than Alcohol: It's Time to Treat It That Way," Marijuana Policy Project, Washington, https://www.mpp.org/marijuana-is-safer/. See also Peter Hoaken and Sherry Stewart, "Drugs of Abuse and the Elicitation of Human Aggressive Behavior," *Addictive Behaviors* 28: (2003): 1533–54, http://www.ukcia.org/research/AgressiveBehavior.pdf.

62. Denver Police Department, Uniform Crime Reporting Program, "Monthly Citywide Data—National Incident-Based Reporting System," http://www.denvergov.org/police/PoliceDepartment/CrimeInformation/CrimeStatisticsMaps/tabid/441370/Default.aspx.

63. Fort Collins crime data yield similar factual conclusions, showing no consistent rise in crime following either the November 2012 legalization or the January 2014 opening of stores.

64. "Crime Dashboard," Seattle Police Department, http://www.seattle.gov/seattle-police-department/crime-data/crime-dashboard.

65. Sierra Rayne, "Seattle's Post-Marijuana Legalization Crime Wave," *American Thinker*, November 13, 2015, http://www.americanthinker.com/blog/2015/11/seattles_postmarijuana_legalization_crime_wave.html.

66. Elsewhere in Washington State, this conclusion seems equally robust. Tacoma, a large city in northeastern Washington where stores have opened, has generally seen stable crime trends before and after legalization. Total monthly offenses, violent crime, and property crime have shown no significant deviation from their recent trends. See Kellie Lapczynski, "Tacoma Monthly Crime Data," Washington Association of Sheriffs and Police Chiefs, 2015, p377–78, http://www.waspc.org/assets/CJIS/crime%20in%20washington%202015.small.pdf.

67. "City of Portland—Neighborhood Crime Statistics," Portland Police Bureau, http://www.portlandonline.com/police/crimestats/.

68. In Salem, Oregon, violent crime, property crime, and drug offenses show no significant jumps post-legalization. Although Salem is farther from the border with Washington, there are no indications of major spillover effects between 2012 and 2014. See Linda Weber, "Monthly Crime Statistics," Salem Police Department, 2015, http://www.cityofsalem.net/Departments/Police/HowDoI2/Pages/CrimeStatistics.aspx. Alaska is not covered in this section because reliable recent crime data for major Alaskan cities were unavailable at the time of writing.

69. For a review of this issues, see Rune Elvik, "Risk of Road Accident Associated with the Use of Drugs: A Systematic Review and Meta-Analysis of Evidence from Epidemiological Studies," *Accident Analysis and Prevention* 60 (2013): 254–67,

doi:10.1016/j.aap.2012.06.017, http://www.ncbi.nlm.nih.gov/pubmed/22785089.

70. Academic studies examining this issue have suggested a possible substitution effect. A 2015 report by the Governors Highway Safety Organization cited one study revealing that marijuana-positive fatalities rose by 4 percent after legalization in Colorado. However, another study from the same report discovered no change in total traffic fatalities in California after its decriminalization of the drug in 2011. See also Andrew Sewell et al., "The Effect of Cannabis Compared with Alcohol on Driving," *American Journal on Addictions* 18, no. 3 (2009): 185–93, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2722956/.

71. Kevin A. Sabet, "Colorado Will Show Why Legalizing Marijuana Is a Mistake," *Washington Times*, January 17, 2014, http://www.washingtontimes.com/news/2014/jan/17/sabet-marijuana-legalizations-worst-enemy/.

72. Associated Press, "Fatal Crashes Involving Marijuana Doubled in Washington after Legalization," *The Oregonian*, August 20, 2015, http://www.oregonlive.com/marijuana/index.ssf/2015/08/fatal_crashes_involving_mariju.html.

73. Noelle Phillips and Elizabeth Hernandez, "Colorado Still Not Sure Whether Legal Marijuana Made Roads Less Safe," *Denver Post,* December 29, 2015, http://www.denverpost.com/2015/12/29/colorado-still-not-sure-whether-legal-marijuana-made-roads-less-safe/.

74. Radley Balko, "Since Marijuana Legalization, Highway Fatalities in Colorado Are at Near-Historic Lows," *Washington Post*, August 5, 2014, https://www.washingtonpost.com/news/the-watch/wp/2014/08/05/since-marijuana-legalization-highway-fatalities-in-colorado-are-at-near-historic-lows/.

75. These data include any kinds of crashes on all types of roads, as recorded by each state's department of transportation. See Colorado Department of Transportation's "Fatal Accident Statistics by City and County," http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/safety-crash-data/fatal-crash-data-city-county/fatal-crashes-by-city-and-county.

76. Annual crash data from the National Highway Traffic Safety Administration (NHTSA) confirm these findings. Our analysis uses state-level traffic accident data from individual state transportation departments because their data are mostly reported monthly and have a shorter reporting time lag than NHTSA data. For NHTSA data, see "State Traffic Safety Information," NHTSA, http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/8_CO/2014/8_CO_2014.htm.

77. We additionally analyzed fatality rates for accidents involving alcohol impairment. Similarly, this time series shows no clear signs of significant swings after marijuana policy changes, suggesting that any substitution effect associated with marijuana has been small compared to overall drunk driving.

78. Washington Traffic Safety Commission, 2015, http://wtsc.wa.gov/research-data/crash-data/.

79. Washington State police routinely test drivers involved in car crashes for traces of various substances. The official legalization of marijuana use at the end of 2012 appears to have had at most a negligible effect on crash fatalities. The Washington Traffic Safety Commission recorded a total of 62 marijuana-related crash fatalities in 2013, compared to 61 in 2012. There does seem to be a temporary increase in fatalities caused by marijuana-related crashes around the same time as the establishment of Washington's first marijuana shops. Nevertheless, any sort of spike seems to have been temporary. In the first six months following the opening of stores, 46 crash fatalities were tied to using marijuana while driving; over the following six months, that number dropped to 32.

80. Monthly data on fatal crashes themselves were not available. Monthly 2015 data were also not available at the time of writing.

81. For instance, Meier et al. analyze a large sample of individuals tracked from birth to age 38 and find

that those who smoked marijuana most heavily prior to age 18 lost an average of eight IQ points, a highly significant drop. See Madeline Meier et al., "Persistent Cannabis Users Show Neuropsychological Decline from Childhood to Midlife," *Proceedings of the National Academy of Sciences* 109, no. 40 (2012): E2657–E2664, http://www.ncbi.nlm.nih.gov/pubmed/22927402.

However, other studies have found results that rebut Meier et al. Mokrysz et al. examine an even larger sample of adolescents and, after controlling for many potentially confounding variables, discover no significant correlation between teen marijuana use and IQ change. See Claire Mokrysz et al., "Are IQ and Educational Outcomes in Teenagers Related to Their Cannabis Use? A Prospective Cohort Study," *Journal of Psychopharmacology* 30, no. 2 (2016): 159–68, http://jop.sagepub.com/content/30/2/159.

82. Cobb-Clark et al. show that much of relationship between marijuana use and educational outcomes is likely due to selection, although there is possibly some causal effect in reducing university entrance scores. See Deborah A. Cobb-Clark et al., "'High'-School: The Relationship between Early Marijuana Use and Educational Outcomes," *Economic Record* 91, no. 293 (June 2015): 247–66.

Evidence in McCaffrey et al. supports this selection explanation of the association between marijuana use and educational outcomes. See Daniel F. McCaffrey et al., "Marijuana Use and High School Dropout: The Influence of Unobservables," *Health Economics* 19, no. 11 (November 2010): 1281–99.

Roebuck et al. suggest that chronic marijuana use, not more casual use, likely drives any relationship between marijuana use and school attendance. See M. Christopher Roebuck et al., "Adolescent Marijuana Use and School Attendance," *Economics of Education Review* 23, no. 2 (2004), 133–41.

Marie and Zölitz estimate grade improvements are likely due to improved cognitive functioning among students whose nationalities prohibited them from consuming marijuana. See Olivier Marie and Ulf Zölitz, "'High' Achievers? Cannabis Access and Academic Performance," CESifo Working Paper Series no. 5304, Center for Economic Studies and Ifo Institute, Munich, 2015.

Van Ours and Williams review the literature concluding that cannabis may reduce educational outcomes, particularly with early onset of use. See Jan van Ours and Jenny Williams, "Cannabis Use and Its Effects on Health, Education and Labor Market Success," *Journal of Economic* Surveys, 29, no. 5 (December 2015): 993–1010.

For additional evidence on likely negative effects of early onset of use see also Paolo Rungo et al., "Parental Education, child's grade repetition, and the modifier effect of cannabis use," *Applied Economics Letters* 22(3)(2015): 199-203; Jan C. van Ours and Jenny Williams, "Why Parents Worry: Initiation into Cannabis Use by Youth and Their Educational Attainment," *Journal of Health Economics* 28, no. 1 (2009): 132–42; and Pinka Chatterji, "Illicit Drug Use and Educational Attainment," *Health Economics* 15, no. 5 (2006): 489–511.

83. "Suspension/Expulsion Statistics," Colorado Department of Education, 2015, http://www.cde.state.co.us/cdereval/suspend-expelcurrent.

84. "Washington State Report Card, 2013–14 Results," Washington State Office of the Superintendent of Public Instruction, http://reportcard.ospi.k12.wa.us/summary.aspx?groupLevel=District&schoolId=1&reportLevel=State&year=2013-14&yrs=2013-14.

85. Sarah Berger, "Colorado's Marijuana Industry Has a Big Impact on Denver Real Estate: Report," *International Business Times*, October 20, 2015, http://www.ibtimes.com/colorados-marijuana-industry-has-big-impact-denver-real-estate-report-2149623.

86. "S&P/Case-Schiller Denver Home Price Index," S&P Dow Jones Indices, http://us.spindices.com/indices/real-estate/sp-case-shiller-co-denver-home-price-index/.

87. U.S. Department of Commerce, Bureau of Economic Analysis, http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri =1&acrdn=1#reqid=70&step=30&isuri=1&7022=36&7023=0&7024=non-indust3000&7027=1&7001=336&7028=-&7031=0&7040=-083=levels&7029=36&7090=70.

88. As an example, Oregon state legislator Ann Lininger wrote an op-ed predicting a "jobs boom" in southern Oregon after marijuana legalization. See Lininger, "Marijuana: Will Legalization Create an Economic Boom?" *The Huffington Post.* October 1, 2015. http://www.huffingtonpost.com/ann lininger/marijuana-will-legalizati_b_8224712.html.

89. "Local Area Unemployment Statistics," Bureau of Labor Statistics, http://www.bls.gov/lau/.

90. U.S. Department of Commerce, Bureau of Economic Analysis, http://www.bea.gov/iTable/iTa blecfm?reqid=70&step=1&isuri=1&acrdn=1#reqid=70&step=10&isuri=1&7003=200&7035=-.

91. Colorado Department of Revenue, "Colorado Marijuana Tax Data," Colorado Official State Web Portal, https://www.colorado.gov/pacific/revenue/colorado-marijuana-tax-data.

92. Tom Robleski, "Up in Smoke: Colorado Pot Biz Not the Tax Windfall Many Predicted," January 2015, http://www.silive.com/opinion/columns/index.ssf/2015/01/up_in_smoke_colorado_pot_biz_n.html.

93. Washington State Department of Revenue, "Marijuana Tax Tables," http://dor.wa.gov/Content/AboutUs/StatisticsAndReports/stats_MMJTaxes.aspx and http://www.502data.com/.

94. "Washington Rakes in Revenue from Marijuana Taxes," RT (Russia Today television channel), July 13, 2015, https://www.rt.com/usa/273409-washington-state-pot-taxes/.

95. Oregon Department of Revenue, "Marijuana Tax Program Update," Joint Interim Committee on Marijuana Legalization, May 23, 2016, https://olis.leg.state.or.us/liz/2015I1/Downloads/CommitteeMeetingDocument/90434.

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