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Considering marijuana legalization carefully: insights for other jurisdictions from analysis for Vermont

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ABSTRACT

Background and Aims In 2014 the legislature of Vermont, USA passed a law requiring the Secretary of Administration to report on the consequences of legalizing marijuana. The RAND Corporation was commissioned to write that report. This paper summarizes insights from that analysis that are germane to other jurisdictions. **Method** Translation of key findings from the RAND Corporation report to the broader policy debate. **Results** Marijuana legalization encompasses a wide range of possible regimes, distinguished along at least four dimensions: which organizations are allowed to produce and supply the drug, the regulations under which they operate, the nature of the products that can be distributed and taxes and prices. Vermont's decriminalization had already cut its costs of enforcing marijuana prohibition against adults to about $1 per resident per year. That is probably less than the cost of regulating a legal market. Revenues from taxing residents' purchases after legalization could be many times that amount, so the main fiscal cost of prohibition after decriminalization relative to outright legalization may be foregone tax revenues, not enforcement costs. Approximately 40 times as many users live within 200 miles of Vermont's borders as live within the state; drug tourism and associated tax revenues will be important considerations, as will be the response of other states. Indeed, if another state legalized with lower taxes, that could undermine the ability to collect taxes on even Vermont residents' purchases. **Conclusions** Analysis of possible outcomes if Vermont, USA, legalized marijuana reveal that choices about how, and not just whether, to legalize a drug can have profound consequences for the effects on health and social wellbeing, and the choices of one jurisdiction can affect the options and incentives available to other jurisdictions.

Keywords Cannabis, decriminalization, drug policy, legalization, markets, policy analysis.

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INTRODUCTION

Marijuana legalization is a controversial and multi-faceted issue. Since 2012, four US states have legalized for-profit commercial marijuana industries, and in December 2013 Uruguay became the first country to legalize nation-wide; the Netherlands only tolerates retail sales and does not allow commercial production. These moves were unprecedented, going well beyond reducing the penalties for simple possession.

Legislation to legalize marijuana production was introduced in the state of Vermont in 2014, but lawmakers instead passed a law [1] requiring its Secretary of Administration to produce a comprehensive report on the consequences of legalizing marijuana. RAND prepared this document [2], which aimed to inform the debate but not make a recommendation. This paper translates key findings from that report to the broader policy debate. (Given origins in analysis for Vermont, we use the term 'marijuana', not cannabis, except when referring specifically to the plant.)

Vermont's situation is somewhat atypical. It has allowed medical marijuana since 2004, including dispensaries as of 2013, and reduced the penalty for possessing small amounts from a criminal to a civil offense. Its prevalence is also among the highest in the nation, but the most salient circumstance is that Vermont is a small state (population 625 000) close to major population centers, including Boston, Montreal and New York City. This geography couples Vermont's policy choices more tightly with its neighbors than is the case for the four US states that have already legalized commercial production and sales (Colorado and Washington in 2012; Alaska and Oregon in 2014).

Vermont also stands out by virtue of having commissioned analysis before locking into any particular supply architecture or regulatory posture. The four states that legalized by voter proposition effectively placed control over the principal decisions into the hands of those who wrote the proposition. In some states it can be very difficult for legislatures to make substantive changes to initiatives after they have passed. Legalization via the traditional legislative process may bring a broader set of considerations to the table, and greater professionalism in the crafting of regulatory frameworks.

Nevertheless, much of the report's analysis is relevant to other jurisdictions. Perhaps the most important insight is that legalization is not a binary choice. In a very real sense the question: 'Should jurisdiction X legalize?' is ill-posed, and invites the response: 'That depends on what form the legalization would take'. Indeed, Fig. 1 arrays 12 alternatives concerning marijuana supply, ranging up to completely removing marijuana from the law books (the libertarian dream of no regulation). Not all are mutually exclusive; Uruguay permits home-growing and co-operatives, and is in the process of allowing government-controlled supply. However, there are interactions; liberal rules concerning home-growing and co-operatives may undermine the ability to collect high taxes on large-scale production. Different models could apply to different products, e.g. restricting for-profit companies to traditional forms of marijuana while placing greater constraints on concentrates and other forms whose risk profiles are less well studied.

The report describes the pros and cons of each of these 12 approaches (see table in online Supporting information). Space considerations preclude summarizing them all here, but this paper captures many of the key insights by contrasting three categories of marijuana reforms: decriminalizing possession, legalizing small-scale production and legalizing large-scale production. We do not discuss pseudo-medical regimes that allow production for recreational use under the guise of providing treatments to seriously ill people because—at least at present—Vermont's medical regime is controlled much more tightly than those in some other states.

DECRIMINALIZING POSSESSION

The terms 'decriminalization' and 'legalization' are often used interchangeably, and this obfuscates policy debates. The former refers to reducing penalties for possessing small amounts from being a criminal to a civil offense (e.g. a citation with a fine) [3]. One could truly legalize only possession, so there are not even fines, but we follow the convention that the term 'legalization' refers to also legalizing production and sales.

The main benefits of decriminalization are reducing the harms associated with criminal arrest and conviction and saving criminal justice resources. Because the majority of marijuana arrests are for possession, as opposed to production or sale, decriminalization can affect these outcomes significantly.

Conventional wisdom holds that decriminalizing possession is not associated with significant increases in use [4,5], although some demur [6]. (One reason that most studies do not find large effects is that formal decriminalization is often implemented in jurisdictions that have already become quite lenient in their enforcement practices.)

On 1 July 2013 the penalty in Vermont for adults possessing up to 28 g of marijuana or 5 g of hashish was reduced to a civil offense with fines of $200–500, depending on the number of prior violations. In the subsequent year, the number of criminal cases involving marijuana dropped by 80% (from 1602 to 306), although the total number of cases (i.e. criminal + civil) actually increased by 20% (from

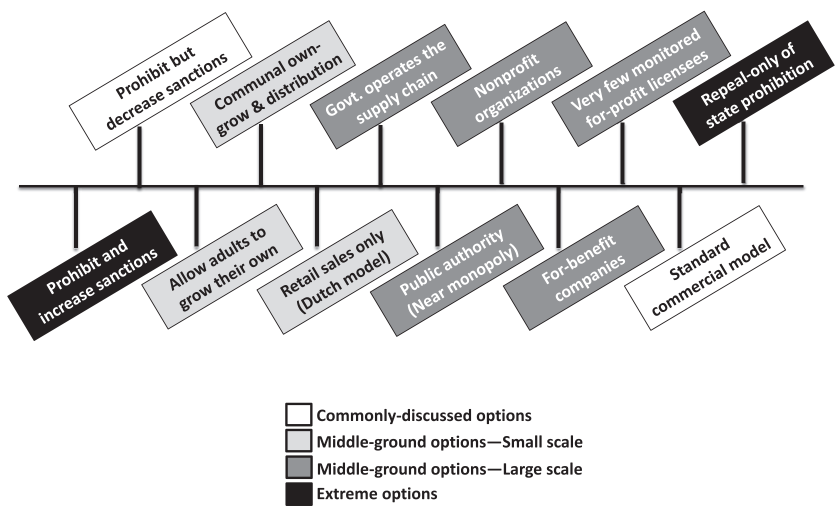

Figure 1 Twelve alternatives to *status quo* prohibition of marijuana supply. Source: Slightly updated from Caulkins *et al.* [2]

1602 to 1921). Among the 306 post-decriminalization arrests, one-third involved minors, 40% involved multiple charges, not only marijuana possession, and 30% involved trafficking, sale or possession of larger amounts.

The latter group could, in theory, receive stiff prison terms: up to 5 years for selling more than 14 g (18 V.S.A. § 4230; Vermont Legislature), but that is rare. A Vermont Department of Corrections official (personal communication) reported that on 3 September 2014, 'amongst 2,045 inmates, there are only three (2 sentenced and 1 detained) who are being held incarcerated with only marijuana charges'.

As the report describes in detail, multiplying counts of various events (arrests, prosecutions, etc.) by unit costs suggests that the State of Vermont spent only $1–1.3 million enforcing its marijuana prohibition in the year after decriminalization. Adjusting for fines collected and activities related to defendants who were under 21, the net cost of enforcing prohibition on adults is $500 000–750 000.

To put these figures into perspective:

- Vermont now makes more criminal arrests for driving under the influence of alcohol per past-month alcohol user than it makes arrests for all marijuana violations per past-month marijuana user.
- Criminal justice costs associated with prohibiting marijuana for adults are now only approximately $1 per resident per year.
- We estimate that the Vermonters spend $125–225 million per year on marijuana, so foregoing revenues from even a 1% excise tax has a greater fiscal impact than does enforcing Vermont's prohibition after decriminalization.

Hence, while saving criminal justice resources can be an argument for decriminalizing marijuana, it is not an important reason for moving from Vermont-style decriminalization to outright legalization. This is an important point, as more than one-third of Americans live in states that have already decriminalized, and others live in cities that have decriminalized within states that have not. (An additional 5% live in states that have legalized.)

ECONOMICS OF LEGAL PRODUCTION

The rest of this paper contrasts options for small- versus large-scale production. That distinction is crucial, because large-scale production economies could have important consequences for public policy and public health.

Traditional methods of producing marijuana are immensely inefficient; prohibition forces producers into convoluted labor- and energy-intensive forms of production. These issues have been explored elsewhere [2,7–11], but an abbreviated analysis makes the point. Approximately 10 years ago, farmgate prices in the United States for high-quality marijuana flowers ('sinsemilla') were on the order of $3000–6000 per pound [12]. They have fallen by more than 50% in the current quirky context of production that is state-legal but still banned by federal law [2].

Comparisons with conventional crops suggest that after national legalization, production costs would fall considerably further. Yield varies, but a good general-purpose number is 40 g of flowers per square foot under canopy per harvest [13]. With two harvests per year and half of the production area devoted to flowering plants, that same figure would also apply to annual production per square foot. If marijuana's growing costs are in line with those of conventional plants, such as $10–20 per square foot for hydroponic tomatoes and lettuce grown in greenhouses [14], then growing costs would be just $0.25–0.50 per gram.

A full analysis makes many adjustments. Conventional useable marijuana requires drying and trimming, but processing of tobacco leaf costs less than $1 per pound [15]. Also, not all the plant's tetrahydrocannabinol (THC) is in its flowers; THC extracted from other plant parts can be used for producing oils, waxes and other products.

It is difficult to be precise, but the orders of magnitude are clear. After national legalization, professional farmers should be able to produce high-quality marijuana products in greenhouses for the equivalent of $0.50 per gram, or $225 per pound. Parallel analysis for cannabis extracts (not whole flowers) from outdoor farming suggest production costs on a THC-equivalent basis of roughly $0.10–0.20 per gram, or below 5 cents per hour of intoxication. That is so low that establishments could afford to give cannabis products away free, in the way that bars serve free salty nuts and hotels leave chocolates by the bedside, if such generosity stimulated demand for those businesses' main products.

Not all marijuana would be cheap; premium products would still exist, as they do for chocolates and wine. However, prices for the generic intoxicant could become decoupled from production costs, and be driven more by consideration of marketing, branding and bundling—and taxes and minimum pricing regulations, if any.

Large-scale production also facilitates greater product variety and supports firms large enough to develop national brands and associated marketing campaigns. Small-scale production's higher prices, lower variety and potentially lower availability would generally be preferred from a public health perspective, and also by existing growers who may not remain competitive in a high-volume, large enterprise market. This creates an odd confluence of interest between current artisanal growers and the prevention community; both have reason to fear creating the marijuana equivalent of a Big Tobacco industry.

OPTIONS FOR SMALL-SCALE MARIJUANA PRODUCTION

Options for small-scale production include: (1) allowing adults to grow their own; (2) cannabis clubs that allow members to pool their own-growing privileges and trade within the club, but not to outsiders; and (3) the Dutch model of allowing retail sales but not production. We do not discuss the Dutch model because it has been discussed thoroughly in the literature [16–19].

Allowing only home production is perhaps primarily symbolic. Black market products are so readily available that few people bother to grow their own even when that is allowed.

Furthermore, the productivity of the cannabis plant creates problems when trying to grow for just one person. Data from Colorado's Marijuana Enforcement Division [20] suggest that annualized production rates in Colorado are now 335 g per mature plant being grown (144 g per plant overall, counting those in the vegetative state). Yields can be even greater when large plants are grown outdoors.

Hence, even most heavy users would only need one plant flowering at any time. If that one plant survives its harvest would exceed the 28-g limit allowed for personal possession, but if it dies the grower would have to resort to illegal supplies until the next plant matured. Therefore, Alaska, Colorado and Washington DC allow up to six plants, with no more than three flowering. This produces 864 g per year at the yields mentioned above, considerably more than even a heavy user would normally consume, and so invites distribution. Furthermore, many marijuana users like to have multiple strains available, which exacerbates the problem of the lumpiness of production at the individual-level.

Cannabis clubs address this problem. Even if each member were permitted only one or a few plants, pooling the growing privileges of 45 people (the maximum number allowed by Uruguay) permits more continuous harvesting throughout the year, even if there are several strains. Furthermore, as one member can cultivate on behalf of others, clubs can provide a legal supply to people who lack the time, space or skill to grow themselves.

Cannabis clubs are probably the smallest-scale operation that can undermine a substantial share of the black market, but they could morph easily into medium-scale production—and so acquire some of the potentially objectionable characteristics of larger-scale production. (Black market businesses often used to grow 99 plants at a time, one below the number which triggers an enhanced federal sanction; this is just two plants per member for a 50-member club.) Limits would need to be written carefully, and probably should be expressed not only in terms of plants, but also the area under cultivation and perhaps the wattage of growing lights [21].

OPTIONS FOR LARGE-SCALE MARIJUANA PRODUCTION

Large-scale production offers greater ability to regulate and to collect taxes, and thereby to modulate prices and consumption; but taxes do not collect themselves and enforcing regulations can be costly; the more stringent the regulation, the more enforcement is needed to ensure compliance. High taxes and stringent regulations also leave room for an illicit market. Striking the right balance among these competing considerations can be challenging.

Regulations

The Vermont report offers a 'Regulatory Checklist' based on public health principles, experience with other products (including alcohol, tobacco and gambling) and existing research [22–25]. The list covers approximately 30 regulatory areas pertinent to policy goals, such as revenue generation, product safety, marketing to minors and diversion to other jurisdictions.

Product labeling is one such area. Even if regulations do not constrain product form or potency, they can insist that consumers be well informed. Labels in the less-regulated medical markets can be deceiving; a recent study found that just 17% of 75 purchased edible medical products were labeled accurately [26].

Outlet density is another area. Some alcohol literature finds a positive association between outlet density and alcohol-related problems [27–29], and there is evidence that medical marijuana dispensaries increase adult marijuana use [30]. Washington State expects to license up to 334 retail outlets (one for every 20 000 residents), which was the number of state liquor stores before sales were privatized in 2013. As of December 2014, Colorado had 827 licensed retail stores and medical dispensaries [20], or approximately one per 6500 residents, so Colorado has more marijuana stores than did the Netherlands in 2014, even though the Netherlands has three times the population (16.8 versus 5.4 million).

In theory, marijuana stores in the United States may only sell marijuana products, although 'gas and grass' petrol stations in Colorado evade this regulation by co-locating two distinct businesses on the same site. This permits cross-subsidization across product lines. If and when grocery and convenience stores are allowed to sell, they may sell marijuana below cost as a loss-leader to bring in customers who buy other things, and that tactic reduces the burden of *ad valorem* marijuana taxes.

Two higher-level considerations will shape the regulatory environment. First, what agency will be in charge [31]? Colorado and Washington opted for 'good government' agencies (departments of revenue and liquor control, respectively). These agencies care a great deal about equity, fairness and timeliness to licensees; protecting tax revenue; fighting corruption; and enforcing laws against diversion to minors. However, unlike the Food and Drug Administration, which regulates tobacco, the agencies are largely uninterested in pursuing public health priorities such as limiting consumption by drug-dependent adults. As one regulator is reputed to have quipped: 'Once the customer walks out of the store, our responsibility is over'.

Secondly, how much flexibility will regulators have? Because legalizing production is plunging into uncharted territory, the regime needs flexibility to adjust rules over time. For example, following problems with overdosing on marijuana-infused edibles (particularly in Colorado), Washington State passed emergency rules requiring that they be homogenized (so intoxicants are distributed uniformly throughout the product) and divided into identifiable pieces, with just one dose per piece.

However, regulatory agencies are always vulnerable to industry-capture because the industry has the resources and interest to fight the myriad small battles over regulatory questions that are individually minor but collectively shape public health outcomes. The early track record is concerning in this regard. Among the 15 people Oregon named to its chief regulatory advisory committee, five are from the industry, something that is explicitly banned for parallel bodies that advise the FDA on pharmaceutical regulations.

Tax bases

Our report explores the pros and cons of 10 different bases for taxing marijuana, as well as consumer fees and auctioning licenses. It also examines indirect effects on other tax revenues (e.g. income tax revenue on wages that are now reported). We summarize here key considerations for three of the more prominent options for tax bases.

Early proposals considered taxes assessed on the weight of marijuana sold, such as the $50 per ounce tax proposed by California's Ammiano Bill in 2010 [10]. Weight-based taxes need to be indexed to preserve value in the face of inflation, and they incentivize high-potency forms to minimize the tax per hour of intoxication. This helps to explain why Oregon replaced the $35 per ounce tax on marijuana flowers passed in 2014 with a 20% sales tax.

With that change, Oregon joins Colorado and Washington in assessing taxes as a percentage of value. Such *ad valorem* taxes are easy to collect, but amplify price changes. If a bad harvest drives up prices, then taxes will also go up. Similarly, taxes will diminish as prices decline over time with growing industry efficiency. If pre-tax prices decline from $10 per gram to $2 per gram, a 20% excise tax that kicks the price back up to $2.40 per gram will not stave off the effects of lower prices on use and abuse [23,32]. It might be better to have lower taxes initially, to undercut the black market, and higher taxes later, but *ad valorem* taxes will deliver the opposite trend.

One might prefer taxing THC, in the way the US federal tax on liquor depends upon alcohol content [33], but THC taxes are more difficult to administer because they require accurate testing. (They may be easier to implement with concentrates, which can be mixed homogenously, than with heterogeneous plant material such as conventional flowers.) We are not aware of any jurisdiction that has implemented them to date, although one was proposed in Massachusetts.

Revenues from taxing own residents' purchases

Our report estimated that Vermont had 60 000–100 000 past-month marijuana users who spend $125–225 million per year buying marijuana, or approximately $200–350 per resident annually.

The report projects that potential tax revenue from taxing these in-state consumers could be in the range of $20–75 million per year (or $30–115 per resident per year), where the range reflects uncertainty only in parameter values, not the actions of the federal government or other states. For example, whereas the base-case scenario imagined that one-third of consumer spending would be captured as tax revenue, a range for that parameter of 20–50% was considered.

Dividing that $20–75 million range by the number of past-month users works out to $330–750 per past-month user. By comparison, a pack-a-day smoker facing taxes of $2.50–3.00 per pack would pay $900–1100 per year in cigarette taxes—if they actually paid all the taxes (evasion is not uncommon).

These estimates pertain to revenues from marijuana sales, and do not consider indirect effects on revenue generated by taxing other substances. The report reviews literature addressing how changes in marijuana supply affect consumption of other substances. We concluded that the literature was divided evenly as to whether the net effect on alcohol use would be positive or negative. However, the literature finds evidence that marijuana and tobacco have been complements in the past. If that pattern persisted then legalizing marijuana might increase tobacco use, which would be a bonus in terms of tax revenues, as cigarettes are taxed, but a loss from a public health perspective, and it might increase state spending on health care in the long term.

Revenues from taxing residents of other jurisdictions

Jurisdictions that legalize can also generate tax revenue from 'marijuana tourists'. Light *et al.* [34] estimated that out-of-state buyers in Colorado accounted for 44% of tax revenue in metro-areas and 90% in mountain ski communities during the first 9 months of commercial marijuana sales. This issue is especially salient for Vermont, which is located in the densely populated northeastern United States (Fig. 2). Although Vermont itself probably has fewer than 100 000 current marijuana users, more than 1 million more live within a 2-hour drive of Vermont and 2.7 million (nearly 40 times the size of Vermont's market) live within 200 miles. In theory, Vermont could generate hundreds of millions in additional tax revenue by supplying out-of-state users if (or until?) another nearby state legalized with a lower tax rate. Drug tourists could also boost the economy more generally (e.g. through restaurant and hotel spending), but create traffic risks—especially those who use before driving home—and might alter the 'Vermont brand', which now produces considerable tourism of the conventional sort.

If (or when) neighboring states legalize, that could not only reduce tourist revenue for Vermont, it could also undermine taxes generated from Vermonters who start to buy out of state, in the way they now cross state lines to take advantage of New Hampshire's lower alcohol taxes. This could drive states into a 'race to the bottom' with respect to tax rates, which would be a boon for industry and a disaster for jurisdictions counting on those revenues.

Ownership structure

We use the adjective 'commercial' to describe legalization regimes that permit for-profit companies to produce and/or sell. Commercial legalization is just one possible structure for large-scale production [35], but it is the form being pursued in the four states that have legalized to date. Commercialization will create an industry that may fight against regulations and try to keep taxes low. Further, reversing commercialization might be extremely difficult after the industry and its lobbyists have become well entrenched. A special concern in the United States is that commercialization will lead to aggressive marketing intended to expand the base of heavy users (as daily users account for the majority of consumption). While Uruguay bans all marijuana advertising, limiting marketing in the United States will be difficult after national legalization because its constitutional protections extend to commercial not just individual free speech.

It is important to recognize that any large-scale production scenario has the potential to produce government revenues, not just the commercial for-profit approach. States could limit the market to non-profit organizations focused on public health or to 'for-benefit' corporations that are not focused exclusively on maximizing profits for shareholders, and still collect sales and excise taxes on their activities and income taxes from employees. Indeed, the greatest potential revenues might come from a government monopoly that could control production (and thus diversion) and price. This approach has not received much attention in the United States because under the ongoing federal prohibition it would put state employees at risk of arrest.

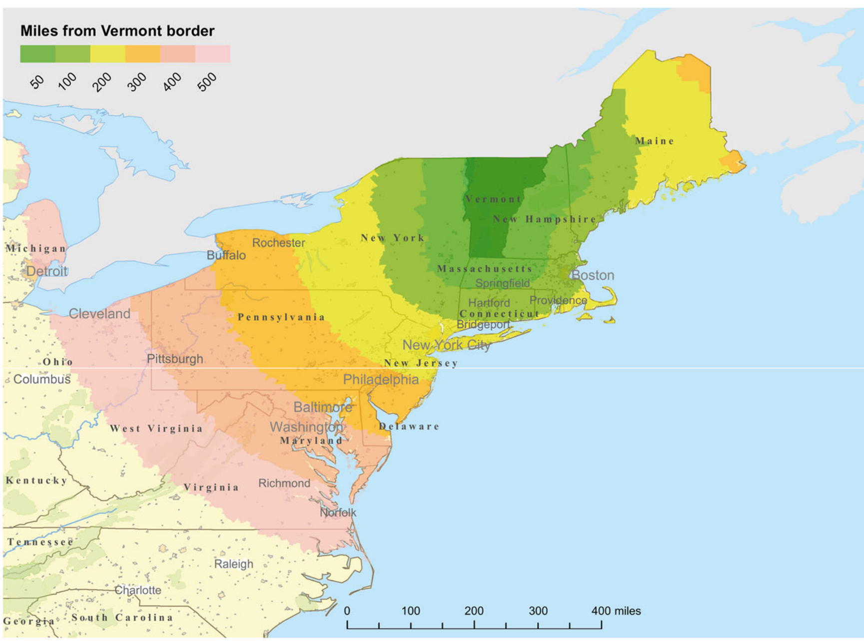

Figure 2 Millions of marijuana users live close to Vermont. Source: Caulkins *et al.* [2]

CONCLUDING THOUGHTS

Legalization is not a binary choice between commercial legalization and continuing prohibition. Legalization encompasses a range of possible regimes, distinguished along at least four dimensions: the kinds of organizations that are allowed to provide the drug, the regulations under which those organizations operate, the nature of the products that can be distributed and taxes and prices.

These choices could have profound consequences for health and social wellbeing, as well as for job creation and government revenue, and these choices will be shaped by the values of the voters and politicians and the bureaucratic culture of the agencies to whom they delegate regulatory responsibility.

The chief tension may be whether the regime is designed to serve the majority of controlled users or to protect the minority whose use turns problematic. Adults with no abuse or dependence problem and who consume on fewer than 10 days per month comprise the majority of users but less than 5% of consumption; more than 50% of marijuana is consumed by the relatively small number of daily users. A commercial industry provides excellent service to the majority while profiting primarily by promoting sales to heavy users. There is no agreement as to whether legalization should retain prohibition's aspiration of protecting users from their own poor choices or instead embrace fully the efficiency and dynamism of the free market. Libertarians will prefer options with fewer regulations while public health-minded individuals worried about commercialization and price declines may prefer a government monopoly.

Legalization appears to be the emerging trend, at least for marijuana, so policy analysis needs to extend beyond debating whether legalization is a good idea to include detailed discussions of how best to implement it. As the full consequences of legalization will take a generation or more to manifest, this is more of a design task than an evaluation task. This paper takes a step in that direction by outlining multiple options for the architecture of a legalization regime, within which various particular regulatory options can be pursued.

Declaration of interests

None.

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