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Davide Dragone
University of Bologna

Giovanni Prarolo
University of Bologna

Paolo Vanin
University of Bologna

Giulio Zanella
University of Bologna and IZA

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Crime and the Legalization of Recreational Marijuana

We provide first-pass evidence that the legalization of the cannabis market across US states may be inducing a crime drop. Exploiting the recent staggered legalization enacted by the adjacent states of Washington (end of 2012) and Oregon (end of 2014) we find, combining county-level difference-in-differences and spatial regression discontinuity designs, that the legalization of recreational marijuana caused a significant reduction of rapes and thefts on the Washington side of the border in 2013-2014 relative to the Oregon side and relative to the pre-legalization years 2010-2012. We also find evidence that the legalization increased consumption of marijuana and reduced consumption of other drugs and both ordinary and binge alcohol.

JEL Classification: K23, K42

Keywords: cannabis, recreational marijuana, crime

Corresponding author:
Giulio Zanella
Department of Economics
University of Bologna
Piazza Scaravilli, 2
40126 Bologna
Italy
E-mail: giulio.zanella@unibo.it

1 Introduction

Gary Becker was a strong advocate of the legalization of drugs (Becker and Murphy, 2013), particularly — in the wake of the first wave of legalization of recreational cannabis in the US — of marijuana (Becker, 2014). Becker and Murphy (2013) claimed that the largest costs of a prohibitionist approach to buying and selling drugs in the US "are the costs of the crime associated with drug trafficking", predicting that legalizing this market would "reduce the role of criminals in producing and selling drugs [and] improve many inner-city neighborhoods": "Just as gangsters were largely driven out of the alcohol market after the end of prohibition, violent drug gangs would be driven out of a decriminalized drug market". That is, letting the drug market emerge from illegality would make illegal activities in this market not pay, thus greatly reducing fertile ground for crime, a central theme in Becker's economic approach to crime (Becker, 1968).

The present paper provides evidence in favor of these conjectures exploiting the full legalization of the cannabis market recently enacted by some states in the US. Although possessing, using, selling and cultivating marijuana is illegal under US federal law,[1] between 2012 and 2016 eight states have legalized recreational marijuana: Colorado and Washington in 2012, Alaska and Oregon in 2014, California, Nevada, Maine and Massachusetts in 2016.[2] The comparison between Washington (WA) and Oregon (OR) offers an experimental opportunity to study the effect of such legalization on crime because these are neighboring (hence similar, in many respects) states that legalized cannabis for recreational use at about the same time, but with a 2-year time lag that induces a quasi-experiment, and sufficiently early to allow the observation of crime rates for at least two years from official sources. Combining difference-in-differences (DID) and spatial regression discontinuity (SRD) designs at the county level to identify the causal impact of the legalization of cannabis for recreational use on crime rates we find that the legalization reduced rapes by about 4 per 100,000 inhabitants

[1] Except for restricted uses, cannabis has been illegal under US federal law since the Marihuana Tax Act of 1937. The Controlled Substance Act of 1970 (Title II of the Comprehensive Drug Abuse Prevention and Control Act, Public Law 91-513) classified marijuana and tetrahydrocannabinols among the drugs listed in Schedule I, which have high potential for abuse and no accepted medical value.

[2] Many more states have passed medical marijuana laws. These, however, do not legalize the supply side of the market. Making marijuana legal for recreational purposes is the strongest form of legalization of the cannabis market.

(a 30% drop), and thefts by about 100 per 100,000 inhabitants (a 20% drop).

These results support Becker and Murphy's conjectures, and are also in line with two possible reasons that have been suggested for why illicit drugs may increase crime (Goldstein, 1985): stealing to buy expensive drugs, and drug wars within the system of drug distribution. However, they stand in sharp contrast with the presumption that drugs cause crime, a major argument in support of a prohibitionist approach to substance use. For instance, according to the California Police Chiefs Association (2009), "public officials and criminal justice organizations who oppose medical marijuana laws often cite the prospect of increased crime". Case studies of crime reports found drugs to be, in fact, a contributing factor (Goldstein, 1985), and it has been observed that a higher percentage of persons arrested test positive for illicit drugs compared with the general population (US Department of Justice). Yet, research on the recent wave of legalization of cannabis for medical use ("medical marijuana laws", MML henceforth) in the US yields mixed results on the association between illicit drug use and crime. Some researchers find no significant relationship between MML and crime (Keppler and Freisthler, 2012; Braakman and Jones, 2014; Morris *et al.*, 2014; Freisthler *et al.*, 2016; Shepard and Blackley, 2016), while others show that MML may reduce some kind of non-drug crimes (Ingino, 2015) because of reduced activity by drug-trafficking organizations (Gavrilova *et al.*, 2014). Using data from the UK, Adda *et al.* (2014) argue that the decriminalizing marijuana allows the police to reallocate effort away from drug-related crimes and towards other types of offenses. However, the estimation of a causal effect going from legalizing cannabis to crime rates remains an elusive question because of the lack of an experimental design (Miron, 2004). The present paper makes progress in this respect by engineering a quasi-experiment that is able to provide first-pass causal evidence on the relationship between recreational cannabis and crime rates.

At this level of analysis we cannot pin down the mechanisms operating behind the effects we identify. Moving retail cannabis deals from degraded streets to safe, legal shops most likely played a role. Anecdotal evidence is provided by this message posted on Twitter by the Portland Police on June 10, 2016: "If you are looking to buy marijuana, go to a legit business and avoid street dealers who might rob you". Substitution away from drugs which have remained illegal and from alcohol which makes consumers more aggressive than if

consuming cannabis is another possibility for which we provide evidence via a complementary analysis that uses substance consumption as an outcome. We find that the legalization of recreational marijuana in Washington induced an increase in the consumption of cannabis of about 2.5 percentage points (off a base level of about 10%), a decrease in the consumption of other drugs of about 0.5 points (off a base level of about 4%), and a decrease in the consumption of both ordinary alcohol and binge alcohol of about 2 points (off base levels of about 50% and 20%, respectively). Finally, the police reallocation channel suggested by Adda *et al.* (2014) is certainly a plausible mechanism. We expand on mechanisms in the concluding Section of the paper. In the next one, we summarize the legal details that generate our quasi-experiment. The data and the results are presented in Section 3.

2 Legal framework

At the general election ballot of November 2012, voters in the state of WA approved with about 56% of votes Initiative 502, which allows producing, processing, and selling cannabis, subject to licensing and regulation by the Liquor Control Board, allows limited possession by persons aged 21 and over (but not home cultivation), and taxes sales. Legal possession began on December 9, 2012. Regulations for producers, processors and sellers were approved in 2013 and retail sales of recreational cannabis began July, 8 2014 (Darnell, 2015). Shortly after, the state of OR passed a similar reform. At the November 2014 general election ballot, voters in OR approved with about 56% of votes Measure 91, a cannabis law reform that is similar to the one passed in WA in terms of taxing sales and subjecting them to regulation and licensing by the Liquor Control Commission, but is more permissive in terms of possession and cultivation.[3] A previous legalization attempt in OR (Measure 80 of 2012), quite permissive in terms of regulation and oversight, was marginally rejected with around 53% of votes in November 2012, thus enhancing the comparability with WA. Legalization of possession, use and home cultivation started in OR in July 2015, recreational sales through medical dispensaries in October 2015, and retail store licenses began in October 2016.

[3]Home cultivation of up to four plants per household is allowed. Adults over the age of 21 are allowed to carry 1 ounce and keep 8 ounces at home, whereas WA establishes a possession limit of 1 ounce.

Therefore, the timing of the reforms was such that cannabis was legal on one side of the border two years before the other side. Specifically, in 2013 and 2014 cannabis was legal in WA but not in OR, a temporary 2-year window followed by a virtually identical legal status across the border between two similar states where voters had a similar attitude towards legalizing cannabis. This allows us to combine a difference-in-differences (DID) design (where WA acts as the treatment group, OR as the control group, 2010-2012 is the pre-legalization period and 2013-2014 is the post-legalization period) and a spatial regression discontinuity (SRD) design (where the WA-OR border marks a discontinuity in the legal status of cannabis in 2013-2014) to identify the causal impact of legal cannabis on violent and property crime.

Even after the legalization, there are counties in WA where cannabis business is prohibited or where, according to the WA Liquor Control Board, Marijuana Sales Activity by License Number, no recreational cannabis retailers are present. These are Columbia, Franklin, Garfield, Wahkiakum, and Walla Walla County, all of them bordering Oregon except Franklin County. We show later that our results are robust to excluding these counties from the analysis.

A potential confounding factor in our analysis is that other relevant legal or institutional changes affecting crime rates in WA may have taken place in 2013-2014. A search for such changes reveals no relevant events that may have affected crime rates at the same time as the legalization of cannabis possession and use. During this period, a reorganization of the 911 emergency call system took place in WA, and there were reforms related to health services, regulation of wine and beer, and drug courts. There were also changes in the statute of limitations for child molestation, incest (victim under age eighteen), and rape (victim under age eighteen), as well as new norms concerning commercial sale of sex and commercial sexual abuse, sexually violent predators, and sexual violence at school. However, all of these changes were too marginal to exert a plausible first-order effect on crime.

3 Data and results

We employ data on criminal activity at the county level from the US Uniform Crime Reporting (UCR) statistics. The data base contains the number of offenses reported by the

sheriff's office or county police department. For the reasons detailed below, these are not necessarily the county totals, but they are the only publicly available information from the UCR at the county level of disaggregation. We collected these crime data for years 2010 to 2014. For each county and each year, we have the total number of reported offenses for murder, rape, assault, robbery, burglary, and theft. The final dataset is an unbalanced panel (since not all counties report crime data every year) consisting of 335 observations for 75 counties, 36 in OR and 39 in WA. County-level population from the 2010 Census is used to obtain crime rates per 100,000 inhabitants. The distance of each county's centroid from the WA-OR border is computed using a GIS software. Table 1 reports crime rates in WA and OR counties between 2010 and 2014: all counties at the top of the table, counties at the WA-OR border (where our comparison takes place) at the bottom. Because these rates result from the aggregation of county-level reports in the UCR, they do not necessarily coincide with state-level counts. The reason of the discrepancy is twofold, as explained by the FBI's Criminal Justice Information Services Division at the UCR website. First, "only data for city law enforcement agencies 10,000 and over in population and county law enforcement agencies 25,000 and over in population are on this site". That is, crimes occurring in smaller cities are not counted for the published county-level totals. Second, "Because not all law enforcement agencies provide data for complete reporting periods, it is necessary to estimate for the missing data" when building statistics beyond the county level of aggregation. That is, the FBI imputes crime counts to non-reporting agencies when building estimates at the state and nation levels.

In addition, we employ data from the National Survey on Drug Use and Health (NSDUH) to include in our analysis information on substance consumption. Such information may shed some light on competing channels in the explanation of our results. Specifically, we pulled from the NSDUH the rates of use over the previous month for marijuana, other Federal illicit drugs, and alcohol. These statistics are publicly available only as averages over the 2010-2012 and 2012-2014 periods. Fortunately, these roughly correspond to the "pre" and "post" periods in our DID-SRD analysis.[4] Table 2 reports these consumption rates for the

[4] For smaller counties the NSDUH data come as aggregates for larger units consisting of groups of neighboring counties. In these cases, each county in the group is imputed the group-level average rate of consumption.

Table 1: Crime rates at the county level

Year	Murder	Rape	Assault	Robbery	Burglary	Theft
			All WA counties ($N = 39$)			
2010	0.76	10.96	46.66	12.17	265.79	458.97
2011	0.85	9.65	40.84	10.30	265.08	440.87
2012	1.03	9.16	42.70	9.99	287.77	432.55
2013	0.80	9.07	41.23	9.21	258.73	419.59
2014	0.73	9.70	41.21	10.47	246.90	399.60
			All OR counties ($N = 36$)			
2010	0.80	7.22	34.31	6.82	132.96	393.71
2011	0.66	7.26	32.02	6.26	142.14	387.37
2012	0.84	7.51	29.31	6.75	150.93	412.93
2013	0.88	5.69	22.48	5.40	146.14	433.22
2014	0.66	7.22	30.21	4.72	115.17	335.12
			Border WA counties ($N = 11$)			
2010	0.35	15.37	33.69	8.51	224.00	529.80
2011	0.48	13.56	33.55	9.69	212.19	491.00
2012	0.75	12.80	42.00	7.58	223.30	445.11
2013	0.59	10.28	40.78	6.15	210.41	407.93
2014	0.71	10.52	39.48	6.97	184.76	357.10
			Border OR counties ($N = 10$)			
2010	0.34	1.58	13.40	3.04	41.88	163.57
2011	0.44	2.51	11.22	1.31	49.15	158.78
2012	0.31	2.59	10.76	1.14	56.88	176.11
2013	0.10	1.77	11.67	1.67	41.04	144.27
2014	0.11	0.91	14.89	2.39	40.91	128.08

Notes: Average crimes per 100,000 inhabitants in WA and OR counties, estimated from the county-level counts reported in the Uniform Crime Reporting Statistics. The averages are weighted by county population.

Table 2: Substance Consumption rates at the county level

Year	Marijuana	Other drugs	Alcohol	Binge alcohol
		All WA counties ($N = 39$)		
2010-2012	0.102	0.044	0.560	0.222
2012-2014	0.127	0.039	0.542	0.206
		All OR counties with consumption data ($N = 34$)		
2010-2012	0.112	0.042	0.596	0.214
2012-2014	0.122	0.040	0.579	0.213
		Border WA counties ($N = 11$)		
2010-2012	0.093	0.042	0.535	0.223
2012-2014	0.101	0.034	0.486	0.199
		Border OR counties ($N = 10$)		
2010-2012	0.145	0.050	0.630	0.238
2012-2014	0.130	0.043	0.600	0.233

Notes: Average rates of substance use in WA and OR counties, estimated from the rates reported in the National Survey on Drug Use and Health. The averages are weighted by county population.

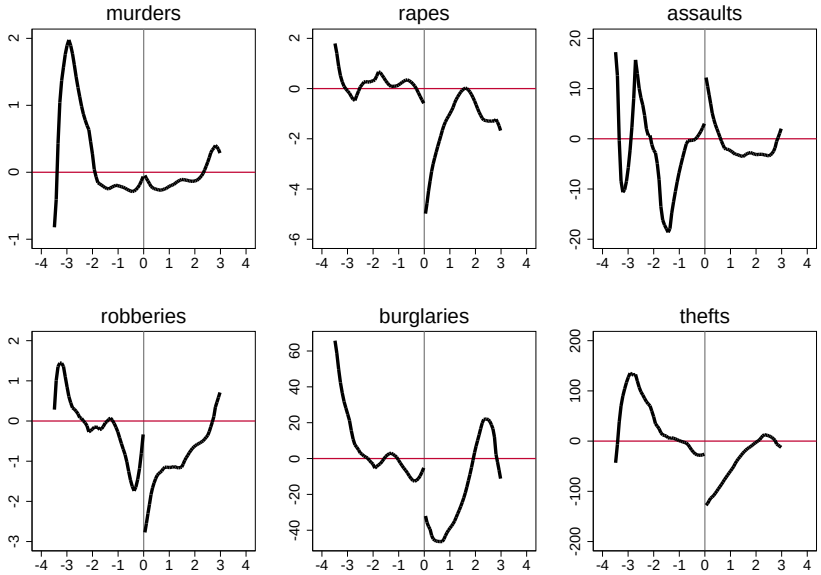
same WA and OR counties used in Table 1.

Four features of our data are crucial for identification. First, WA and OR share similar geographic, economic and institutional characteristics, including (quite crucially) a similar attitude towards legal cannabis (see Section 2). Second, WA legalized the cannabis market at the end of 2012, and OR (despite an attempt to legalize in that same year, marginally failed) in 2014, which results in a 2-year period in which recreational cannabis is legal on one side of the border and illegal on the other side. Third, the longitudinal dimension of the data allows us to condition on county fixed effects and time effects, thus netting out unobserved local characteristics that do not change over time, as well as those factors that vary over time but are common to all counties. Fourth, the geographical features of the data allow us to identify the effect of the policy at the WA-OR border, where treated and control counties offer a better comparison: arguably, the similarity between two different states is maximized when comparing bordering counties. Moreover, by conditioning on distance from the border

and by allowing for different effects of the spatial gap before and after the legalization, the SRD design controls for the effect of distance from the border on crime rates, including possible spillovers due to cross-border activity in response to the different legal status of cannabis.

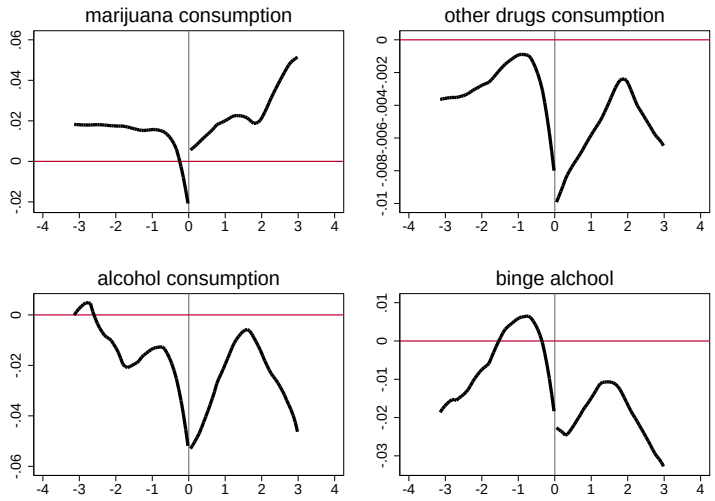
Preliminary graphical evidence about the causal effect of interest is offered in Figure 1. The figure plots nonparametric estimates of the difference between county-level crime rates before (2010-2012) and after (2013-2014) the WA legalization, as a function of the distance (measured in hundreds of kilometers) of the county centroid from the WA-OR border. In each panel of Figure 1, the difference between the variations in crime rates at the border (i.e., the jump at zero distance) is therefore a nonparametric estimate of the effect of legalizing cannabis. Except for murders (for which the variation is essentially zero on both sides of the border) and assaults, the drop in crime on the WA side of the border is much larger than the corresponding drop on the OR side. Figure 2 illustrates the analogous evidence for consumption.

Figure 1: Variation in crime between before and after the WA legalization



Notes: Variation in county-level crimes per 100k inhabitants (vertical axis) as a function of the distance of the county centroid from the OR-WA border measured in hundreds Km (horizontal axis). A positive distance means that the county is located in WA, and a negative distance means that the county is located in OR. The jump at zero distance is a non-parametric DID-SRD estimate of the effect of the legalization policy on crime. The lines are smoothed county-level differences in crime rates obtained from local linear regressions, weighted by county population, employing a triangular kernel and a bandwidth of 100 Km.

Figure 2: Variation in consumption between before and after the WA legalization



Notes: Variation in county-level rates of use of substances (vertical axis) as a function of the distance of the county centroid from the OR-WA border measured in hundreds Km (horizontal axis). A positive distance means that the county is located in WA, a negative distance means that it is located in OR. The jump at zero distance is a non-parametric DID-SRD estimate of the effect of the legalization policy on consumption. The lines are smoothed county-level differences in crime rates obtained from local linear regressions, weighted by county population, employing a triangular kernel and a bandwidth of 100 Km.

To provide a more formal statistical analysis, we employ a parametric model that allows us to condition on unobserved county and time effects. Let c_{it} be the crime rate in county i and year t, and define the following binary variables: first, $w_i = 1$ if county i is located in WA (treatment), and $w_i = 0$ if county i is located in OR (control); second, $p_t = 1$ if year $t > 2012$ (post), and $p_t = 0$ if year $t \leq 2012$ (pre). The DID-SRD design, sometimes referred to as the Difference-in-Spatial-Discontinuity design (Dickert-Conlin and Elder, 2010; Gagliarducci and Nannicini , 2013) can be represented by the following model:

$$c_{it} = k + \alpha p_t + \beta w_i p_t + f(d_i)p_t + g(d_i)w_i p_t + \theta_i + \xi_{it}, \tag{1}$$

where k is a constant, $f(.)$ and $g(.)$ are polynomials of the same order (but possibly different coefficients) in distance d_i from the WA-OR border, θ_i are county fixed effects, and ξ_{it} are residual determinants of crime. Coefficient β is the difference in the SRD estimates between the pre and post periods, i.e., by how much liberalizing recreational cannabis in WA changed the difference in crime rates right across the WA-OR border. We estimated Eq. (1) by OLS, employing quadratic polynomials in distance as is appropriate in a parametric framework (Gelman and Imbens, 2014). The resulting estimates of β are reported in Table 3.

Table 3: Effect of recreational cannabis on crime

	Murder	Rape	Assault	Robbery	Burglary	Theft
Estimated β	0.23	–4.21**	–1.30	–1.26	–36.32	–105.62*
	(0.45)	(1.26)	(8.79)	(1.92)	(22.20)	(40.21)
Observations	335	335	335	335	335	335

Notes: The table reports estimates of β from OLS on Equation 1, a coefficient that represents the difference in the spatial regression discontinuity estimates between the pre and post periods, i.e., by how much liberalizing recreational cannabis in WA changed the difference in crime rates right across the WA-OR border. Ordinary standard error are reported in parentheses (robust standard errors clustered at the county level are smaller than the ordinary ones displayed here). Each county is weighted in the regression based on the size of its population in the 2010 Census. Significance level: * 5%; ** 1% or better.

There is evidence in this table that the legalization of recreational cannabis enacted in WA caused a decrease in crime rates. The point estimates for rape, assault, robbery, burglary and theft are all negative. This conclusion is reinforced by the statistical significance of the drop in rapes (p-value = 0.001) and thefts (p-value = 0.01). For rapes, the reduction is 4.2 offenses per 100,000 inhabitants, which is about 30% of the 2010-2012 rate. For thefts, the reduction is 105.6 offenses per 100,000 inhabitants, which is about 20% of the 2010-2012 rate.[5] Note that the parametric estimates of β in Table 3 are in the same ballpark of the jump at zero-distance in Figure 1 (except for burglaries). This indicates that our parametric choices are not driving the results.

As a robustness check, we re-estimate the DID-SRD model after excluding 5 WA counties where cannabis business is prohibited and where, according to the Liquor Control Board, Marijuana Sales Activity by License Number, no non-medical cannabis retailers are present. These are Columbia, Franklin, Garfield, Wahkiakum, and Walla Walla County, all of them bordering Oregon except Franklin County. Results are reported in Table 4 . These confirm negative point estimates for all of the categories considered, and significant drops in rapes and thefts.

The analogous estimates using consumption as an outcome are reported in Table 5. Our DID-SRD estimates reveal that the legalization increased consumption of cannabis by about 2.5 percentage points (off a base level of about 10%), decreased in the consumption of other

[5]Although the point estimate for murders is positive, it is imprecise and not statistically significant.

drugs by about 0.5 points (off a base level of about 4%), and decreased consumption of both ordinary alcohol (in a marginally significant way) and binge alcohol of about 2 points (off base levels of about 50% and 20%, respectively). These effects on consumption suggest that one of the mechanisms underlying the reduction in crime may be a substitution away from other drugs which have remained illegal substances, such as alcohol, which makes consumers more aggressive than if consuming cannabis. We expand on this point in the next section.

Table 4: Effect of recreational cannabis on crime: robustness check

	Murder	Rape	Assault	Robbery	Burglary	Theft
Estimated β	0.20	–3.77**	–0.36	–1.19	–41.84	–117.51**
	(0.49)	(1.49)	(9.14)	(2.04)	(25.40)	(39.67)
Observations	310	310	310	310	310	310

Notes: The table reports estimates of β from OLS on Equation 1, a coefficient that represents the difference in the spatial regression discontinuity estimates between the pre and post periods, i.e., by how much liberalizing recreational cannabis in WA changed the difference in crime rates right across the WA-OR border. WA counties are excluded were cannabis business is prohibited and where, according to the Liquor Control Board, Marijuana Sales Activity by License Number, no non-medical cannabis retailers are present. These are Columbia, Franklin, Garfield, Wahkiakum, and Walla Walla County, all of them bordering Oregon except Franklin County. Ordinary standard error are reported in parentheses (robust standard errors clustered at the county level are smaller than the ordinary ones displayed here). Each county is weighted in the regression based on the size of its population in the 2010 Census. Significance level: + 10%; * 5%; ** 1% or better.

Table 5: Effect of recreational cannabis on consumption

	Marijuana	Other drugs	Alcohol	Binge alcohol
Estimated β	0.025**	–0.005**	–0.023^{+}	–0.020**
	(0.009)	(0.001)	(0.014)	(0.007)
	[0.016]	[0.002]	[0.016]	[0.010]
Observations	135	135	135	135

Notes: The table reports estimates of β from OLS on Equation 1 when measures of consumption are used as an outcome, a coefficient that represents the difference in the spatial regression discontinuity estimates between the pre and post periods, i.e., by how much liberalizing recreational cannabis in WA changed the difference in consumption right across the WA-OR border. Ordinary standard error are reported in parentheses, and robust standard errors clustered at the county level are reported in brackets. Each county is weighted in the regression based on the size of its population in the 2010 Census. Significance level: * 5%; ** 1% or better.

4 Concluding remarks

Our analysis of the causal effects on crime of the legalization of cannabis for recreational use reaches conclusions in line with what Becker and Murphy (2013) expected when advocating the full decriminalization of the drugs market, namely a crime drop. What are the possible possible channels through which legalizing the production and sales of cannabis affects criminal behavior? The effects may work through a change in market price and market structure, as well as through institutional changes.

First, the policy leads to the emergence of a legal market, which offers more safety and more reliable product quality. It thus reduces the risk of being victimized while buying, the risk of being sanctioned, search costs (especially for first-time buyers), as well as the psychological unease possibly related to purchasing an illegal product. From the consumer's point of view, this amounts to a reduction in quality-adjusted relative prices. Moreover, retail prices should be expected, on average, to drop when the market is legalized due to a corresponding lower risk on the supply side. Provided that cannabis is a normal good, a price reduction should lead to an increase in its consumption, which is what we find analyzing consumption data. Such increase may take place both at the extensive and intensive margin: the number of consumers may increase and existing ones may consume more. Since cannabis use determines a variety of psychoactive effects, which include a state of relaxation and euphoria (Hall et al., 2001; Green et al, 2003), an increase in consumption may reduce the likelihood of engaging in violent activities. This would hold, in particular, if cannabis is a substitute for violence-inducing substances such as alcohol, cocaine and amphetamines.

Interestingly, the evidence is mixed in this respect. Some studies find that marijuana and alcohol are substitutes (Anderson, Hansen, and Rees 2014; Crost and Guerrero 2012; Kelly and Rasul, 2014; DiNardo and Lemieux, 2001), while others find that they are complements (Williams *et al.*, 2004; Wen *et al.*, 2014). As observed in Sabia *et al.* (2016), who study the effects of MML on body weight and health, the substitutability/complementarity between alcohol and marijuana seems to be heterogeneous, depending on age.

Our results are in line with Gavrilova *et al.* (2016), who find that in US states bordering Mexico the introduction of MML leads to a decrease in violent crimes such as homicides,

aggravated assaults and robberies, and that this reduction in crime rates is mainly due to a drop in drug-law and juvenile-gang related homicides. The introduction of MML is found to reduce the violent crime rate in Mexican-border states by 15-25 percent. This is a large effect, but it is fully compatible with our estimates on the impact of recreational marijuana.

Besides directly affecting cannabis price and consumption, legalizing cannabis also changes market structure. Entry of new legal sellers, who provide better quality than illegal competitors, may drive the latter out of the market. Some illegal dealers might survive if legal consumption is severely taxed, and they will surely survive during the time it takes to open legal dispensaries. Yet, one may expect their profitability to fall – certainly their expected future profits do. One reason is the increase in competitive pressure. Another one is that product quality is not only likely to be higher in the legal part of the market, but it is presumably also easier to identify, so that legalization might in principle introduce price divergence: prices might increase in the legal relative to the illegal part of the market. The likely result is an increase in average product quality and market exit by illegal suppliers. This change in market structure is likely to reduce the presence of drug-trafficking criminal organizations, together with drug-related conflicts and associated crimes. Yet, we do not really know what previous dealers do after legalization, so this argument remains necessarily incomplete. Moreover, one might be concerned that even legal dispensaries attract criminals, e.g., to steal cash or marijuana. Yet, this concern is mitigated by the fact that dispensaries may take measures to reduce crime and increase guardianship, such as doormen or video cameras (Kepple and Freisthler, 2012). What seems more obvious is that the legalization may not just affect the behavior of potential offenders, but also of potential victims. The availability of cannabis through legal channels arguably makes consumers substantially less willing to take risks in the illegal market. This might also contribute to explain the drop in assaults, robberies and thefts that we document.

On top of altering behavior through changes in the cannabis market, legalization may also generate a reallocation of police efforts. A lower rate of drug-related crimes opens the possibility for the police to divert resources toward preventing non-cannabis related crimes, as shown by Adda *et al.* (2014) for the decriminalization of possession of small quantities of cannabis in London, UK. Interestingly, such reallocation may be driven by expectations,

and therefore need not wait for the actual opening of new dispensaries.

Summing up, the WA-OR quasi-experiment provides first-pass evidence that legalizing cannabis may well cause a drop in crime. What we estimate is the short-run response. As new data become available over time, for these states as well as for the other ones that legalized in 2016, it will be possible to appropriately distinguish between short and long-run effects.

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