Braakmann N, Jones S. [Cannabis depenalisation, drug consumption and crime - Evidence from the 2004 cannabis declassification in the UK](#). *Social Science and Medicine* 2014, 115, 29-37.

Copyright:

This is the author's version of a work accepted for publication. © 2014, *Social Science and Medicine*.
Licensed under the [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International](#).

DOI link to article:

<http://dx.doi.org/10.1016/j.socscimed.2014.06.003>

Date deposited:

01/06/2015

Embargo release date:

05 June 2016

This work is licensed under a
[Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International licence](#)

**Cannabis depenalisation, drug consumption and crime – Evidence from the 2004
cannabis declassification in the UK**

Nils Braakmann & Simon Jones

Newcastle University

Corresponding author: Nils Braakmann, nils.braakmann@newcastle.ac.uk,

Newcastle University, Business School – Economics, 5 Barrack Road,

Newcastle upon Tyne, NE1 4SE, United Kingdom.

Abstract:

This paper investigates the link between cannabis depenalisation and crime using individual-level panel data for England and Wales from 2003 to 2006. We exploit the declassification of cannabis in the UK in 2004 as a natural experiment. Specifically, we use the fact that the declassification changed expected punishments differently in various age groups due to thresholds in British criminal law and employ a difference-in-differences type design using data from the longitudinal version of the Offending, Crime and Justice Survey. Our findings suggest essentially no increases in either cannabis consumption, consumption of other drugs, crime and other forms of risky behaviour.

Keywords: cannabis; crime; anti-social behaviour; gateway theory; risky lifestyle; England; Wales

Acknowledgment/s: Helpful comments from 3 anonymous reviewers and participants at the 2013 conferences of the European Economic Association, the European Society for Population Economics and the Royal Economic Society are gratefully acknowledged.

Introduction

The effects of cannabis use on a range of outcomes and whether access to it should be regulated have been discussed heavily in both the public and in academia (see, e.g., Pudney, 2010, for a recent survey). Evidence from various countries indicates that cannabis consumption (a) may lead to physical and mental health problems, although effects are often not large (van Ours and Williams, 2011; 2012); (b) has mixed effects on wages (Kaestner, 1991; Gill and Michaels, 1992; Register and Williams, 1992; Kaestner, 1994; van Ours, 2007); (c) has negative, but often weak effects on (un-)employment (e.g., Gill and Michaels, 1992; Register and Williams, 1992; Kaestner, 1994; Burgess and Propper, 1998; Zarkin et al., 1998; MacDonald and Pudney, 2000; French et al., 2001; De Simone, 2002; van Ours, 2006) and (d) is correlated with the use of other, harder drugs, although it is not clear to what extent cannabis causes the consumption of these drugs as predicted by the gateway theory (e.g., van Ours, 2003; Pudney, 2003; Melberg et al., 2010).

In this paper, we evaluate a depenalisation of cannabis possession and consumption in the UK in 2004. Using individual-level panel data we consider the effects of this depenalisation on crime, consumption of cannabis and other drugs as well as other forms of risky behaviour. A link between cannabis consumption and the consumption of other drugs has long been suspected (the so-called gateway theory), even though causality has been hard to establish (e.g., van Ours, 2003; Pudney, 2003; Melberg et al., 2010). Furthermore, a link between cannabis consumption and crime can be hypothesized for a range of reasons: (a) consumption of cannabis might have a direct impact on individuals' criminal behaviour (e.g., Adda, McConnell and Rasul, 2011), (b) there might be an increase in property crime if individuals commit crimes to obtain money for buying drugs (e.g., Adda, McConnell and Rasul, 2011), (c) there might be an increase in violent crimes if drug users are also more likely to sell drugs

and engage in turf-wars with other dealers (e.g., Adda, McConnel and Rasul, 2011), (d) buying drugs might bring drug users into contact with criminals, such as dealers, which might influence criminal behaviour through peer effects (e.g., Pudney, 2003) and finally (e) depenalisation of cannabis might lead rebellious adolescents turn towards other forms of risky behaviour such as low level crime.

Evidence on the relationship between cannabis, crime and other forms of risky behaviour – despite its prominence in society’s opinion and the minds of countless worried parents – is relatively sparse. For Britain, Pudney (2003) finds some evidence that early cannabis use can increase minor offending and less clear evidence for a link with serious crime. Adda, McConnel and Rasul (2011) look at the effects of a localized depenalisation of cannabis, leading to an increase in cannabis possession offences and – through a shift in police resources towards non-drug crime – to lower crime rates. Further evidence has linked the uptake of cannabis use to subsequent criminal behaviour in New Zealand (Fergusson and Horwood, 1997), while there also exists evidence on the link between the size of drug markets and crime rates (Grogger and Willis, 2000; Pacula and Kilmer, 2003).

The evidence on the link between legalisation or decriminalisation of cannabis and cannabis consumption has recently been summarised by Bretteville-Jensen (2006), MacCoun (2010), Pacula (2010) and Pudney (2010). The available evidence can be broadly grouped into estimates of the reaction of cannabis consumption to changes in the monetary price of the drug and into estimates looking into non-price effects of legalisation (see Pacula, 2010, for an overview). For the initiation of cannabis consumption (e.g., Pacula et al, 2001; Pacula, Chriqui and King, 2003; DeSimone and Farrelly, 2003; Jacobson, 2005; van Ours and Williams, 2007; Bretteville-Jensen and Williams, 2011) as well as consumption changes of regular users (e.g., Nisbet and

Vakil, 1972; Williams et al., 2004, Clements and Zhao, 2009) the evidence generally indicates that the number of cannabis users reacts to price changes. Participation elasticities in the first case suggest that the number of first time users would increase by around 0% to 7% following a 10% drop in the price of cannabis, while the number of regular users would increase by between 2.4% to 15%. The evidence on decriminalisation (Johnston, et al., 1981; Chaloupka, Grossman and Tauras, 1999; Chaloupka et al., 1999; DiNardo and Lemieux, 2001; Pacula et al, 2003), changes in enforcement risk (Farrelly et al., 2001; DeSimone and Farrelly, 2003; Pacula et al., 2003) and changes to penalties and fines (Chaloupka, Grossman and Tauras, 1999; Farrelly et al., 2001; Pacula et al., 2003; Markowitz and Tauras, 2009) is very mixed for first time and youth users, but generally indicates that more lenient policing practices and decreases in penalties and fines will increase the number of cannabis users. For regular users, the evidence on enforcement (Pacula,1998; Farrelly et al., 1999) suggest that more lenient enforcement would increase regular use, while the evidence is more mixed and often suggests small or no effects from decriminalisation (Thies and Register, 1993; Pacula, 1998; Saffer and Chaloupka, 1999) or changes to penalties (Farrelly et al., 1999; Williams et al., 2004).

Further – more recent - evidence indicates that Marijuana legalisation may decrease traffic accidents through a reduction in alcohol consumption (Anderson, Hansen and Rees, 2013a) but does not seem to be linked to increased Marijuana consumption among teens (Anderson, Hansen and Rees, 2013b).

In contrast to most of the previous literature on the link between cannabis consumption and crime, we exploit a natural experiment – the declassification of cannabis from a class B to a class C drug in the UK in 2004 – that led to a large reduction in the potential punishment for cannabis possession. The downgrading

moved the maximum penalty for possession from 5 to 2 years of imprisonment and also lowered fines. This depenalisation obviously affects every person residing in the UK, however, the existence of age-related discontinuities in British criminal law means that the reductions in expected punishment differ for individuals in different age brackets: Individuals below 15 years of age can only be sentenced to custodial sentences in a very limited set of circumstances (Power of Criminal Courts (Sentencing) Act 2000, section 100), while for individuals between 15 and below 18 years of age eventual custodial sentences would be detention and training orders served in a youth offender institution or a secure training centre instead of imprisonment. Individuals above 18 are generally tried according to adult law, but individuals between 18 and below 21 years of age would generally be detained in a young offenders institution (Power of Criminal Courts (Sentencing) Act 2000, sections 96 to 98), which are similar to adult prisons but tend to have somewhat better conditions than regular jails and a stronger focus on education and training. These age-related discontinuities imply that, say, an 18-year old thinking about taking cannabis experiences a larger reduction in expected punishment through the 2004-declassification than a 15-year old who experiences a larger reduction than a 14-year old as the latter could not have been sentenced to a custodial sentence anyway. This setup leads to an evaluation design that is quite similar to the one used in evaluations of the Federal minimum wage in the US (e.g., Card, 1992), where everyone is treated after a certain point in time, but the “bite” of the treatment is different between affected units. Evidence on criminal behaviour around these thresholds, in particular at the age of criminal majority, suggest that individuals are generally aware of them, even though they might miscalculate the actual change in expected punishment (Hjalmarsson, 2009), and change criminal behaviour accordingly (Levitt, 1998;

Hjalmarsson, 2009; Lee and McCrary, 2009; Braakmann, 2013). There is also a large and well-established literature in the economics of crime that suggests that individuals in general react to changes in expected punishments (see Freeman, 1999, and Klick and Tabarrok, 2012, for surveys).

Our estimation strategy exploits these differences in the changes in expected punishment in a difference-in-differences-type evaluation design where we compare changes in the consumption of cannabis and other drugs and changes in criminal and other risky behaviour pre and post declassification between individuals aged 10 to 14, 15 to 17, 18 to 21 and above 21. This design implies that we essentially look at changes in penalties and changes to police practices to the extent that the latter vary according to age as changes to prices and (general) police practice are more likely to affect every individual in our sample in a similar way. Our findings imply no consistent pattern of changes in either cannabis consumption or other risky behaviour. These results are broadly consistent with the existing literature on the effects of decriminalization or changes to penalties.

Empirical strategy

Background: The declassification of cannabis and changes in expected punishment for possession

The possession and distribution of cannabis in the UK is generally illegal. For most of the time cannabis was classified as a class B drug, placing it in the middle category of the classification system created by the Misuse of Drugs Act 1971. Class A covers the most dangerous drugs such as heroin, cocaine or crack, while class C encompasses drugs such as sleeping pills, ketamine or anabolic steroids. Other class B drugs are amphetamine or codeine.

Penalties for possession and distribution differ across drug classifications. The maximum prison sentences for possession are 7 years for class A, 5 years for class B and 2 years for class C. Furthermore, being caught in possession of a class C drug will generally only lead to a formal warning or caution (unless there is a history of drug offences or the intent to distribute), while possession of a class A or B drug is more likely to lead to prosecution (see, e.g., the advice by the British government at <https://www.gov.uk/penalties-drug-possession-dealing> or the advice by DrugScope at <http://www.drugscope.org.uk/resources/faqs/faqpages/what-are-the-uk-drug-laws>).

Maximum sentences for distribution are generally much higher and may involve life sentences for class A and imprisonment up to 14 years for both class B and class C drugs.

Following a lengthy discussion about the classification of cannabis (see, e.g., Police Foundation, 1999), then-Home Secretary David Blunkett announced the intention to declassify cannabis to a class C drug in 2001, which became effective in January 2004. Cannabis was reclassified as a class B drug in January 2009. However, due to a lack of data this later reclassification plays no role in this paper. The declassification effectively makes possession of cannabis less risky as both the likelihood of a prosecution (as opposed to a warning or caution) and the maximum penalties are lowered.

To fix thoughts consider a standard Becker model of illegal behaviour (Becker, 1968; Freeman, 1999) applied to cannabis consumption. Individuals weight the expected utility of not consuming cannabis (the legal alternative, U^{NC}) with the utility of taking cannabis (U^C) while taking into account the risk of being caught by the police (occurring with probability p) and the disutility of punishment ($U[S]$), where S denotes the severity of punishment. An individual will take cannabis if

$$U^{NC} < (1-p)*U^C - p*U[S], \quad (1)$$

i.e., if the utility of taking cannabis (taking into account the risk of punishment) exceed the utility of not taking cannabis. Depenalisation can affect consumption through two channels: (a) The detection probability p can change if police priorities change and (b) the severity of punishment will change.

Evidence from sentencing statistics is only available for a few years, but to give an impression about expected punishments: In 2006 – when cannabis was a class C drug – there were 113,322 recorded offences of cannabis possession. Of these, 80,500 (71%) ended with a formal warning, 20,370 (18%) with a caution, 6368 (5.6%) with a fine, 2527 (2.2%) with a community sentence, 141 (0.1%) with immediate custody, 66 (0.06%) with a suspended sentence, 3069 (2.7%) with a discharge and 281 (0.2%) with other sentences. In contrast, for Amphetamines (a class B drug), there were 4058 offences, of which 1899 (46.8%) ended with a caution, 940 (23.9%) with a fine, 429 (10.6%) with a community sentence, 85 (2.1%) with custody, 38 (0.9%) with a suspended sentence, 601 (14.8%) with a discharge and 66 (1.6%) with another sentence (all statistics from Department of Health, 2008, p. 200). In other words, punishments for the possession of a class B drug appear to be much more severe than for class C drugs.

Further evidence on changes to penalties associated with cannabis use is available in Bryan, Del Bono and Pudney (2013), who present descriptive evidence from the Criminal Justice Statistics. This evidence suggests that convictions and cautions for cannabis possession drop after 2003, while the number of cannabis warnings and on-the-spot-fines increase (p.22). Furthermore, the number of people sentenced to immediate custody decreases over time and reaches a low during the years 2004 to 2007, while the number of people sentenced to custody for production increases

steadily over the same time period (p. 24). Finally, their evidence (p. 25) suggest that the vast majority of custodial sentences for cannabis possession are very short, i.e., below 1.5 months, which suggests that the main effect of the declassification will be around the type of sentence and not the length of an eventual custodial sentence.

(FIGURE 1 ABOUT HERE.)

It is also possible that the declassification changes police practice. For example, if the police do not agree with the lower penalties, they could potentially try to increase arrest probabilities to reach the same level of deterrence as before the declassification. Figure 1 investigates this possibility by plotting the probability of an arrest for drug possession for cannabis users and non-cannabis users using the Offending, Crime and Justice Survey for the years 2003 to 2006. The evidence clearly suggests an decrease in the likelihood to be arrested for drug possession for cannabis users of all age groups for the years 2004 and 2005 and for all age groups except for 18 to <21 year olds also for 2006. Overall figure 1 suggests that the police became more lenient and did not try increasing arrests to counter the lower penalties with the possible exception of the age group 18 to <21, where arrests returned to pre-declassification levels in 2006.

As outlined in the introduction, the declassification affects principally every individual living in the UK. However, the changes in the expected severity of punishment differ in two dimensions between individuals of different age. The first dimension is the risk of being convicted to a custodial sentence, the second is the unpleasantness associated with this custodial sentence that will differ according to the institution where the custodial sentence needs to be served (Katz et al., 2003, use a similar idea, i.e., that the conditions encountered during imprisonment can lead to variation in expected punishment and thus deterrence.):

- For individuals below 15 years of age expected punishments change only slightly if at all. These individuals cannot not be sentenced to a custodial sentence, so the only difference for them would be a change in a potential fine
- For individuals above 15, the declassification lowers the risk of receiving a custodial sentence. The fact that the type of institution offenders are sent to in case of a conviction changes at 18 and 21 creates further variation within this group.

Data

This paper uses the four-year panel version of the Offending, Crime and Justice Survey (OCJS) for the years 2003 to 2006. The data were collected by BMRB Social Research and the National Centre for Social Research (NatCen) on behalf of the Home Office with the aim to provide a longitudinal picture of the prevalence of offending and drug use among the general population, in particular among young people. Fieldwork took place between January and July in 2003, between January to September in 2004 and between January and October in 2005 and 2006. The sample covers individuals living in England and Wales who were between 10 and 25 years of age at the time of the first wave in 2003. In each wave individual from the previous waves were re-interviewed. In addition, refreshment samples were drawn in each year the survey was conducted. The version of the OCJS used here is the longitudinal version provided by the Home Office via the Economic and Social Data Service. As this paper uses secondary data analysis from publicly available data sources, additional ethical approval was not required. The data cover all individuals who were interviewed in each of the four waves the survey was conducted, in total 2539 individuals and 10,156 person-year observations. As there is a potential concern with selective attrition, we also estimated all regressions using the four cross-sectional

datasets of the Offending, Crime and Justice Survey as well as an unbalanced panel.

The results were qualitatively identical.

Cannabis consumption is measured by a dummy variable that is “1” if the individual reports to have consumed any cannabis in the previous year. As outcomes we consider the consumption of a range of drugs, in particular, heroin, cocaine, crack, amphetamines, ecstasy, acid, amyl nitrites and glue, as well as a summary measure for the consumption of any class A drug. These are all measured by dummy variables that are “1” if an individual took the respective drug at least once per year. In terms of crime, we look at a range of dummy variables that are “1” if an individual reports to have committed a certain type of crime in the respective year. We look at general crime as well as violent and property crime and also consider various subcategories. Finally, we also have data on a range of low-level criminal activities that can be classified as anti-social behaviour, as well as information on victimization. All of these variables are self-reported, which might lead to measurement error problems discussed in the next subsection. However, the crime and drug use data was collected using computer assisted self-completion to minimise individuals over- or understating their criminal behaviour.

Table 1 present descriptive statistics for the whole estimation sample.

(TABLE 1 ABOUT HERE.)

Estimation

Our basic estimation strategy is a difference-in-differences type of design where we exploit different intensities in treatment among individuals aged 10 to 14, 15 to 17, 18 to 20 and 21 and older. Our base group are 10 to 14 years, i.e., the group where the declassification led to the lowest change in punishment. Our basic estimating equation is

$$Y_{it} = a_i + f_t + b' f(\text{age}_{it}) + \sum_{k=1}^3 t^k * (\text{treat}_{it}^k - \text{post}_{it}) + e_{it}, \quad (2)$$

where Y_{it} is the respective measure of cannabis consumption of individual i observed in year t . a_i is an individual-level fixed effect that captures time-constant variables such as family background. f_t are year dummies. We also control for the individual's age through a set of dummies for each year of age. The coefficient of interest is t^k which measures changes in cannabis consumption between individuals in age group k relative to individuals aged 10 to 14 (marked by treat_{it}^k) after the declassification (marked by post_{it}). Note that the effects of treat_{it}^k are not identified, as group membership is based on age and thus perfectly collinear with the age dummies. Similarly the base effect of post_{it} is not identified due to the year dummies. The effect of their interaction, however, is identified from the data. Note that individuals can change the treatment group they are in if they cross one of the age thresholds. This, however, is what we want as their expected punishment and hence their incentives to consume cannabis would change at the same time.

Note that this design implies that we identify t^k using the differential impact the declassification had on the four age groups. Changes to general police practices or the price of cannabis after the declassification cannot be detected with this design. As such our estimates are closer to studies looking into changes to penalties and police enforcement than to studies incorporating price effects.

A concern with the presence of the individual fixed effects is a possible exacerbation of measurement error resulting in attenuation bias towards zero. This problem would be more severe if there was comparatively little variation in cannabis consumption (or other variables of interest) within individuals over years. Table 2 plots year-to-year-

changes in the consumption of cannabis. As we can see there is always a sizeable number of cases starting or stopping to consume cannabis between each pair of years. Pooled over all years, 3% of the under 15-year-olds, 22% of the 15 to 17-year-olds, 29% of the 18 to 20-year-olds and 21% of the over-21-year-olds consumed cannabis. We also looked at the percentage of variation in cannabis consumption that is explained by the fixed effects, year dummies and age alone. For both annual and monthly consumption these factors explain approximately 50% of the total variation, i.e., there is sufficient variation left that could be influenced by the policy.

(TABLE 2 ABOUT HERE.)

As an additional robustness check we also re-estimate equation (2) as a pooled OLS model without fixed effects. The fixed effects in principle control for potential composition bias in the various treatment groups, however, as the treatment groups are defined by an exogenous variable (age) crossing a threshold we would expect the impact of composition bias to be relatively minor anyway.

Note that Y_{it} is usually a dummy, which means that equation (2) is a linear probability model. This fact, however, is not particularly problematic in this case as equation (2) is close to a saturated regression model as all right-hand side variables in our preferred specification are dummy variables. This fact attenuates concerns regarding the linearity assumption typically leading to differences between linear probability models and non-linear models such as Probit (see Angrist and Pischke, 2009, ch. 5.2.1).

It is important to stress that the fact that the declassification was not surprising but was announced and widely discussed prior to 2004 is not a threat to identification in equation (2): The idea underlying our approach is that individuals will react to the change in punishment which came into effect in 2004, not to the earlier

announcement that punishment will change in 2004. This idea seems relatively plausible as long as individuals are deterred from consumption by the higher punishment under the old regime. A potential violation could arise because of misinformation or the belief that courts would treat consumers more leniently in advance of the declassification. However, this possibility seems relatively far fetched. Furthermore, the fact that there are strong age effects in most outcomes (see Figure 2 for cannabis consumption – other outcomes also show strong age effects) is not problematic due to inclusion of the age dummies. A potential threat to identification would be other events that would operate along the same age group margin as the cannabis declassification, in particular other changes to criminal law that would lead to similar changes in expected punishment. Fortunately, there were no such changes during the observation period.

(FIGURE 2 ABOUT HERE.)

Due to the lack of a long time series pre-treatment it is difficult to test the validity of the common trend assumption across the four groups from the micro data used here. Figure 3 presents evidence on trends from an annual report by the British Home Office (Home Office, 2012). Unfortunately, the data does not contain any information for individuals below 16 and the age groups are slightly different from the ones used in this paper. Keeping these problems in mind, the aggregate data at least does not show vastly different trends among the different age groups, which is reassuring.

(FIGURE 3 ABOUT HERE.)

Finally, we employ a basic placebo test where we estimate equation (2) with various outcomes that should be largely uninfluenced by the declassification. Specifically, we look at (grouped) household income, marital status, labour force status, whether the individual is/was brought up by both parents, whether he is currently a tenant,

whether there is disorder in the area of residence, whether he considers crime to be okay, whether he trusts local people and whether he has a negative attitude towards the local area. Obviously, some of these variables could be influenced by cannabis consumption; however, it seems plausible that the declassification should have very weak and indirect, if any, effects on them. Results can be found in table 3. If these resulted in statistically significant impacts of the declassification, we would have strong indications that unobservables are driving the differences between the four groups. Luckily, the results do not indicate any such pattern, even though some of the estimates are imprecise enough to allow for substantial differences to go undetected. While there are significant effects on one or two variables, these are well within the range of false positives one would expect and there is no consistent pattern that would indicate any problems.

(TABLE 3 ABOUT HERE.)

Results

Consider first figure 4, which plots the change in the proportion of individual who report to have taken cannabis at least once a year pre and post declassification. The figure suggests that – while changes in consumption vary considerably with age – there is no clear pattern across age groups more or less affected by the declassification.

(FIGURE 4 ABOUT HERE.)

The estimates in table 4 confirm these results. Overall there are very few statistically significant and economically large effects: There appears to be a 4.6% increase in the likelihood to consume cannabis after 2004 in the 15 to 17-age group, but only if one looks at the fixed effects estimates. At the same time, however, we observe (non-

significant) decreases in the likelihood of cannabis consumption in the two older age groups and no statistically significant impact on the likelihood of regular (monthly) cannabis consumption, except for one age group in the pooled OLS results where a statistically significant decrease is seen. For other drugs, there are generally almost no changes in consumption patterns – including for the age group where an increase in cannabis consumption could be observed. However, some of the estimates are not very precise and could in principle allow for fairly large increases in consumption to go undetected. Overall, these results do not appear to lend much support to the idea that cannabis depenalisation increases consumption of cannabis or might even induce people to consume other drugs, even though it is possible that it led to a higher number of first-time users among 15 to 17-year olds. The previous literature on cannabis deregulation is very heterogeneous in terms of findings, but it appears as if our results suggest at most a relatively modest effect of the declassification.

(TABLE 4 ABOUT HERE.)

Consider now the results on crime in table 5. Given that there does not appear to have been an increase in drug consumption, some of the theoretical arguments for a link between cannabis depenalisation mentioned in the introduction can be ruled out a priori except for the 15 to 17-age group. Specifically, explanations such as people committing property crimes to obtain money for buying drugs or any direct behavioural consequence of drug consumption would require an increase in drug consumption as a starting point. It would, however, still be possible to observe an increase in crime if teenagers or young adult gain consumption value from illicit behaviour, cannabis loses part of its appeal due to the depenalisation and people substitute cannabis consumption with other forms of illicit or risky behaviour.

The evidence in table 5 suggests no increases in crime for any of the older groups where we also did not observe an increase in consumption. However, some of the point estimates are fairly large and are just rendered insignificant by large standard errors. For the 15 to 17-age group, where we also observed an increase in cannabis consumption, the fixed effects estimates suggest an increase in the likelihood of having committed a property offence by 5% to 7%, depending on whether minor theft is included. There are no increases in violent crime in any of the groups following the declassification. Interestingly, however, there appears to be an increase in the production of drugs for individuals older than 21. In principle, this could be a consequence of the declassification, either because of an increase in demand or because individuals misinterpret the fact that production penalties have not changed.

(TABLE 5 ABOUT HERE.)

We also considered more disaggregated crime categories,. Detailed results are available on request, but broadly spoken, the estimates suggest that the increases in property crime observed for the 15 to 17 year-olds are driven by increases in criminal damage and other theft, i.e., relatively low-level crimes relative to other property crime such as robbery and burglary. Impacts on other types of crime are usually small and often insignificant. Overall, the results do not strongly suggest that the cannabis declassification led to an increase in crime rates: Most of the results are small and insignificant, and, more importantly, there is no consistent picture over treatment groups or estimation methods and the few significant effects that are found might be very well due to chance.

We also considered a possible effect on risky behaviour in general as well as going out and drinking. For the latter Anderson, Hansen and Rees (2013a) found some evidence that alcohol and cannabis are substitutes in the US. Detailed results are again

available on request, but the estimates suggest that risky behaviour, such as graffiti spraying, being unruly and noisy, the carrying of weapons and victimization, did not increase after the declassification. If anything, the estimates suggest substantial reductions in racially motivated attacks and victimization risks among 15 to 17 year-olds, while there are essentially no impacts in any of the other groups. For going out and drinking, our results suggest no consistent pattern of changes to either clubbing, visiting pubs or drinking. If anything, moderate drinking seems to have increased in some age groups, while heavy drunkenness remained essentially unchanged.

The overall picture that emerges from these estimates suggests that following the declassification there do not appear to have been any increases in cannabis consumption in the groups that should have benefitted more from the declassification. There appears to have been a slight increase in occasional (but not regular) cannabis consumption among 15 to 17 year-olds, although this result might very well be due to chance. In the same group there has also been an increase in property crimes, driven by relatively low-level offences such as criminal damage and other theft. There does not appear to have been an increase in violent crime, drug crime or more serious property crime in any of the groups. Among 15 to 17 year-olds there also appears to have been a drop in victimization risks. Some of these results, however, depend on whether individual fixed effects are included. Overall, the estimates certainly do not suggest that individuals react very strongly to reductions in penalties associated with cannabis consumption, neither in terms of drug consumption nor in terms of other forms of criminal or risky behaviour. It is important, however, to be clear that our estimates cannot detect consumption changes caused by changes to the price of cannabis. The previous literature has regularly found strong demand reactions to these and prices might well have changed in response to the declassification. Our paper is

closer to the part of the literature looking at changes to penalties, police enforcement or decriminalisation more generally. Our findings are also broadly in line with this literature in the sense of not finding very much evidence that decriminalisation of cannabis leads to large increases in consumption.

Conclusion

We exploited differences in the expected punishment for cannabis consumption through the 2004 cannabis declassification in the UK across various age groups. Our results from difference-indifferences estimates do not suggest strong increases in cannabis consumption or indeed crime, risky behaviour or drug consumption more generally in the age groups that benefitted more from the declassification. There is some evidence that cannabis consumption and some forms of property crime increased among 15 to 17 year-olds. At the same time, however, racially motivated attacks and victimization risks dropped. Overall, the estimates certainly do not suggest that individuals react very strongly to reductions in penalties associated with cannabis consumption, neither in terms of drug consumption nor in terms of other forms of criminal or risky behaviour.

References

- Adda, J., McDonnel, B. & Rasul, I. (2011). Crime and the depenalisation of cannabis possession: Evidence from a policing experiment. *Mimeo*, London and Florence.
- Anderson, D.M., Hansen, B. & Rees, D.I. (2013a). Medical Marijuana laws, traffic fatalities, and alcohol consumption. *Journal of Law and Economics*, 65, 333-369.
- Anderson, D.M., Hansen, B. & Rees, D.I. (2013b). Medical Marijuana laws and teen

- Marijuana use. *Mimeo*, Montana, Oregon, Denver.
- Angrist, J.D. (2001). Estimation of Limited-Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice. *Journal of Business and Economic Statistics*, 19, 2-28.
- Angrist, J. D. & Pischke, J.S. (2009). *Mostly harmless econometrics – an empiricist’s companion*. Princeton: Princeton University Press.
- Becker, G.S. (1968). Crime and Punishment: An Economic Approach. *Journal of Political Economy*, 78, 526–536.
- Braakmann, N. (2012). Deterrence and age thresholds in punishment in British criminal law. *Mimeo*, Newcastle upon Tyne.
- Bretteville-Jensen, A.L. (2006). To legalize or not to legalize? Economic approaches to the decriminalization of drug. *Substance Use and Misuse*, 41, 555-565.
- Bretteville-Jensen A & Williams, J. (2011). Decriminalization and Initiation into Cannabis. University of Melbourne, *Department of Economics Working Paper 1130*.
- Bryan, M., Del Bono, E. & Pudney, S. (2013). *Licensing and regulation of the cannabis market in England and Wales: Towards a cost-benefit analysis*. Essex: Institute for Social and Economic Research,.
- Burgess, S.M. & Propper, C. (1998). Early health-related behaviors and their impact on later life chances: evidence from the US. *Health Economics*, 7, 381–399.
- Card, D. (1992). Using regional variation in wages to measure the effects of the Federal minimum wage. *Industrial and Labor Relations Review*, 46, 22-37.
- Chaloupka F.J., Grossman, M. & Tauras, J.A. (1999). The Demand for Cocaine and Marijuana by Youth. In: F. Chaloupka, M. Grossman, W. Bickel, & H. Saffer, (Eds.), *The Economic Analysis of Substance Use and Abuse: An Integration of*

- Econometric and Behavioral Economic Research* (pp. 133-155). NBER Conference Report Series. Chicago and London: University of Chicago Press.
- Chaloupka, F.J., Pacula, R.L., Farrelly, M.S., Johnston, L.D. & O'Malley, P.M. (1999). Do Higher Cigarette Prices Encourage Youth to Use Marijuana? *NBER Working Paper 6939*.
- Clements K & Zhao, X. (2009). *Economics and Marijuana*. Cambridge: Cambridge University Press.
- Department of Health (2008). *United Kingdom drug situation: annual report to the European Monitoring Centre for Drugs and Drug Addiction 2008*. London.
- DeSimone J. (2002). Illegal drug use and employment. *Journal of Labor Economics*, 20, 952–977.
- DeSimone J, & Farrelly, M.C. (2003). Price and Enforcement Effects on Cocaine and Marijuana Demand. *Economic Inquiry*, 41, 98-115.
- DiNardo, J.E. & Lemieux, T. (2001). Alcohol, marijuana and American youth: the unintended consequences of government regulation. *Journal of Health Economics*, 20, 991-1010.
- Farrelly, M.C., Bray, J.W., Zarkin, G.A., Wendling, B.W. & Pacula, R.L. (1999). The effects of prices and policies on the demand for marijuana: Evidence from the National Household Surveys on Drug Abuse. *NBER Working Paper 6940*.
- Fergusson, D.M. & Horwood, L.J. (1997). Early onset cannabis use and psychosocial adjustment in young adults. *Addiction*, 92, 279-296.
- Freeman, R.F., 1999. The economics of crime. In O. Ashenfelter & D. Card (Eds.), *Handbook of Labor Economics 3C* (pp. 3529-3571), Amsterdam: Elsevier.
- French, M.T., Roebuck, M.C. & Alexandre, P.K. (2001). Illicit drug use, employment and labor force participation. *Southern Economic Journal*, 68, 349–368.

- Gill, A.M. & Michaels, R.J. (1992). Does drug use lower wages? *Industrial and Labor Relations Review*, 45, 419–434.
- Grogger, J.T. & Willis, M. (2000). The emergence of crack cocaine and the rise in urban crime rates. *Review of Economics and Statistics*, 82, 519-529.
- Hjalmarsson, R. (2009). Crime and Expected Punishment: Changes in Perceptions at the Age of Criminal Majority. *American Law and Economics Review*, 11, 209-248.
- Home Office (2012). *Drug Misuse Declared: Findings from the 2011/12 Crime Survey for England and Wales*. London.
- Jacobson, M. (2005). Baby Booms and Drug Busts: Trends in Youth Drug Use in the United States 1975-2000. *Quarterly Journal of Economics*, 119, 1481-1512.
- Johnston, L., O'Malley, P. & Bachman, J. (1981). *Marijuana Decriminalization: The Impact on Youth 1975-1980*. Ann Arbor: Institute for Social Research
- Kaestner, R. (1991). The effects of illicit drug use on the wages of young adults. *Journal of Labor Economics*, 9, 381–412.
- Kaestner, R. (1994). New estimates of the effects of marijuana and cocaine use on wages. *Industrial and Labor Relations Review*, 47, 454–470.
- Katz, L.F., Levitt, S.D. & Shustorovich, E. (2003). Prison Conditions, Capital Punishment and Deterrence. *American Law and Economics Review*, 5, 318–343.
- Klick, J. & Tabarrok, A. (2012). Police, Prisons and Punishment: The Empirical Evidence on Crime Deterrence. In: B.L. Benson & P.R. Zimmerman (Eds.), *Handbook of the Economics of Crime* (pp. 127-144). Cheltenham, UK and Northampton, MA: Edward Elgar Publishing.

- Lee, D. S. & McCrary, J. (2012). The Deterrence Effect of Prison: Dynamic Theory and Evidence. *Mimeo*.
- Levitt, S. D. (1998). Juvenile Crime and Punishment. *Journal of Political Economy*, 106, 1156-1185.
- MacCoun, R.J. (2010). Examining the non-price effects of legalization on cannabis consumption. *RAND working paper WR-767-RC*.
- MacDonald, Z. & Pudney, S. (2000). Illicit drug use, unemployment, and occupational attainment. *Journal of Health Economics*, 19, 1089–1115.
- Markowitz, S. & Tauras, J. (2009). Substance use among adolescent students with consideration of budget constraints. *Review of Economics of the Household*, 7, 423-446.
- Melberg, H.O., Jones, A.M. & Bretteville-Jensen, A.L. (2010). Is cannabis a gateway to hard drugs? *Empirical Economics*, 38, 583-603.
- Nisbet, C.T. & Vakil, F. (1972). Some Estimates of the Price and Expenditure Elasticities of Demand for Marijuana Among U.C.L.A. Students. *Review of Economics and Statistics*, 54, 473-475.
- Van Ours, J.C. (2003). Is cannabis a stepping stone for cocaine? *Journal of Health Economics*, 22, 539-554.
- Van Ours, J.C. (2006). Cannabis, cocaine and jobs. *Journal of Applied Econometrics*, 21, 897-917.
- Van Ours, J.C. (2007). The effects of cannabis use on wages of prime-age males. *Oxford Bulletin of Economics and Statistics*, 69, 619-634.
- Van Ours, J.C. & Williams, J. (2009). Why parents worry: Initiation into cannabis use by youth and their educational attainment. *Journal of Health Economics*, 28, 132-142.

- Van Ours, J.C. & Williams, J., 2011. Cannabis use and mental health Problems. *Journal of Applied Econometrics*, 26, 1137-1156.
- Van Ours, J.C. & Williams, J., 2012. The effects of cannabis use on physical and mental health. *Journal of Health Economics*, 31, 564-577.
- Pacula RL (1998). Can Increasing the Beer Tax Reduce Marijuana Consumption? *Journal of Health Economics*, 17, 557-586.
- Pacula, R.L. (2010). Examining the impact of marijuana legalization on marijuana consumption. *RAND working paper WR-770-C*.
- Pacula RL, Chiqui, J & King, J. (2003). Decriminalization in the United States: What does it mean? *NBER Working Paper 9690*.
- Pacula R.L., Grossman, M., Chaloupka, F.J., O'Malley, P., Johnston, L.D. & Farrelly, M.C., 2001. Marijuana and Youth. In Jonathan Gruber (Ed), *Risky Behavior Among Youth: An Economic Analysis* (pp. 271-326). Chicago: University of Chicago Press.
- Pacula, R.L. & Kilmer, B. (2003). Marijuana and crime: Is there a connection beyond prohibition? *NBER Working Paper 10046*.
- Police Foundation (2000). *Drugs and the law: Report of the inquiry into the Misuse of Drugs Act 1971*, London: Police Foundation.
- Pudney, S. (2003). The road to ruin? Sequences of initiation to drugs and crime in Britain. *Economic Journal*, 113, C182-C198.
- Pudney, S. (2004). Keeping off the grass? An econometrics analysis of cannabis consumption in Britain. *Journal of Applied Econometrics*, 19, 435-453.
- Pudney, S. (2010). Drug policy: what should we do about cannabis? *Economic Policy*, 25, 165-211.
- Register, C.A. & Williams, D.R. (1992). Labor market effects of marijuana and

- cocaine use among young men. *Industrial and Labor Relations Review*, 45, 435–448.
- Saffer, H. & Chaloupka, F.J. (1999). The Demand for Illicit Drugs. *Economic Inquiry*, 37, 401-411.
- Thies, C. & Register, C. (1993). Decriminalization of Marijuana and the Demand for Alcohol, Marijuana and Cocaine. *The Social Science Journal*, 30, 385-399.
- Williams, J., Pacula, R.L., Chaloupka, F.J. & Wechsler H. (2004). Alcohol and Marijuana Use Among College Students: Economic Complements or Substitutes" *Health Economics*, 13, 825-843.
- Zarkin G.A., French, M.T., Mroz, T.A. & Bray, J.W. (1998). The relationship between drug use and labour supply for young men. *Labour Economics*, 5, 385–409.

Table 1: Descriptive statistics

Variable	Mean	Std.dev.	Min.	Max.
Aged 15 to 17	0.258	0.438	0	1
Aged 18 to 20	0.162	0.368	0	1
Aged above 21	0.257	0.437	0	1
Age	17.4	4.5	10	29
Household income £20k to £30k	0.154	0.361	0	1
Household income £30k or higher	0.300	0.458	0	1
Unemployed	0.024	0.152	0	1
Inactive	0.070	0.255	0	1
Married	0.042	0.200	0	1
Cohabiting	0.075	0.263	0	1
Not brought up by both parents	0.323	0.468	0	1
Tenant	0.286	0.452	0	1
Disorder problems in local area	0.677	0.468	0	1
Considers crime to be okay	0.089	0.285	0	1
Trusts local people	0.310	0.462	0	1
Has negative attitude towards local area	0.205	0.404	0	1
Any offence last year	0.225	0.418	0	1
Any offence, minus minor offences	0.211	0.408	0	1
Any serious offence last year	0.107	0.310	0	1
Any property offence last year	0.125	0.330	0	1
Any property offence, minus minor heft	0.115	0.319	0	1
Any violent offence last year	0.145	0.352	0	1
Any violent offence, minus school fights	0.134	0.340	0	1
Any vehicle theft	0.013	0.115	0	1
Any drug offence	0.029	0.168	0	1
Taken cannabis at least once per year	0.167	0.373	0	1
Taken cannabis monthly	0.081	0.273	0	1
Age taken up cannabis (only cannabis users)	17.8	3.5	10	29
Taken amphetamine at least once per year	0.022	0.145	0	1
Taken cocaine at least once per year	0.038	0.191	0	1
Taken crack at least once per year	0.003	0.050	0	1
Taken ecstasy at least once per year	0.030	0.171	0	1
Taken heroin at least once per year	0.001	0.035	0	1
Taken acid at least once per year	0.015	0.123	0	1
Taken amyl-nitrite at least once per year	0.027	0.163	0	1
Taken glue at least once per year	0.008	0.091	0	1
Taken any class A drug at least once per year	0.055	0.227	0	1
Individuals		2521		
Person-year-observations		9521		

Table 2: Year-to-year changes in cannabis consumption

	2003 to 2004	2004 to 2005	2005 to 2006
Does not consume in t, consumes in t+1	139	179	146
Consumes in t, does not consume in t+1	88	123	147
Consumes in both years	204	268	297
Does not consume in both years	1705	1844	1860

Table 3: Placebo test, impact of declassification on various outcomes that it should not have influenced

	HH income £20k to £30k	HH income greater than £30k	Unemployed	Inactive	Married	Cohabiting	Not brought up by both parents	Tenant	Disorder in local area	Considers crime to be okay	Trusts local people	Has negative attitude towards local area
Pooled OLS												
Post 2004 * 15 to 17	-0.007 (0.023)	0.015 (0.029)	0.011** (0.005)	0.002 (0.007)	0.004*** (0.001)	0.005* (0.003)	0.005 (0.032)	0.020 (0.030)	0.023 (0.032)	-0.009 (0.018)	0.004 (0.019)	0.006 (0.024)
Post 2004 * 18 to 20	-0.034 (0.027)	0.011 (0.033)	-0.010 (0.015)	-0.036* (0.020)	-0.001 (0.006)	-0.023 (0.018)	-0.042 (0.034)	- 0.071** (0.034)	0.037 (0.036)	-0.036* (0.021)	-0.026 (0.032)	-0.049 (0.032)
Post 2004 * above 21	-0.000 (0.024)	-0.029 (0.030)	-0.003 (0.010)	- 0.044** (0.017)	-0.022 (0.015)	0.001 (0.020)	-0.034 (0.026)	-0.019 (0.028)	0.036 (0.030)	-0.008 (0.015)	0.061*** (0.023)	-0.036 (0.026)
Fixed effects												
Post 2004 * 15 to 17	0.009 (0.030)	-0.011 (0.036)	0.006 (0.010)	0.003 (0.011)	-0.003** (0.001)	0.005 (0.008)	0.004 (0.017)	0.014 (0.013)	-0.008 (0.033)	-0.007 (0.022)	-0.010 (0.027)	-0.006 (0.027)
Post 2004 * 18 to 20	0.020 (0.035)	-0.006 (0.043)	-0.029 (0.021)	0.016 (0.021)	0.016* (0.009)	0.019 (0.021)	-0.006 (0.013)	-0.037 (0.024)	-0.003 (0.042)	-0.031 (0.027)	-0.072* (0.037)	-0.020 (0.034)
Post 2004 * above 21	0.052 (0.034)	-0.008 (0.042)	-0.008 (0.014)	-0.006 (0.017)	0.023* (0.014)	0.001 (0.024)	-0.009 (0.013)	-0.016 (0.021)	-0.045 (0.038)	-0.010 (0.021)	0.058** (0.029)	-0.065** (0.030)
Person-year- obs.	9521	9521	9521	9521	9521	9521	9521	9521	9521	9521	9521	9521
Individuals	2521	2521	2521	2521	2521	2521	2521	2521	2521	2521	2521	2521
P-value OLS vs FE ^a	0.1309	0.6079	0.5353	0.0057	0.0000	0.2540	0.4780	0.7468	0.0887	0.9932	0.4834	0.4805

Coefficients, standard errors adjusted for clustering on the individual level in parentheses. */**/** denote statistical significance on the 10%, 5% and 1% level respectively. All estimates contain year dummies and the individual's age in dummies.

^a Test of equality of the coefficients in the OLS and FE estimates

Table 4: Cannabis declassification and drug consumption (at least once per year unless otherwise stated)

	Cannabis	Cannabis monthly	Amphetamine	Cocaine	Crack	Ecstasy	Heroin	Acid	Amyl-Nitrite	Glue	Any class A drug
Pooled OLS											
Post 2004 * 15 to 17	0.005 (0.021)	-0.003 (0.015)	0.005 (0.006)	0.004 (0.007)	-0.003 (0.003)	-0.000 (0.008)	-0.003 (0.002)	0.000 (0.006)	-0.020** (0.010)	-0.006 (0.006)	0.006 (0.009)
Post 2004 * 18 to 20	-0.018 (0.030)	-0.048** (0.024)	0.020* (0.012)	-0.002 (0.016)	-0.004 (0.004)	0.009 (0.015)	-0.000 (0.001)	0.003 (0.011)	0.003 (0.014)	-0.008 (0.007)	-0.010 (0.020)
Post 2004 * above 21	-0.031 (0.020)	-0.021 (0.015)	0.002 (0.009)	0.009 (0.013)	-0.001 (0.004)	0.011 (0.011)	0.001 (0.003)	0.001 (0.007)	0.008 (0.009)	-0.004 (0.004)	0.012 (0.013)
Fixed effects											
Post 2004 * 15 to 17	0.046** (0.023)	0.008 (0.017)	0.008 (0.009)	0.016 (0.011)	-0.006* (0.003)	0.014 (0.011)	-0.003 (0.002)	0.003 (0.008)	-0.003 (0.013)	0.007 (0.007)	0.014 (0.013)
Post 2004 * 18 to 20	-0.026 (0.031)	-0.038 (0.025)	0.043** (0.018)	-0.003 (0.018)	-0.001 (0.005)	0.021 (0.020)	0.004 (0.004)	0.020 (0.016)	-0.025 (0.018)	-0.005 (0.011)	0.012 (0.022)
Post 2004 * above 21	-0.016 (0.023)	-0.007 (0.017)	0.003 (0.013)	-0.008 (0.015)	0.002 (0.004)	0.018 (0.013)	-0.002 (0.002)	0.007 (0.009)	0.013 (0.012)	-0.006 (0.006)	0.008 (0.015)
Person-year-obs.	9521	9521	9521	9521	9521	9521	9521	9521	9521	9521	9521
Individuals	2521	2521	2521	2521	2521	2521	2521	2521	2521	2521	2521
P-value OLS vs FE ^a	0.3745	0.7697	0.4870	0.4370	0.1275	0.4463	0.4282	0.5044	0.1372	0.1871	0.7227

Coefficients, standard errors adjusted for clustering on the individual level in parentheses. */**/** denote statistical significance on the 10%, 5% and 1% level respectively. All estimates contain year dummies and the individual's age in dummies.

^a Test of equality of the coefficients in the OLS and FE estimates

Table 5: Cannabis declassification and crime (at least once per year)

	Any offence	Any offence, except minor offences	Any serious offence	Any property offence	Any property offence, except minor theft	Any violent offence	Any violent offence, except school fights	Drug offence (production & distribution)
Pooled OLS								
Post 2004 * 15 to 17	-0.029	-0.016	-0.014	-0.014	-0.013	-0.038	-0.018	-0.000
	(0.030)	(0.028)	(0.022)	(0.023)	(0.023)	(0.026)	(0.025)	(0.010)
Post 2004 * 18 to 20	-0.001	0.003	-0.013	-0.015	-0.005	-0.007	0.002	-0.013
	(0.033)	(0.032)	(0.024)	(0.025)	(0.024)	(0.028)	(0.027)	(0.015)
Post 2004 * above 21	0.004	0.009	-0.012	-0.025	-0.025	0.006	0.014	0.019***
	(0.025)	(0.023)	(0.018)	(0.019)	(0.018)	(0.020)	(0.019)	(0.007)
Fixed effects								
Post 2004 * 15 to 17	0.053	0.059*	0.024	0.067**	0.058**	0.020	0.042	0.008
	(0.033)	(0.032)	(0.026)	(0.028)	(0.028)	(0.030)	(0.029)	(0.013)
Post 2004 * 18 to 20	0.050	0.049	-0.000	0.040	0.041	0.014	0.026	0.007
	(0.040)	(0.039)	(0.030)	(0.032)	(0.031)	(0.034)	(0.033)	(0.019)
Post 2004 * above 21	0.022	0.031	-0.034	-0.021	-0.009	0.000	0.011	0.021*
	(0.031)	(0.030)	(0.024)	(0.025)	(0.024)	(0.026)	(0.025)	(0.011)
Person-year-obs.	9521	9521	9521	9521	9521	9521	9521	9521
Individuals	2521	2521	2521	2521	2521	2521	2521	2521
P-value OLS vs FE ^a	0.0293	0.0620	0.0596	0.0018	0.0154	0.0532	0.0386	0.6616

Coefficients, standard errors adjusted for clustering on the individual level in parentheses. */**/** denote statistical significance on the 10%, 5% and 1% level respectively. All estimates contain year dummies and the individual's age in dummies.

^a Test of equality of the coefficients in the OLS and FE estimates

Figure 1: Probability to be arrested for a drug possession offence by age group

Figure 2: Cannabis consumption by age

Note. The dashed lines indicate the four different age groups used in the analysis.

Figure 3: Trends in cannabis consumption by age group, 1996 to 2011.

Source: Home Office (2012), Table D.03.

Note: The dashed line indicates the timing of the declassification in 2004.

Figure 4: Changes in cannabis consumption by age pre-/post declassification

Note. The dashed lines indicate the four different age groups used in the analysis.