

# Why do some people want to legalize cannabis use?

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## Abstract

Drug policy is one of the more contentious and emotionally charged issues faced by policy makers. It is also an area in which the attitudes and preferences of voters significantly shape policy outcomes. In this paper we study the determinants of individual's preferences over legalizing the consumption of cannabis. We find that in addition to current users, past users of cannabis are also in favor of legalizing cannabis. This result is robust to accounting for the potential endogeneity of current and past experience with cannabis use. Predictions from theory provide a means of learning about the roles of information and self interest in explaining differences in attitudes to legalization. All in all, our results suggest that the pro-legalization stance amongst past users (and to some extent current users) indicates that on average, the benefits of cannabis use out weight the harms for our sample. While the positive correlation between the proportion of peers who have used cannabis and a pro-legalization attitude may reflect information effects for abstainers and past users, for current users it is more likely to reflect mutual self-interest in reducing the user cost of cannabis consumption.

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# 1 Introduction

Globally, cannabis policy has been experiencing a renaissance. While the Californian referendum to legalize cannabis in 2010 attracted much attention, the legal landscape shaping US cannabis policy had already been vastly transformed by the introduction of medical marijuana laws in 14 states.<sup>1</sup> In Europe, a policy of tolerance has existed in the Netherlands since 1976. Under this policy, the possession and consumption of small amounts of cannabis is not pursued by the police or courts and cannabis can be freely purchased in so called “coffee shops”. More recently, cannabis use has been decriminalized in Portugal and the Czech Republic. Not all policy changes have produced more lenient regimes for the use of cannabis. For example, in 2007 the UK Government controversially reversed its 2004 decision to decriminalize cannabis use and possession. The decision to reclassify cannabis was made despite recommendations to the contrary by the government’s own scientific advisory board and was justified on the basis of public perceptions of harm.

It is widely accepted that the attitudes and preferences of voters are an important determinant of public policies. As a consequence, the economics literature has become increasingly interested in understanding the determinants of attitudes to policy issues such as immigration (Scheve and Slaughter, 2001a; O’Rourke and Sinnott, 2006; Mayda, 2006) trade (Mayda and Rodrik, 2004; Scheve and Slaughter, 2001b; O’Rourke and Sinnott, 2001) and redistribution (Alesina and Fuchs-Schndeln, 2007; Alesina and Ferrara, 2005). In this paper, we study the determinants of attitudes to cannabis policy.

Cannabis policy directly affects the welfare of a large proportion of the population in many countries. In the US, the UK and Australia, over 30% of the population have used cannabis and, in doing so, have broken the law. While there is a substantial literature analyzing optimal crime policy, there are surprisingly few papers on the question of optimal drug policy. The small number of papers that do exist provide some interesting insights but disagree over whether criminalization is optimal. Glaeser and Shleifer (2001) claim that

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<sup>1</sup>These laws provide for the legal use of cannabis when prescribed by a doctor. Combined with assurances from the US Attorney General Office that the Federal Government, whose laws strictly prohibit the use of cannabis in all circumstances, will not over-ride states law, medical marijuana laws have lead to the widespread establishment of “dispensaries” openly selling cannabis.

criminalization is preferred to a regime in which drugs are legal and subject to taxation. Their conclusion reflects the assumption that illegal drug activities are easier to detect than tax evasion. Becker et al. (2006) provide results to the contrary. Their argument is based on enforcement costs being very high. Pudney (2010) argues that the empirical evidence is simply not good enough to determine whether criminalizing or legalizing drugs should be preferred. One aspect that has received very little attention is the role of preferences and attitudes of individuals in shaping drug policy.

To understand the development of drug policies we need to know who is in favor of more lenient policies and why this is the case. Our paper is the first to investigate individuals preferences over cannabis policy and how these preferences are affected by experience with cannabis use. In particular, we investigate whether there are differences in the level of support for legalization of cannabis amongst current users, past users and abstainers. Further, we attempt to gain some insight into the factors underlying these preferences. For example, if users of cannabis are more in favor of legalization than abstainers, is this because they are better informed about the costs and benefits of using cannabis or is it simply because legalization reduces the user of cost of their consumption? We use the theory of rational addiction with learning and regret (Orphanides and Zervos, 1995) to get some traction on this issue. On the basis of this model, we develop predictions about the relationship between preferences for legalization and various dimensions of own and peer experience with cannabis that distinguish between information and self-interest as the basis on which preferences are formed.<sup>2</sup>

Our empirical analysis draws on information from six waves of the Australian National Drug Strategy Household Survey, spanning the period 1993 to 2007, and proceeds in three steps. First, we use individual level data to describe the empirical relationship between preferences for legalization and experience with cannabis use controlling for individual characteristics and the state level policy environment. Second, we construct a pseudo panel where the unit of analysis is cohort defined in terms of age in 1993, gender, and

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<sup>2</sup>We use the term self-interest to denote the situation in which an addict, who may regret being an addict in the sense of Orphanides and Zervos (1995), may still prefer legalization because it reduces the user cost of cannabis consumption.

state of residence. This allows us to use panel data techniques to address the potential endogeneity of current and past experience with cannabis use. Finally, we attempt to more deeply explore the roles of self-interest and information gained through personal experience or the experience of peers in forming preferences for legalization. We do this by exploiting information on duration of use amongst current cannabis users, duration since quitting amongst past users, and the proportion of one's friends who have used cannabis.

We find that in addition to current users, past users of cannabis are also in favor of legalizing cannabis. This result is robust to accounting for the potential endogeneity of current and past experience with cannabis use. As the self-interest motive is not relevant for the group of past users, our findings suggest that their preferences for legalizing cannabis reflect an average net benefit from using cannabis. A deeper examination provides further evidence that benefits outweigh harms for this group, with their support for legalization dropping substantially as their experience becomes more dated (ie. as the duration since quitting becomes large). There is also some suggestive evidence that peer use of cannabis acts as a source of information on the net benefits of use for past users and abstainers. However, for current users it appears that the influence of peers on preferences over legalization represents mutual self-interest in lowering the user cost of cannabis.

## 2 Theoretical Background

One of the key factors impacting on an individual's preferences about a public policy is their belief about the costs and benefits of the policy. However, in the case of an illicit substance such as cannabis, accurate and credible information on the potential harms and benefits of policies may not be readily available. In this case, personal experience or experience of peers may be the best means of obtaining information. Along these lines, Orphanides and Zervos (1995) develop a model in which the decision to use an addictive substance depends on the individual's beliefs about the harms associated with consumption of the good. In this model, consumption of the addictive good is not equally harmful to all and individuals are uncertain as to whether they are prone to addiction. While consumption of the drug is known to provide certain instant pleasure, there is some probability that

it will bring future harm. The uncertainty is resolved via a process of learning through experimentation. In effect, people update their beliefs about the potential harm they face from consuming the addictive substance on the basis of their own experience. In addition to shedding light on the role of information in determining drug using behavior, this model can also be used to provide insights into preferences over the legal status of drugs.

In the model of Orphanides and Zervos (referred to as OZ hereafter), a person who is certain that they are prone to addiction, and hence all the harms that follow, will choose to abstain from consuming the drug.<sup>3</sup> As abstainers never experiment with the drug, they never learn the true harms associated with its consumption and there is some evidence that they tend to over-estimate the dangers of consumption (Agostinelli and Miller, 1994). If, however, a person believes with certainty that they are not the addictive type, then they will choose to consume the drug as it is known to provide certain instant pleasure. Non-addictive types use the drug casually and are not subject to the harmful consequences of addiction. Amongst those who are uncertain as to whether they are prone to addiction (and have never consumed the addictive drug), individuals who more strongly believe they are the non-addictive type are more likely to experiment.<sup>4</sup> If they are in fact prone to addiction and experiment, they are at risk of suffering the harmful consequences of addiction. If they discover their addictive nature sufficiently early, they are able to avoid addiction by quitting use.<sup>5</sup> If, however, they discover it too late, they become addicted.

The OZ model emphasizes the informational role of consumption when there is uncertainty about potential harms associated with a good. Specifically, the experience of consumption acts as a signal to the potential harm of the addictive good. Assuming that non-addicts preferences for drug policies are based on their beliefs about the net benefits associated with the drug use, experience is also an important input into individuals' attitudes towards the legal status of the drug. Specifically, abstainers do not support legalizing

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<sup>3</sup>Strictly speaking, this is the case for a potential addict who has never consumed the addictive good. If this is not the case and their initial stock of the addictive good is larger than the critical level for becoming addicted, then they converge to a steady state with harmful addiction.

<sup>4</sup>Those who more strongly believe they are prone to addiction are more likely to abstain.

<sup>5</sup>This assumes that the non-addictive steady state for addictive prone individuals is when the stock of the addictive good is zero.

cannabis use because they believe the harms associated with use are high. The group of current cannabis users is composed of those who use casually and hence suffer no ill effects from use, and those who are addicted and suffer the consequences of harmful use. Those who experience the benefits of cannabis use without suffering ill consequences will tend to be pro-legalization. Although those who are harmfully addicted to cannabis may "regret" their addiction, they are also likely to support legalization as it will reduce the user cost of cannabis consumption. Given their self-interest in the matter, support for legalization may be stronger for addicted current users than casual current users.

While predictions regarding the preferences over the legal status of cannabis of abstainers and current users are reasonably clear cut, they are less so for past users. Suppose, for example, that the group of past users consists solely of experimenters with an addictive nature who learned their true nature early enough and quit use, avoiding addiction. Then we would expect that this group would be at least as anti-legalization as the group of abstainers because, for them, cannabis is a harmful drug. This is analogous to past cigarette smokers being strident anti-smokers. On the other hand, suppose that all past users had a non-addictive nature and quit use because the full price of cannabis use increased.<sup>6</sup> This would lead to the prediction that past cannabis users would be pro-legalization because, in their experience, cannabis consumption provided positive utility and no harms. If the group of past users is a heterogeneous, consisting of non-addictive and addictive types who view the harms associated with cannabis use differently, then the attitudes of past users on average, will depend on the mix of these two types. To the extent that there exist a group for whom cannabis use is not harmful, the average attitude to legalization of cannabis use amongst past users will be more favorable compared to the group of abstainers. Moreover, if the informational content of past use depreciates over time, we predict that on average, past users become less in favor of legalization the longer the duration since they quit use.

Duration of use amongst current users may also be informative about their addictive type and preferences over legalization. For example, most people age out of cannabis use as they mature, start a career and a family. If this is the case, a longer duration of use

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<sup>6</sup>This may be because, as they got older their jobs became more demanding, they got married, and had children, and so the opportunity cost of the time spent using drugs increased.

may be indicative of a harmful addiction. This would suggest a stronger level of support for legalization at longer durations of use.

As a final point, Orphanides and Zervos (1995) discuss the role of peers as a source of (potentially inaccurate) information with respect to the decision to start using drugs. As such, peers may influence one's attitude towards legalizing cannabis. In particular, the more friends one has who have ever used cannabis, the stronger the signal of a net benefit of using cannabis. Of course, the informational value of peers' cannabis use may depend on the individual's own experience. For example, peers experience may act as a substitute for past users experience if the value of their own experience depreciates over time, but a peer's experience is unlikely to substitute for a current users own experience. On the other hand, if accounting for peers experience diminishes the role of current users experience but not past users experience in determining preferences for legalization, this may suggest that the effect of peers reflects mutual self interest amongst users in terms of a desire to lower user costs.

### **3 Data**

#### **3.1 The National Drug Strategy Household Surveys and Sample Under Investigation**

This research draws on information collected in the Australian National Drug Strategy Household Surveys (NDSHS). We use information from the NDSHS conducted in 1993, 1995, 1998, 2001, 2004 and 2007. The NDSHS is managed by the Australian Institute of Health and Welfare on behalf of the Commonwealth Department of Health and Aging. It is designed to provide data on attitudes and behavior relating to licit and illicit drug use by the non-institutionalized civilian population in Australia. The sampling framework is a multistage stratified sample design, where stratification is based on geographic region. In each sampled household, the respondent is the person with the next birthday who is at least 14 years of age in the waves prior to 2004 and at least 12 years old in the waves after 2001. Each of the waves used in this analysis asks the same question about the respondent's preferences about the legal status of cannabis as well as asking about lifetime and past

year cannabis use. This enables us to use these six waves of cross-sectional data to analyze the relationship between preferences about the legal status of cannabis and cannabis use history.

We present analysis based on individual level cross-sectional data and analysis based on cohort level panel data. The cohorts are defined by the age of the individuals in 1993: 15-19, 20-24, 25-29, 30-34, 35-39, 40-54; gender: male, female; and state of residence: New South Wales, Victoria, Queensland, Western Australia, South Australia, Tasmania, Australian Capital Territory, Northern Territory. Thus we observe 96 groups of individuals homogeneous in terms of age, gender and state of residence in six survey years. This allows us to analyze the determinants of preferences for legalization of cannabis using a quasi-panel approach, which we explain below. Note that we use a balanced panel so that we observe each of the 96 cohort groups in each of the six survey waves. Thus, the average age of the sample increases over time since individuals aged 15-19 year old are only represented in the 1993 wave. Individuals from this cohort are aged 17-21 in 1995, 20-24 in 1998 and so on. To ensure that results from the individual level and cohort level analysis are comparable, we limit the observations used in the individual level analysis to those used in the cohort level analysis.

### 3.2 Measures

Each of the six waves of NDSHS used in this analysis contains a direct measure of respondents preferences with respect to legalizing cannabis use. Specifically, individuals answered the following question: “To what extent do you support or oppose the following statement: The use of cannabis should be made legal.” Possible responses range from 1 if the person strongly supports legalization to 5 if the person strongly opposes legalization. We re-scaled our dependent variable to 5 minus the original variable so that a higher value indicates more support for legalization. The transformed variable measuring preferences in favor of legalization ranges from 0 to 4 and larger values represent stronger support for legalization.

The top part of Table 1 shows attitudes to legalization for each survey year. The share of individuals who strongly support legalization has decreased since 1998 while the share of individuals who strongly oppose legalization has increased since 2001. On average, the



support for legalization in our sample increased from 1.61 in 1993 to 1.86 in 1998 and then fell to 1.33 in 2007.<sup>7</sup>

We measure cannabis user status as current user, past user and abstainer. Current use is measured by an indicator equal to one if the respondent has used cannabis in the 12 months prior to survey; past use is measured by an indicator equal to one if the respondent has used cannabis in their lifetime but not in the 12 months before being surveyed; and abstainer is measured by an indicator equal to one if the respondent has not used cannabis in their lifetime. The bottom panel of Table 1 shows current and past use for each survey year. The share of individuals currently using cannabis declines from 19.1% in 1993 to 8.2% in 2007. In part, this is explained by an overall decline in the use of cannabis in the general population over the sample period and by the aging of the cohorts (in 2007 the average age of the individuals in our sample is much higher than the average age in 1993). However, the bottom panel of Table 1 also shows that there is sampling variation. If our sample were truly a panel of individuals and there was no recanting, the percentage of past users could not decrease over time, while the percentage of never users could not increase. This is not the case here. Whereas in 1998 46.1% of our sample report having never used cannabis, 56.8% report this to be the case in 2001. These fluctuations in cannabis use status imply that there are differences in the sampling of cohorts across survey waves which we address by taking sampling characteristics and year of survey into account in our analysis. The pattern in the measurement of cannabis use status may also reflect recanting within cohorts. Mensch and Kandel (1988) find some evidence that as people get older, they are less likely to report experimental drug use. When we use aggregate data, we address this issue by applying a mechanical correction to past use to account for potential under-reporting of past infrequent users.<sup>8</sup>

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<sup>7</sup>We speculate that this pattern is due to a general increase in conservatism in the population occurring over the sample period in addition to an increase in conservatism due to the aging of the sample.

<sup>8</sup>This correction is applied to observations for which the proportion of the cohort reporting to have ever used cannabis in the current period is smaller than the proportion of the cohort who have done so in some earlier period. The adjustment involves scaling the proportion of past use in cohort  $j$  in period  $t$  ( $cp_{j,t}$ ), by the ratio of the maximum of the proportion of the cohort reporting having ever used and the proportion

### 3.3 Controls

We control for the following individual characteristics in the analysis: gender is *Male* using an indicator variable with a value of 1 if the individual is male and a value of 0 if the individual is female; *Age* in 1993 (given age at the time of survey); *Low educated* with an indicator equal to 1 if the individual has not completed highschool and a value of 0 otherwise; *Australian born* with an indicator equal to 1 if the individual is Australian born and a value of 0 otherwise; *Aboriginal* with an indicator equal to 1 if the individual is Aboriginal and a value of 0 otherwise; *Capital city* with an indicator equal to 1 if at the time of the survey the individual lived in a state capital city and a value of 0 otherwise; marital status with separate indicators for *Married* and *Divorced* at the time of the survey (reference group is single or widowed); indicator variables for state of residence at time of survey (*Victoria*, *Queensland*, *Western Australia*, *South Australia*, *Tasmania*, *Australian Capital Territory*, *Northern Territory*, reference group is *New South Wales*); and indicator variables for the year of the survey (1995, 1998, 2001, 2004, 2007, reference group is 1993).

### 3.4 Descriptive Statistics

Table 2 presents descriptive statistics for the data used in our analysis. Statistics are reported for the individual level cross sectional data and for the cohort level panel data. Starting with the individual level data, as shown in the table on a scale of 0 (no support) to 4 (full support), the average support for legalizing cannabis is 1.61. On average 13% of the individuals in our sample used cannabis in the year prior to the survey, while 31% have used cannabis in their lifetime but not in the year prior to the survey.<sup>9</sup> In terms of demographic characteristics, 43% of the sample are male, 46% have a low level of education, reporting having ever used in the current period, ( $ce_{j,t}$ ).

$$\tilde{cp}_{j,t} = cp_{j,t} * \frac{\max_t \{ce_{j,t}\}}{ce_{j,t}}$$

We note that the results are not sensitive to whether or not this adjustment is applied and to whether or not current use was also adjusted.

<sup>9</sup>Note that the rate of past year use is quite low because the sample is quite old (in terms of studying cannabis use) and, as we confine analysis to observations used to construct the panel data, the sample is aging. For example, the average age for the sample is 35 in 1995 and 43 in 2007.

77% are Australian born, and 2% are Aboriginal. Two-thirds of the individuals live in a state capital, 60% are married and 15% divorced at the time they were surveyed. Table 2 also shows the characteristics of the dataset after collapsing individuals into gender-age-state of residence cohorts and creating the cohort level panel data. The sample means for the cohort data are very similar to the sample means for the individual level data. Instead of individual characteristics, the variables now refer to cohort averages.

Figure 1 shows the proportion of current cannabis users in each of the surveys years for each of the age-groups (15-19, 20-24, 25-29, 30-34, 35-39, 40-54), for females and males separately. For the 15-19 year old age group, cannabis use goes up from 1993 to 1995. Except for this cannabis use declines over time for each age group. It is also clear that younger individuals – except for the youngest age category – are more likely to use cannabis than older individuals while males are more likely to be cannabis users than females.

Figure 2 shows the relationship between age group and support for legalizing cannabis use by cannabis use status. Clearly, conditional on cannabis use status, there are only mild age effects.<sup>10</sup> Either the support does not vary with age or there is a mild increase of support among older individuals. On a scale from 0 to 4, the average support for legalization of cannabis use among never users is approximately 1, among past users it is about 2, while among current users it is about 3. In the following section we provide a more detailed analysis of the determinants of attitudes towards legalizing cannabis.

## 4 Empirical analysis

### 4.1 Statistical model

We provide an analysis of preferences for legalization of cannabis use at two levels. First, we analyze the determinants of preferences for legalization using individual level data. Second, we form a quasi-panel by taking cohort averages of the individual level data where cohorts are defined in terms of age in 1993 (6), gender (2), and state of residence (8). Thus we observe 96 cohorts homogeneous in terms of age, gender and state of residence in 6

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<sup>10</sup>Note that each line on the graph represents the average level of support for the age group averaged over all those in the age group from the 6 survey waves and hence captures both age and time effects.

survey years. This allows us to analyze the determinants of preferences for legalization of cannabis using a panel approach, which we explain in more detail below.

Using the individual level repeated cross-sectional data, preferences over the legal status of cannabis are modeled as a function of personal characteristics and cannabis use status:

$$y_{i,m,j,s,t} = \alpha_m + \alpha_j + \alpha_s + \alpha_t + \beta x_{i,m,j,s,t} + \epsilon_{i,m,j,s,t} \quad (1)$$

where  $y$  represents the preferences for legalizing cannabis use of individual  $i$ , of gender  $m$ , in the  $j$ th age cohort residing in state  $s$  in year  $t$  and  $x$  is a vector of dummy variables representing cannabis use experience (past or current cannabis user) and personal characteristics (an indicator for not completing high-school, an indicator for being born in Australia, an indicator for being an Aboriginal, an indicator for living in a capital city, an indicator for married or in a common law relationship, an indicator for divorced, with never married or widowed as the omitted category). The  $\alpha$ 's represent fixed effects for gender, age cohort, state and survey year, respectively.<sup>11</sup> Furthermore,  $\beta$  is a vector of parameters while  $\epsilon$  is an error term. We estimate the parameters of this model using Ordinary Least Squares.<sup>12</sup>

When linking a persons preferences for legalizing cannabis consumption with their own cannabis use experience, we have to address the issue of the potential endogeneity of their past and current cannabis use. This is because the same unobserved determinants of preferences for legalizing of cannabis could also affect their users status. If this is the case, then a correlation between cannabis use and preferences could exist even if no causal relationship exists. In analysis using cross-sectional data, Instrumental Variable (IV) estimation is often employed to address this issue. However, it requires one or more instruments for each of the potentially endogenous regressors. Instruments for cannabis use, for example, must fulfill the requirements that they are correlated with cannabis use but have no direct effect on preferences about its legal status. However, all of the personal characteristics that are available in our data affect both cannabis use and policy preferences.

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<sup>11</sup>Note that the parameters of interest do not change when we add a full set of cohort-gender-state interactions.

<sup>12</sup>In estimation we account for clustering of observations by state and calendar year. When we use an ordered probit specification the results are very much the same.

As there are no instruments for cannabis use, instrumental variable estimation is not an option here.

Given that we have six years of cross-sectional data, an alternative strategy is to form a pseudo-panel and use panel data techniques to address the issue of potentially endogenous regressors. More specifically, we construct a panel where the unit of analysis is cohort defined in terms of age in 1993, gender, and state of residence. As a first step in the analysis of the cohort panel data we estimate the cohort analogue to the model estimated using the individual data:

$$\bar{y}_{m,j,s,t} = \alpha_m + \alpha_j + \alpha_s + \alpha_t + \beta \bar{x}_{m,j,s,t} + \epsilon_{m,j,s,t} \quad (2)$$

where  $\bar{y}$  indicates the average preference for legalization in each of the 96 cohorts, and  $\bar{x}$  is a vector of variables calculated as cohort averages.

With panel data, the potential endogeneity of user status, current and past, can be addressed using the Arellano-Bond estimator. This estimator first differences equation (3) to remove the time invariant fixed effects and then instruments first differenced endogenous variables with appropriate lags in levels. Arellano and Bond (1991) developed the estimator in the context of dynamic panel data models and show that if the error term  $\epsilon_{j,t}$  is serially uncorrelated, then lags of the endogenous regressor of order two or greater are orthogonal to the first difference of the endogenous regressor. Lags of order 1 or greater can serve as instruments for first differenced predetermined variables that are potentially correlated with past errors. In our application, current cannabis use is treated as an endogenous regressor and its first difference is instrumented with lags of two or greater. Past cannabis use is treated as a predetermined, not strictly exogenous variable and its first difference is instrumented with lags of order one or greater. The first differenced model is estimated by Generalized Method of Moments.

## 4.2 Baseline parameter estimates

Table 3 provides the parameter estimates for the model of preferences over legalization of cannabis use based on individual level cross-sectional data (columns 1 and 2) and cohort level panel data (columns 3 and 4). Although not reported, all models include a set of

indicators for age group (defined by age in 1993), year of survey, and state of residence.

We start by discussing the results based on individual level cross sectional data. The first column of Table 3 shows parameter estimates for a specification that excludes variables capturing (potentially endogenous) experience with cannabis use. Indicators for past and current use are included in the specification in column 2. As can be seen, accounting for user status does not much affect the qualitative findings. Being male, being born in Australia, being Aboriginal, and living in a capital city are associated with being more in favor of legalizing cannabis use, as is being single and not having a low level of education. The magnitude of these effects tend to be smaller in the specification that accounts for users status. This is because these characteristics affect whether a person is a current or past cannabis user, and therefore affect preferences for legalizing cannabis directly and indirectly in column 1. The main parameters of interest in this analysis are the coefficients on the indicator for being a current cannabis user and for being a past user. In line with Figure 2, we find that being a current cannabis user has a large positive effect on preferences for legalization while being a past cannabis user has a positive effect but only around half the size of the effect of being a current cannabis user.

We next turn to the results for analysis based on the cohort level panel data, contained in columns three and four. In column three we replicate the analysis of the second column. A comparison of the parameter estimates in both columns reveals that the point estimates of the parameters of interest, current use and past use, are not much affected by the aggregation of individuals into cohort groups. Our main results, the positive effects of current and past cannabis use on preferences for legalization remain in tact. We note that, with the exception of the coefficients on Aboriginality and cannabis use status, none of the parameter estimates are significantly different from zero. This is because there is very little within-cohort variation in these variables.

Finally, in the fourth column we present our panel data estimates based on the Arellano-Bond (AB) estimator. These results account for the potential endogeneity of cannabis use status. At the bottom of each panel we report two diagnostic tests for the AB results. The first, labeled AR(2), examines the validity of using lags as instruments in terms of their exogeneity. The null hypothesis is that there is no second order autocorrelation in the

first differenced error term, in which case the instruments are exogenous.<sup>13</sup> As can be seen from Table 3, the AR(2) test finds no evidence of autocorrelation of order two in the first differenced errors, hence lagged levels of variables can serve as instruments. The second diagnostic test we report is the Sargan test of over-identifying restrictions. This tests the null hypothesis that the over-identifying restrictions are valid. As can be seen from the table, we cannot reject the null hypothesis. Taken together, these results indicate that the use of the AB estimator is appropriate for these data. In terms of the parameters of interest, as shown in the table, addressing the endogeneity issue does not affect our main results. We still find that current users and past users of cannabis support legalization, with current users being more supportive than past users. Since on average, past users are more supportive of legalization than abstainers, we infer that cannabis use was not found to be harmful for a significant portion of past users.

### 4.3 Accounting for Cannabis Policy

Individuals preferences over cannabis policy are likely to affect the nature of this policy. However, it may also be that cannabis policy has an influence on opinions about the policy. To investigate this potential influence, we augment the individual level NDSHS data with time varying information on cannabis price and policies measured at the state level. *Cannabis price* is based on information from the Illicit Drug Data Report prepared by the Australian Crime Commission, the Australian Illicit Drug Report and its predecessor, the Australian Drug Intelligence Report, prepared by the Australian Bureau of Criminal Intelligence.<sup>14</sup> The legal environment surrounding cannabis use varies across Australias eight states and territories. We capture these differences using separate indicators for living in a state where cannabis *decriminalization* has been legislated and an indicator for living in state that has introduced a *diversion* program. Decriminalization refers to the

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<sup>13</sup>Note that, by construction, first order autocorrelation is expected since  $D\epsilon_{j,t} = \epsilon_{j,t} - \epsilon_{j,t-1}$  should be correlated with  $D\epsilon_{j,t-1} = \epsilon_{j,t-1} - \epsilon_{j,t-2}$  as both contain  $\epsilon_{j,t-1}$ .

<sup>14</sup>This information is supplied by covert police units and police informants. Following the method outlined in Saffer and Chaloupka (1999), we constructed a predicted price of a gram of high-quality cannabis (see Van Ours and William (2007) for details).

removal of criminal status and criminal penalties for cannabis use.<sup>15</sup> Under this system, it is still illegal to use, possess, or grow cannabis for personal use, but (for small quantities) the offense is punishable by payment of a fine, with no conviction recorded. Diversion refers to changes in legislation or police standing orders to ensure that minor cannabis offenses are diverted out of the criminal justice system. The specifics of what diversion involves differs across Australian states. In New South Wales and Victoria, on admitting to the offense, diversion involves a caution notice being issued and an educational brochure is provided along with referral information for optional education. Queensland has a diversion program that requires eligible offenders to agree to undertake a drug assessment or brief intervention that includes an education program.

As shown in the bottom part of Table 2, the average price of cannabis for the sample period is \$23.00 per gram, measured in constant 1989 dollars. Furthermore 25% of the individuals in our sample live in a state that has decriminalized the use of cannabis while 63% live in states that have introduced a diversion program.<sup>16</sup>

Panel b of Table 3 adds the potentially endogenous state level policy variables to our estimates. As before, initially we ignore the potential endogeneity, but in column 4 we show parameter estimates in which we take both the potential endogeneity of cannabis user status and the potential endogeneity of the cannabis policy variables into account. Specifically, as with current cannabis use, the price of cannabis and the indicator for living in a state that has decriminalized cannabis and the indicator for living in a state that has a diversion program are treated as endogenous variables and their first difference is instrumented with their own levels lagged two or more periods.

In terms of the estimates reported in the lower panel of Table 3, we fail to find robust evidence that the legal regime governing cannabis use (either decriminalized or penalized

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<sup>15</sup>South Australia was the first to adopt this system, introducing it in 1987. The Australian Capital Territory followed suit in 1992, the Northern Territory in 1997, and Western Australia in 2004.

<sup>16</sup>There are two main reasons that the proportion of the sample who lived under a regime of a diversion program is so large. First, diversion programs were introduced from 1997 and were all in place by 2001, and this timing corresponds with the an expansion in the size of samples collected by the NDSHS. In effect 80% of the data are from the post 2000 period. Second, the most populous states introduced diversion programs.



through diversion programs) has a significant impact on preferences for legalizing cannabis. Nonetheless, it is interesting that we find that higher prices are associated with less support for legalizing cannabis. This may be because, holding user status constant, current users consume cannabis less frequently and face lower expected penalties from consuming an illegal substance. A comparison of panels a and b reveals that the parameter estimates are almost identical, suggesting that policy endogeneity is unlikely to be a significant issue in this case. Importantly, a comparison of panels a and b reveal that are main results are not sensitive to accounting for the policy environment.

#### 4.4 More evidence on information versus self-interest

As discussed above, we have found that current cannabis users are on average in favor of legalizing cannabis. This may be either because, as casual users they believe that cannabis can be used without incurring the harms associated with addiction or because, given that they are addicted, they prefer to face a lower user cost of cannabis. We also find that past cannabis users are more in favor of legalization than abstainers. This suggests that there exist a significant proportion of past users who are not of the addictive type and as such, the benefits of cannabis use exceed the costs. We next investigate more deeply the hypothesis that experience with cannabis provides information on the net benefits of its consumption, which is then used to inform preferences over legalization.

For reasons discussed in Section 2, it may be easier to infer the informational content of experience with cannabis from past users than current users. For example if past cannabis use does serve as a signal on harms but the informational value of past experiences depreciates over time, then it seems reasonable to expect that as past users experience becomes more distant, their attitudes towards legalization become more similar to those of an abstainer. Duration of use amongst current users may also help untangle signals concerning harmless and harmful use of cannabis. For example, addicted users are more likely to use for longer durations than casual users because casual users are more responsive to increases in the full cost of use generated for example, by the greater importance placed on career and family responsibilities that tend to occur as people age. If this is the case, and addicted users are more pro-legalization than casual users, we would expect preferences for

legalization amongst current users to be stronger at longer durations of use.

In order to examine these hypotheses, we require information on when individuals started and quit cannabis use. Information on individuals quitting behavior has only been collected in the 1998 wave of the NDSHS. For this reason the following analysis is based on data from the 1998 wave of the NDSHS only. This precludes the use of the Arellano-Bond (AB) estimator to address issues of endogeneity of current and past cannabis use. We note, however, that the OLS and AB estimates of the parameters of interest reported in Table 3 are quite similar. For this reason it is unlikely that there are large biases arising from the potential endogeneity of past and current use.

OLS parameter estimates based on data from the 1998 NDSHS are shown in Table 4. The first column shows that the estimated effect of current use and past use on preferences for legalization using individual level data from 1998 only is very similar to the estimated effect based on individual level data from the six waves. The second column shows that if we assume linear effects in duration of use for current users and in duration since quitting for past users we find the duration of use amongst current users has a significant positive effect, while for past users the duration since last use has an insignificant negative effect on preferences for legalization. The results in column three suggest that the effects of the duration of use and duration since quitting are nonlinear. Going from less than 1 year of use to 1-2 years of use increases the preference for legalization from 1.45 to 1.76 but a further increase only occurs with a duration of use of more than four years. The strongest effect occurs for a duration of greater than 10 years. The high levels in support for legalization at the longer durations of use compared to shorter and moderate durations is consistent with the prediction that the pool of users at longer durations is comprised of relatively more addicted current users than at shorter durations, and for reasons of self-interest, this group is more strongly pro-legalization.

For past cannabis users we find no significant difference in the support for legalization between those who quit less than a year before being surveyed and those who quit up to four years before being surveyed. However, the support for legalization falls from 0.71 to 0.47 amongst those who quit five or more years before being surveyed. The finding that distant past cannabis use is associated with a reduction in support for legalization compared

to recent past use is consistent with the prediction that preferences over legalization for past users move closer to those of abstainers as the informational value of past experience depreciates over time.

Finally, we examine whether, in addition to personal experience, peer use of cannabis influences attitudes to legalization. As discussed in section 2, in the absence of first hand experience or recent experience with cannabis use, peers cannabis use may influence an individuals preferences over its legal status by providing information on the net costs of using this drug. However, peers effects on attitudes to legalization may reflect the self-interest of the peers in the case of abstainers and past users or common self-interest in the case of current addicted users. Our results shed light on this issue.

Column four reports results for a specification in which we control for the proportion of the respondents friends who have ever used cannabis with indicators for most, half and few have ever used (the omitted category is none of their friends have ever used cannabis). As can be seen from Table 4, peer use of cannabis is positively and significantly related to preferences in favor of legalizing the use of cannabis. Moreover, respondents for whom at least one half of their friends have ever used cannabis are significantly more in favor of legalization compared to those with fewer than half or no friends who have ever used cannabis. This suggests that peers may provide evidence of a net benefit to cannabis use.

It is interesting to note that the introduction of the peer use variables decreases the estimated impact of duration of use amongst current users by around 25%, while having little effect on the estimated impact of duration since use amongst past users with the exception of those who had quit more than ten years ago. That fact that the inclusion of peers' cannabis use impacts on the coefficients for current users duration of use (whose information on harms is recent and relevant) but not past cannabis users duration since use (whose information is older and hence less informative) casts doubt on the hypothesis that that peer use provides additional information about harms that inform an individual's attitude to legalizing cannabis use. This finding is more suggestive of a traditional "peer" effect, where the attitudes and behavior of one's peers has a spill over effect on one's own behavior and attitudes or, in the case of current users, simply reflects a common self-interest motive for supporting the legalization of cannabis.

Once we account for peer use, duration of use amongst current users and duration since quitting use amongst past users the size of the point estimates on past and current use of cannabis are almost halved. This suggests that the strong positive relationship between experience with cannabis and preferences for legalizing cannabis is in part reflective of the influence of their friends in forming opinions on the issue of legalization as well as indicative of information on the costs and benefits of cannabis use acquired from experience with the drug.

## 5 Discussion

Cannabis policy is back in the political arena. More often than not, the debate on legalizing cannabis use is based on moral stances and emotional arguments rather than on evidence about potential costs and benefits of the policy. Given the role of public opinion in determining policy outcomes, understanding how opinions over cannabis' legal status are formed is a necessary first step in examining optimal cannabis policy.

As far as we are aware, research on preferences for particular types of cannabis policy is absent. We provide a first empirical study on the determinants of preferences for legalization of cannabis use. We focus on the role of experience with cannabis as a determinant of preferences over legalization and ask whether differences in preferences across current users, past users and abstainers, are informative about the net benefits of cannabis use. Understanding why preferences differ across user groups is complicated by the fact that, for illicit substances in general and cannabis in particular, there is an absence of accessible and clear information on the potential harms and benefits of using the drug. For this reason, own and peers experience are important sources of information for determining the net benefit to an individual of using cannabis and hence their preference for legalization. While preferences in favor of legalization for casual cannabis users suggest a net benefit of use, for addicts preferences for legalization are more likely to reflect self interest and a desire to reduce their own user costs. Given that we are unable to distinguish casual users from addicted users, we draw on the theory of Orphanides and Zervos (1995) to form predictions regarding the relationship between preferences and various dimension of use in

order to untangle these effects.

Our empirical analysis is based on data from the Australian National Drug Strategy's Household Surveys covering the period 1993-2007. The Australian data are informative about individuals experience with cannabis and about their preferences for particular types of cannabis policy. Our results indicate that, after accounting for the potential endogeneity of cannabis use, current cannabis users are very much in favor of legalization, while past cannabis users are also in favor but to a lesser degree. As the self interest motive is not relevant for past users, this would suggest that on average, the experience of past users resulted in a net benefit from cannabis use. Moreover, the support for legalization amongst past users is found to fall off as their experience becomes more distant. This suggests that for past users, more recent experience with cannabis provides better information about the costs and benefits of using this substance, and this is reflected in greater support for legalization. We also find a positive correlation between peers' use of cannabis and preferences for legalization. While peer use may impact on preferences for legalization by providing information on net benefits of use, especially amongst abstainers and past users, there is suggestive evidence of a spill-over effect of the peers' interest in lowering the user cost of cannabis.

All in all, we conclude that personal experience with cannabis use leads to stronger preferences for legalization. Because, in addition to current users, past cannabis users are also in favor of legalization, it appears that preferences go beyond direct personal interest. From this we conclude that on average, for past cannabis users and possibly many current cannabis users, the benefits of legalization outweigh potential costs. The fact the cannabis use is not as harmful as for example alcohol or tobacco may explain why individuals are more inclined to be in favor of legalizing cannabis once they have used cannabis themselves.

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Table 1: **Attitudes to legalization and cannabis use by survey year**

	1993	1995	1998	2001	2004	2007	Total
Support for legalization							
0	30.3	29.6	25.7	31.6	32.4	38.8	32.4
1	19.0	15.4	15.6	15.3	16.8	19.2	16.7
2	19.2	19.0	20.3	19.1	20.0	19.9	19.7
3	22.3	24.1	23.9	21.2	20.8	14.6	20.3
4	9.2	11.8	14.5	12.9	10.0	7.5	10.9
Total	100	100	100	100	100	100	100
Average	1.61	1.73	1.86	1.68	1.59	1.33	1.61
Cannabis Use							
Never	54.6	54.2	46.1	56.8	57.8	60.7	56.4
Past	26.4	27.1	36.1	29.0	30.9	31.1	30.6
Current	19.1	18.8	17.8	14.2	11.4	8.2	13.0
Total	100	100	100	100	100	100	100
Observations	2,438	2,596	6,674	16,504	17,550	11,052	56,814



Table 2: Means for individual level data and cohort data

	Individual data	Cohort data
Preference for Legalization	1.61	1.75
Current user	0.13	0.18
Past user	0.31	0.33
Low educated	0.46	0.44
Australian born	0.77	0.79
Aboriginal	0.02	0.02
Capital city	0.67	0.71
Married	0.60	0.62
Divorced	0.15	0.12
Male	0.43	0.50
Age in 1993		
15-19	0.14	0.17
20-24	0.15	0.17
25-29	0.15	0.17
30-34	0.13	0.17
35-39	0.12	0.17
40-54	0.31	0.17
State		
New South Wales	0.25	0.13
Victoria	0.20	0.13
Queensland	0.18	0.13
Western Australia	0.11	0.13
South Australia	0.09	0.13
Tasmania	0.05	0.13
ACT	0.06	0.13
Northern Territory	0.06	0.13
Survey year		
1993	0.04	0.17
1995	0.05	0.17
1998	0.12	0.17
2001	0.29	0.17
2004	0.31	0.17
2007	0.19	0.17
Cannabis price/100	0.23	0.24
Decriminalization	0.25	0.37
Diversion	0.63	0.31
Observations	56,814	576

Table 3: **Parameter estimates of the support for legalizing cannabis use; 1993–2007**

Support for legalization (0–4)				
		Individual data	Grouped data	
			OLS	AB
a. Baseline estimates				
Current user	–	1.95 (77.4)**	2.05 (12.4)**	2.66 (5.7)**
Past user	–	0.83 (42.7)**	0.89 (8.4)**	1.39 (5.3)**
Male	0.21 (15.9)**	0.05 (4.6)**	0.03 (0.9)	–
Low educated	-0.11 (6.0)**	-0.12 (9.4)**	0.00 (0.0)	0.09 (0.1)
Native Australian	0.10 (3.5)**	0.03 (1.8)*	-0.02 (0.1)	0.22 (1.2)
Aboriginal	0.20 (5.2)**	0.13 (3.7)**	0.80 (3.5)**	0.95 (2.4)
Capital city	0.02 (1.2)	0.02 (1.8)*	0.01 (0.1)	0.03 (0.2)
Married	-0.36 (23.3)**	-0.15 (11.7)**	-0.27 (2.7)**	-0.28 (2.5)
Divorced	-0.06 (2.8)**	-0.05 (2.4)**	-0.24 (0.8)	-0.30 (1.2)
AR(2) - p value				0.99
Sargan test - p value				0.77
b. Including policy variables				
Current user	–	1.95 (77.0)**	2.04 (11.9)**	2.78 (6.8)**
Past user	–	0.83 (42.8)**	0.88 (8.2)**	1.41 (5.4)**
Cannabis price/100	-0.24 (1.9)*	-0.21 (2.4)**	-0.31 (4.6)**	-0.30 (1.7)*
Decriminalization	-0.07 (1.6)	-0.06 (2.1)**	0.01 (0.5)	0.06 (0.8)
Diversion	0.05 (1.8)*	0.01 (0.6)	0.01 (0.2)	-0.00 (0.1)
Male	0.21 (15.9)**	0.05 (4.6)**	0.03 (1.0)	–
Low educated	-0.11 (6.0)**	-0.12 (9.4)**	-0.02 (0.1)	-0.04 (0.2)
Native Australian	0.10 (3.5)**	0.03 (1.8)*	-0.01 (0.0)	0.24 (1.2)
Aboriginal	0.20 (5.2)**	0.13 (3.7)**	0.82 (3.6)**	0.92 (2.0)**
Capital city	0.02 (1.2)	0.02 (1.8)*	-0.01 (0.1)	0.05 (0.4)
Married	-0.36 (23.3)**	-0.15 (11.7)**	-0.27 (2.7)**	-0.26 (2.0)**
Divorced	-0.06 (2.8)**	-0.05 (2.4)**	-0.24 (0.9)	-0.30 (1.1)
AR(2) - p value				0.94
Sargan test - p value				0.82
Observations	56,814	56,814	576	480

Note: Both the individual level and the grouped level estimates contain age group fixed effects, state fixed effects and year fixed effects; in the Arellano-Bond (AB) estimates in panel *a* (panel *b*) 52 (36) instruments are used; in parentheses: absolute *t* statistics based on robust standard errors; \*\* (\*) indicates significance at a 5% (10%) level.

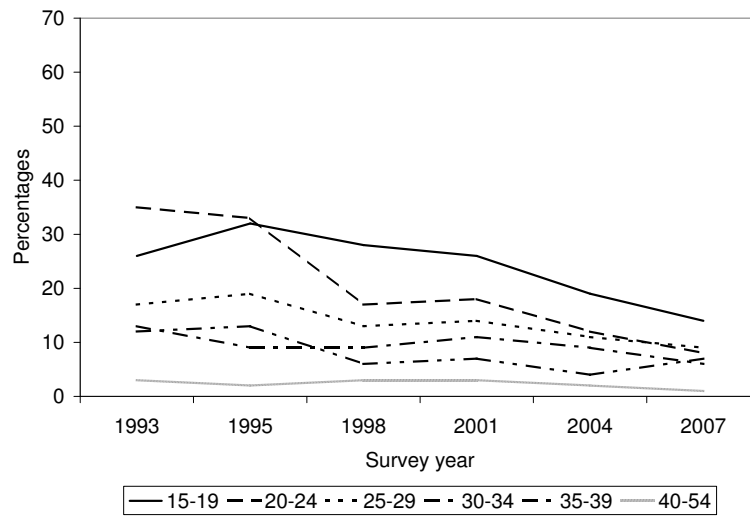
Table 4: **Parameter estimates of the support for legalizing cannabis use; 1998**

	(1)	(2)	(3)	(4)
Current user	2.02 (29.9)**	1.53 (18.3)**	1.45 (20.9)**	1.12 (13.8)**
Past user	0.84 (13.6)**	0.74 (6.8)**	0.71 (8.5)**	0.49 (5.6)**
Duration of use (years)/10	—	0.36 (19.4)**	—	—
Duration since last use (years)/10	—	-0.06 (1.4)	—	—
Duration of use (years)				
1-2			0.31 (2.8)**	0.25 (2.3)**
2-3			0.23 (3.8)**	0.17 (2.9)**
3-4			0.26 (4.9)**	0.18 (3.0)**
4-5			0.45 (4.9)**	0.37 (3.7)**
6-10			0.58 (22.6)**	0.47 (13.2)**
10+			0.65 (17.4)**	0.51 (14.8)**
Duration since last use (years)				
1-2			0.05 (0.5)	0.01 (0.1)
2-3			-0.11 (0.8)	-0.15 (1.1)
3-4			0.08 (0.7)	0.08 (0.7)
4-5			-0.24 (3.6)**	-0.25 (2.9)**
6-10			-0.28 (3.2)**	-0.27 (2.9)**
10+			-0.24 (3.2)**	-0.19 (2.5)**
Peer group -most have used				0.86 (20.1)**
Peer group -half have used				0.77 (10.8)**
Peer group -few have used				0.42 (9.2)**

Note: The estimates are based on 6,330 observations from the 1998 survey; the estimates also include the same personal characteristics and policy variables as Table 3, but the related parameter estimates are not reported; in parentheses: absolute  $t$  statistics based on robust standard errors; \*\* (\*) indicates significance at a 5% (10%) level.

Figure 1: **Evolution of the percentages current cannabis users by age-cohort and gender**

a. Females



b. Males

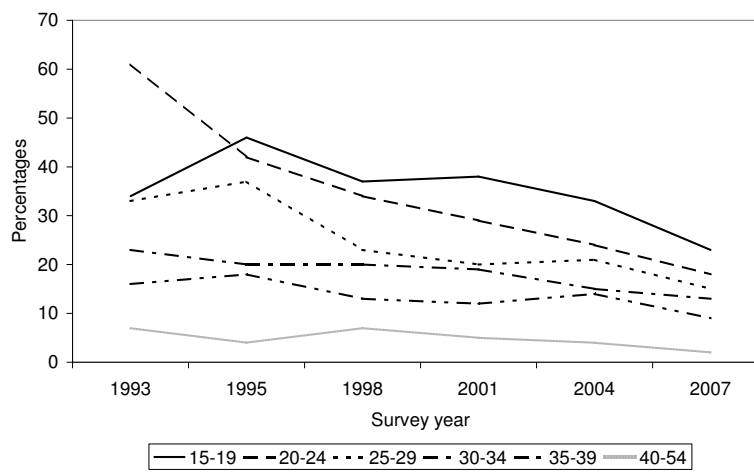
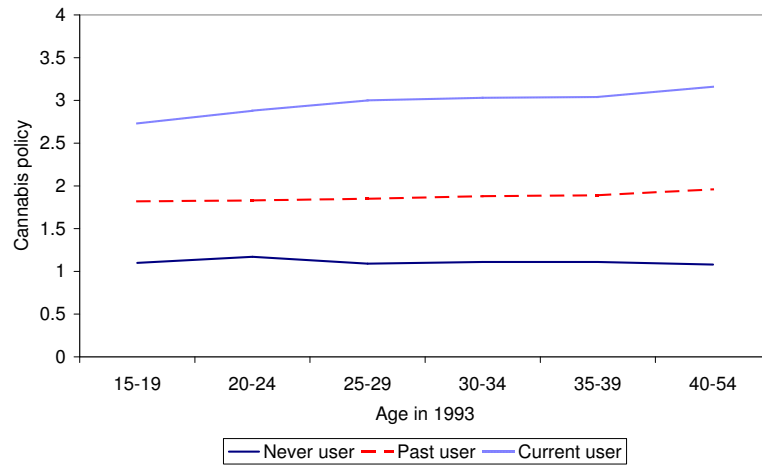


Figure 2: Support for legalizing cannabis by age-cohort, gender and cannabis use

a. Females



b. Males

