# Cannabis, cocaine and jobs

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**Abstract**

This paper uses a dataset collected among inhabitants of Amsterdam, to study the employment effects of the use of cannabis and cocaine. For females no negative effects of drug use on the employment rate are found. For males there is a negative relationship between past cannabis and cocaine use and employment. However, this relationship has to do with correlation through unobserved personal characteristics and not with causality.

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# 1 Introduction

The use of illicit drugs is often related to detrimental health effects. The damage to the health of an individual is sometimes thought to have a negative effect on the labor productivity of that individual. This negative effect on labor productivity may result in a bad labor market position. So, illicit drug use may have a negative effect on the employment status of individuals. Although the negative effect of illicit drug use on employment and wages seems plausible, results from empirical research are inconclusive. The number of available datasets to investigate the labor supply effects of illicit drugs use is limited but there is a wide variety of outcomes concerning these effects. Even if based on the same dataset some studies find no effects, while other studies find strong negative employment effects. The common problem in these studies is that the use of illicit drugs may not be exogenous with respect to labor supply. The traditional approach is to find suitable instrumental variables that affect the use of illicit drugs but have no direct effect on employment. As will be spelled out in more detail in the next section empirical studies on the same dataset use different instrumental variables, which may be one reason of the range in results.

The current paper is on the employment effects of the use of cannabis and cocaine in Amsterdam (the capital of the Netherlands).[2] In the Netherlands cannabis use is quasi-legalized since cannabis can easily be bought in so-called coffee shops. Within the Netherlands it is especially the capital Amsterdam that has a reputation as a drug users city. This reputation is partly based on the fact that most tourists only visit Amsterdam while the largest part of cannabis selling places is found in tourist areas so tourists are easily confronted with soft drug users. Nevertheless, it is more than just tourists that get biased observations about drug use. Surveys indicate that actual drug use in Amsterdam is quite high. In 2001 of the Amsterdam population of 12 years and older 38 % had ever used cannabis and 10 % had ever used cocaine. Average for the Netherlands this was 17 % for cannabis and 3

[2] In a companion paper (Van Ours, 2004) we study the wage effects of the use of cannabis and cocaine for male adult workers.

% for cocaine (Abraham et al., 2003).

The high use of illicit drugs makes it interesting to investigate the labor market position of Amsterdam drug users. In the analysis data are used that were collected in surveys in 1994, 1997 and 2001. The current study has a number of distinguishing features. Amsterdam is interesting from a drug research point of view since the Netherlands is one of the few countries with a liberal attitude towards the use of soft drugs. Also in other respects the current study has distinguishing features. The data collected contain information about parental cannabis use, which is a unique instrumental variable. In addition to an instrumental variables approach this study also relates the process by which individuals start consuming illicit drugs in the past to the current labor market position.

The paper is set up as follows. Section 2 gives an overview of previous studies on the effects of drug use on the employment status of individuals. Section 3 presents stylized facts about the use of cannabis and cocaine and about job opportunities in Amsterdam. Section 4 analyzes the dynamics in the consumption of cannabis and cocaine. Section 5 presents a preliminary analysis of relationship between employment and the use of cannabis and cocaine. Section 6 addresses the issue of whether there is a causal relationship from cannabis and cocaine use to employment or whether drug use and employment is merely correlated through unobserved characteristics. Section 7 concludes.

# 2 Previous studies on illicit drugs and employment

Although the negative relationship between illicit drug use and productivity seems plausible, it is not often found in empirical research.[3] Since the

[3]There are also studies on the relationship between wages and the use of alcohol and tobacco. The use of alcohol is often found to have a positive effect on wages, while the use of tobacco has a negative effect on wages. These studies are not discussed here. See Van Ours (2002) for an overview of this literature. I also ignore the study by Terza and

1990s as many as five studies were published on the relationship between employment and illicit drug use all based on the same dataset, the U.S. National Longitudinal Survey on Youth (NLSY). The studies differ in terms of the specification of the dependent variable, the specification of drugs use, the specific NLSY waves used, the individuals of whom the labor supply behavior is analyzed, the estimation procedure and the instrumental variables used. And, perhaps most surprising, the studies differ a lot in terms of the results concerning the relationship between drug use and labor supply.

Gill and Michaels (1992) use the 1980 and 1984 waves of the NLSY They estimate employment equations accounting for potential selectivity due to the endogeneity of the drug use decision. As instrumental variables they use information concerning illegal activities, income from illegal activities, attitude towards drinking and frequency of going to bars as instrumental variables. They find that hard drug use does not have a negative effect on the employment probability but for the sample of all drug users (combing users of hard and soft drugs) there is a reduced employment probability. They hypothesize that on the demand side of the labor market drug use may be related to for example low productivity and increased absenteeism, which will lower the employment rate. On the supply side drug use may be complementary with leisure. Nevertheless, they conclude that the disparity in employment effects between the effects of soft and hard drugs is difficult to explain.

Register and Williams (1992) who use the 1984 wave of the NLSY find similar results. In their analysis they use attendance of religious services, parental education and previous divorce as instrumental variables. Their results suggest that for young male workers cannabis has a negative employment effect while cocaine use is found not to be significantly related to employment status. They too mention the possibility that their analysis did not account for unobserved differences between users and nonusers correlated with both use and productivity.

Kaestner (1994) finds a negative association between cannabis or cocaine

Vechnak (2001) who consider a substance abuse indicator that includes the use of cannabis and cocaine but also alcohol.

use and the hours of labor supplied by young males. He uses variables like household composition at a young age, frequency of past religious attendance and a measure of perceived self-esteem as instrumental variables. He compares separate cross-sectional estimates based on the 1984 and 1988 waves of the NLSY with panel estimates based on these two waves. In the cross-sectional estimates he finds that illicit drug use has large, negative effects on labor supply. However, the panel estimates indicate that illicit drug use does not have a significant negative effect on labor supply.

Burgess and Propper (1998) use the NLSY to study long term effects of drug use for males. As instrumental variables they use parental attainment and work status, circumstances at age 14 (living with parents, religious upbringing, living in the south), and number of siblings. They find that soft drugs use has no harmful effects on labor market participation 10 years on. Heavy substance use has a negative effect on later labor market participation.

Finally, De Simone (2002) again uses the 1984 and 1988 waves of the NLSY to study the employment effects of cannabis and cocaine use. His main criticism on previous in which no negative effect of drug use were found relates to the use of instrumental variables. It is possible that variables like past-year divorce, prior delinquency and parental education may have a direct effect on the employment rate or may be correlated with unobserved determinants of employment. De Simone uses drug price related variables and family background variables as instruments. The price variables are past-year local retail price of cocaine and an indicator of whether cannabis possession is decriminalized in the state of residence. The family background variables are and indicator that both the mother and father were present in the household when the respondent was 14 years old and an indicator of parental alcoholism or problem drinking. De Simone finds than cannabis and cocaine use has substantial negative effects on the employment of males, while no such effects are found for females.[4] Since the effects of cannabis and cocaine use are established in separate estimates and almost all cocaine users use cannabis it is not clear that cocaine use has a negative effect *in addition*

[4]In a footnote (11) De Simone (2002) states that for females neither cannabis nor cocaine use affects female employment.

to the negative effect of cannabis use. Or, alternatively since 30-40% of the cannabis users also use cocaine it is not clear whether the estimated effect from cannabis use is a mixture of cannabis use having no effect and cocaine use having a large effect or is to be attributed to cannabis use irrespective of cocaine use[5]

All in all, what is striking is that on the basis of the same NLSY dataset such a wide range of wage effects of the use of cannabis and cocaine are found. One would be tempted to conclude: anything goes.

A second U.S. dataset that has been used to study the relationship between drug use and labor supply is the National Household Survey on Drug Abuse (NHSDA). Zarkin et al. (1998) use the 1991 and 1992 NHSDA data to study for young men (age 18 to 24) the relationship between hours worked and illicit drug use. They use respondents' assessment of the risk associated with using illicit drugs and their assessment of the difficulty in obtaining illicit substances as instrumental variables. Their main conclusion is that illicit drug use has little effect on the number of hours worked.[6] French et al. (2001) use 1997 NHSDA data to study the employment rate for different types of drug users. They use a composite religiosity indicator to test for exogeneity of drug use finding that exogeneity of chronic drug use was not rejected. They find that chronic drug use has a negative effect on employment, while non-chronic use has no effect. So also on the basis of two studies based on NHSDA data no clear conclusions can be drawn.

MacDonald and Pudney (2000) use the British Crime Survey to estimate a model covering drug use and unemployment.[7] Instrumental variables used are religious attendance and housing tenure. They conclude that there past use of soft drugs tends not to be significantly associated with current unemployment, but there is strong evidence of long-term damage to employment

[5] The parameter estimates are sensitive with respect to the set of instrument used. If the parental background variables are not excluded from the employment equation no significant negative employment effect of drug use is found for the year 1988.

[6] With respect to the working hours effect of the use of 1 to 3 marijuana joints in the past month they find conflicting results depending on the dataset used. For 1991 they find a positive effect, for 1992 a negative effect.

[7] MacDonald and Pudney (2001) is a strongly overlapping study.

prospects from the use of hard drugs.[8]

# 3 Drugs and labor supply in Amsterdam

The Netherlands has a special type of drug policy. The main aim is to protect the health of individual users, the people around them and society as a whole.[9] There are clinics for the treatment of addicts and care services, which aim to reach as many addicts as possible to assist them in efforts to rehabilitate, or to limit the risks caused by their drug habit. Methadone programs enable addicts to lead reasonably normal lives without causing nuisance to their immediate environment, while needle exchange programs prevent the transmission of diseases such as AIDS and hepatitis B through infected needles. The services also provide counseling.

Regulations on drugs are laid down in the Opium Act, which draws a distinction between hard drugs and soft drugs. The distinction that is drawn relates to the health risks involved in drug use. Hard drugs are those substances which can seriously harm the health of the user and include heroin, cocaine an synthetic drugs such as ecstasy. Soft drugs, i.e. cannabis derivatives marijuana and hashish cause far fewer health problems. The possession of hard drugs is a crime. However, since 1976 the possession of a small quantity of soft drugs for personal use is a minor offence.

The data used in the analysis are collected in Amsterdam, which has a population of 700.000 inhabitants and has around 300 recognized, so-called "coffee-shops" were soft drugs can be purchased. The data are from three surveys by CEDRO, the Center for Drug Research of the University of Amsterdam (see the appendix for a more detailed description). The surveys were carried out in 1994, 1997 and 2001. The data on drug use are based on self-reported information, which is the norm for analyses of drug consumption.

[8] MacDonald and Pudney (2000b) is very similar in many respects including the conclusions.

[9] See Ministry of Health, Welfare and Sport (1997) from which I derived most of the information in this section. An international perspective on Dutch drug policy is given in Boekhout van Solinge (1999).

To give an impression about the use of cannabis and cocaine and their relation with labor supply variables some stylized facts are presented in Tables 1 and 2. The focus of the analysis is on prime age males and females (age 26 to 50).[10]

Table 1 shows prevalence indicators for cannabis and cocaine. As shown, of the prime age females in the sample 47.8% has ever used cannabis while 12.4% has ever used cocaine. For prime age males the lifetime prevalence numbers are 57.9% for cannabis and 17.3% for cocaine.[11] There is a clear correlation in the use of cannabis and cocaine. As shown 52% of the female individuals in the sample have neither used cannabis nor cocaine. For males this number is about 42%. About 12% of the females in the sample have (ever) used both cannabis and cocaine, while this is the case for about 17% of the male individuals. As shown there are only a few individuals that have ever used cocaine but never used cannabis. The percentage of individuals that have ever used cannabis and never used cocaine is quite high. As shown the last year prevalence numbers are substantially smaller and last month prevalence are substantially smaller than last year prevalence numbers. The last two indicators could suggest that many users have stopped using, i.e. the difference between the two could be an indication of stopping. Nevertheless it is also possible that some individuals use infrequently, i.e. less than once a month. Therefore, we consider last year use as recent use. Table 1 shows that of the recent cannabis users (defined as having used in the past year) only a very small percentage is also current cocaine user. In fact more than

[10] As will be shown in more detail below if an individual will start using cannabis (s)he will usually do so before age 26. Furthermore, most individuals have completed their full-time education before age 26. After age 50 individuals in the Netherlands employment participation rates start to decline due to inflow into disability benefits and early retirement schemes. **Source?**

[11] The use of cannabis and cocaine in Amsterdam is substantially higher than in other parts of the Netherlands. Of the population of 12 years and older in 2001 in Amsterdam 38.1% had ever used cannabis and 10.0% had ever used cocaine. Average for the Netherlands this was 17.0% for cannabis and 2.9% for cocaine. Remarkably, *average* across the U.S. in 2001 lifetime prevalence for cannabis was 36.9% and lifetime prevalence for cocaine was 12.3%. **Source?**

half of the current cannabis users has never used cocaine. Many of the users have only used cannabis and cocaine for a couple of times. The majority of users (ever) used the drugs 25 times or less. Of the frequent cannabis users only a very small part has also frequently used cocaine. Again, more than half of the frequent cannabis users have never used cocaine.

Table 2 shows how for prime age individuals the four groups of cannabis and cocaine users and the group of abstainers compare with each other in terms of average characteristics. As shown, in terms of average age there is not a lot of difference between the groups, except perhaps for the current cannabis users and recent cocaine users who are somewhat younger than the others. With respect to education there are clear differences. Individuals that have never used cannabis or cocaine are lower educated than average while individuals that ever used cannabis have the highest educational level. Of the male abstainers only about 38% has a higher education, while of the ever cannabis users almost 60% has a higher education. Of the female abstainers about 42% has higher education, while of the individuals that ever used cannabis about 53% has a higher education. Similar differences between the groups are present concerning marital status and the presence of children. Of the group of female never users about 34% is single, while of the group of recent cannabis users or recent cocaine users almost 60% is single. For males marital status has a similar effect. Furthermore, of the male individuals the have never used cannabis or cocaine 38% has one of more children while of the males that recently used cannabis the share with children is about 15% while of the recent cocaine users only 11% has one or more children. Whether or not parents ever used cannabis has a large effect on the probability that their children also use cannabis or cocaine. Of the females that abstained from cannabis and cocaine only about 2% has parents that ever used cannabis, while of the frequent cocaine users 32% has parents that ever used cannabis. Of the females that recently used cannabis 22.2% has parents that ever used cannabis. Also for males there is this large effect of parental cannabis use. Of the abstainers 1.5% has parents that use cannabis, of the males that recently used cannabis this is 17.4%.

Table 2 also gives information about the employment rates of the indi-

viduals in the sample. Full-time jobs are defined as jobs that have regular working hours of more than 20 hours per week.[12] Part-time jobs are defined as jobs that have regular working hours between 1 and 20 hours per week. As shown for females in the sample the average full-time employment rate is 64%, while the total employment rate is 76%. For males the average full-time employment rate is 84%, while the total employment rate is 88%. To do a comparable analysis the analysis of the employment rates will focus on the full-time employment rate. For females the full-time employment rate is lowest for frequent cocaine users (52.6%) and abstainers from cannabis and cocaine (58.5%), while the highest full-time employment rate is for recent cocaine users (70.4%). Of course the employment rates are influenced by differences in educational level and family situation. For males the highest full-time employment rate is for abstainers from cannabis and cocaine (87.4%). Frequent cocaine users have the lowest employment rate (61.2%), but note that this group also has the lowest share of individuals with higher education. Before we start the analysis of the determinants of the employment rate we will first investigate the determinants of the starting rates for cannabis and cocaine. This will be helpful in the analysis when we distinguish between the causal effect from cannabis and cocaine use to employment and the effect caused by joint unobserved determinants.

# 4 Starting to use cannabis and cocaine

Figure 1 shows the cumulative starting probabilities of cannabis and cocaine.[13] As shown for females the cumulative starting probability of cannabis increases from about 5% at age 15 up to 45% at age 25. After that the cumulative starting probability hardly increases. For males the pattern is the same but the maximum cumulative probability is about 55%. As shown in Figure 2 the pattern for cocaine is about the same although here the increase

[12] As shown in the appendix this broad definition of a full-time job is driven by data availability.

[13] An individual who did not use cannabis or cocaine but is below age 50 is considered to have an incomplete duration of non-use, i.e. is assumed to have be 'right censored'.

is only small after age 30 at a level of about 12% for females and 17% for males..

To investigate the determinants of the starting rates of cannabis and cocaine we use a bivariate mixed proportional hazard model with a flexible baseline hazard. Differences between individuals in the rate by which they start using a particular drug are characterized by the observed characteristics $x$, the elapsed duration of time they are exposed to potential use and unobserved characteristics $v$. We take age 12 to be the time at which this potential exposure to drugs starts.

The starting rate for cannabis and cocaine, at time (age) $t$ conditional on observed characteristics $x$ and unobserved characteristics $v$ is specified as:[14]

$$\theta_j(t \mid x, v) = \lambda_j(t) \exp(x'\beta_j + v_j) \text{ for } j = a, b \tag{1}$$

where $\lambda(t)$ represents individual duration dependence, $v$ represents individual specific unobserved heterogeneity, the subscript $a$ represents cannabis and the subscript $b$ represents cocaine. We model flexible duration dependence by using a step function:

$$\lambda_j(t) = \exp(\Sigma_k \lambda_{jk} I_k(t)) \text{ for } j = a, b \tag{2}$$

where $k$ (= 1,..,4) is a subscript for age-intervals and $I_{jk}(t)$ are time-varying dummy variables that are one in subsequent age-intervals. We distinguish 4 age intervals in line with the pattern in Figure 1. For cannabis the age intervals are up to 15, 16-20, 21-25, over 25; for cocaine the age intervals are up to 20, 21-25, 26-30, over 30. Because we also estimate a constant term, we normalize $\lambda_{j1} = 0$.

The conditional density functions of the completed durations of non-use can be written as

$$f_j(t \mid x, v_j) = \theta_j(t \mid x, v_j) \exp(-\int_0^t \theta_j(s \mid x, v_j) ds) \text{ for } j = a, b \tag{3}$$

[14] I ignore the potential causal relationship from cannabis to cocaine. See Van Ours (2003) for a discussion of this relationship.

I take the possible correlation between the unobserved components into account by specifying the joint density function of the two durations of non use $t_a$ and $t_b$ conditional on $x$ as

$$f(t_a, t_b \mid x) = \int_{v_b} \int_{v_a} f_a(t_a \mid x, v_a) f_b(t_b \mid x, v_b) dG(v_a, v_b) \tag{4}$$

$G(v_a, v_b)$ is assumed to be a discrete distribution 4 points of support $(v_{1a}, v_{1b})$, $(v_{2a}, w_{1b})$, $(w_{1a}, w_{2b})$, $(w_{2a}, w_{2b})$. The associated probabilities are denoted as follows:

$$\begin{aligned} \Pr(v_a &= v_{1a}, v_b = v_{1b}) = p_1 \qquad \Pr(v_a = v_{1a}, v_b = v_{2b}) = p_2 \\ \Pr(v_a &= v_{2a}, v_b = v_{1b}) = p_3 \qquad \Pr(v_a = v_{2a}, v_b = v_{2b}) = p_4 \end{aligned}$$

where $p_n$ $(n = 1, .., 4)$ is assumed to have a multinomial logit specification:

$$p_n = \frac{\exp(\alpha_n)}{\Sigma_n \exp(\alpha_n)} \tag{5}$$

and we normalize $a_4 = 0$. We do not estimate the mass points $v_{2a}$ and $v_{2b}$ directly but estimate the differences between the two mass points: $\lambda_a = v_{2a} - v_{1a}$ and $\lambda_b = v_{2b} - v_{1b}$.[15]

The parameters are estimated using maximum likelihood. In the estimates observations of individuals that did not start to consume cannabis or cocaine are considered to be right censored durations.

The parameter estimates for females are presented in the first two columns Table 3. As shown the starting rates are the same across the three survey years. Females with secondary or higher education have higher starting rates for both cannabis and cocaine than females with lower education. Recent birth cohorts also have higher starting rates for cannabis. Later generations are more likely to start using cannabis. And, cannabis use of parents has a positive effect on both starting rates. The parameter estimates also indicate clear evidence of age dependence. For cannabis the starting rates of females are highest in the age range 16-25, for cocaine the highest starting rates

[15] Note that if $\lambda_a = \lambda_b = 0$ there is no unobserved heterogeneity but also note that if so the probabilities $p$ are not identified.

are in the age rage 21-30 years. Finally, there is presence of unobserved heterogeneity. We can identify three groups, which for unknown reasons behave differently. Conditional on age and observed characteristics there is a group of females of 26.1% that has both a high starting rate for cannabis and a high starting rate for cocaine. There is also a group of 63% that has low starting rates for both cannabis and cocaine. The remaining group has a high starting rate for cannabis and a low starting rate for cocaine (10.9%). If we use the parameter estimates from Table 5 to perform some simulations for synthetic persons with average characteristics we find that these persons at age 40 have a cumulative probability of 95.2% to have ever used cannabis if they belong to the high cannabis starting rate type. If with the same characteristics they belong to the low cannabis starting rate type, 17.6% have ever used cannabis. This leads to an average of 46.3% of lifetime cannabis use at age 40. In the same way we can calculate that these individuals would have a lifetime prevalence at age 40 of 39% if they belong to the high cannabis starting rate category and a lifetime prevalence of 1.2% if the belong to the low cannabis starting rate category. This would lead to an average lifetime prevalence at age 40 of 11.1%. Clearly, there as big differences in starting rates due to unobserved heterogeneity. But, of the high starting rates categories not everyone will start using cannabis or cocaine. And, of the low starting rates not everyone will abstain from cannabis or cocaine.

The starting rates for males are influenced by similar characteristics, although education is less important then it is for females. The starting rate for cannabis is positively affected by birth year and cannabis use of parents is important for both starting rates. Also for males there is unobserved heterogeneity affecting the starting rates of cannabis and cocaine. For males there is conditional on age and observed characteristics a group of 31.9% that has both a high starting rate for cannabis and a high starting rate for cocaine. There is a group of 53% that has small starting rates for both cannabis and cocaine. The remaining group (15.1%) has a high starting rate for cannabis and a low starting rate for cocaine.

# 5 Cannabis, cocaine and jobs

We use $e$ as the indicator of whether ($e = 1$) or not ($e = 0$) an individual has a (full-time) job and use $c$ as the indicator of whether ($c = 1$) or not ($c = 0$) an individual has used cannabis recently. We use the following latent variable specifications representing the individual's unobserved propensity to have a job and to be a current cannabis user

$$\begin{aligned} e^* &= x_e\beta_e + \delta_c c_p + \varepsilon_e, \qquad e = 1 \quad \text{if } e^* > 0, \text{ and 0 otherwise} \\ c^* &= x_c\beta_c + \varepsilon_c, \qquad\qquad c = 1 \quad \text{if } c^* > 0, \text{ and 0 otherwise} \end{aligned} \tag{6}$$

where $x_e$ is a vector of personal characteristics affecting the probability to have a job (including whether or not an individual ever used cocaine), $c_p$ is a dummy variable whether the individual has used cannabis in the past, $\beta_e$ is a vector of parameters, $\delta_c$ indicates whether past cannabis use affects the employment probability and $\varepsilon_e$ is an error term. In the same way $x_c$ is a vector of personal characteristics affecting the probability to be a current cannabis user, where $x_c$ partly overlaps with $x_e$. Furthermore $\beta_c$ is again a vector of parameters,and $\varepsilon_c$ is an error term. In the modeling we have to take into account that there may be a correlation between current cannabis use and having a job. One can imagine that current cannabis use has a negative effect on the employment rate, but one can also imagine that if one does not have a job this has a positive effect on the probability to use cannabis. We take this correlation into account by modelling the joint distribution of employment rate and current cannabis use.

When an individual has a full time job three situations are possible with respect to past and current cannabis use[16]

1. Past and current cannabis use: $\Pr(e^* > 0, c^* > 0 | c_p = 1)$

2. Past but no current cannabis use: $\Pr(e^* > 0, c^* < 0 | c_p = 1)$

[16] For individuals that do not have job the specifications of the three situations are similar.

3. No past cannabis use: $\Pr(e^* > 0, c^* < 0 | c_p = 0) = \Pr(e^* > 0 | c_p = 0)$[17]

We assume that conditional on the observed characteristics there may be unobserved heterogeneity affecting the probability to have a job and the probability to be a current cannabis user. In the analysis we use a multivariate logit specification with a discrete mixing distribution with $j$ points of support ($j = 1, ..n$). Then the possible observable outcomes in case the individual has a job are

1. past cannabis use, no current use: $\Lambda_j(x_e\beta_e + \delta_c, -x_c\beta_c)$
2. past and current cannabis use: $\Lambda_j(x_e\beta_e + \delta_c, x_c\beta_c)$
3. no past cannabis use: $\Lambda_j(x_e\beta_e)$

where the multivariate logit $\Lambda_j(x_e\beta_e + \delta_c, x_c\beta_c)$ is specified as $\sum_{j=1}^{n} p_j \Lambda(x_e\beta_e + \delta_c + v_{je})\Lambda(x_c\beta_c + v_{jc})$. Here, the $v_{je}$ represent the mass points in the employment part while the $v_{jc}$ represent the mass points in the current cannabis part. Furthermore, the mixture of binomial logits is specified similarly with $\Lambda_j(x_e\beta_e) = \sum_{j=1}^{n} p_j \Lambda(x_e\beta_e + v_{je})$. In these specifications the $p_j$ has a multinomial logit specification defined as $\sum_{j=1}^{n} \frac{\exp(\alpha_j)}{1+\exp(\alpha_j)}$. To identify all parameters we normalize $v_{1c} = v_{1e} = \alpha_n = 0$. Note that we do not estimate the mass points itself but estimate $\lambda_{je} = v_{je} - v_{1e}$ and $\lambda_{jc} = v_{jc} - v_{1c}$. Note that if $\lambda_{je} = \lambda_{jc} = 0$, there is no unobserved heterogeneity affecting employment and current cannabis use.[18]

We start the analysis with a mixing distribution with $j = 2$.[19] The parameters are estimated with maximum likelihood and are shown in Table

[17] Note that $\Pr(e^* > 0, c^* < 0 | c_p = 0) = \Pr(e^* > 0 | c^* < 0, c_p = 0) * \Pr(c^* < 0 | c_p = 0)$ In our data if there is no past cannabis use, there is no current cannabis use, which implies that $\Pr(c^* < 0 | c_p = 0) = 1$. Therefore $\Pr(e^* > 0 | c^* < 0, c_p = 0) * \Pr(c^* < 0 | c_p = 0) = \Pr(e^* > 0 | c_p = 0)$

[18] Also note that in this case the $p's$ is not identified.

[19] In the appendix we show parameter estimates in case we use a bivariate probit specification in stead of a bivariate logit specification. Note that the main outcomes of the analyses do not differ.

4. For females current use of cannabis was higher in 1997 than it was in 1994 and 2001. It is also higher if parents have used cannabis in the past and it is lower for females with higher education and females with children than it is for their counterparts. The probability to have a full-time job is higher in 1997 and 2001 than it was in 1994, which is consistent with the growth of employment in the Netherlands during the second half of the 1990s. Age initially has a positive effect on the probability to have to job but a negative one at higher age (the maximum job probability is around age 40, but this could also be a cohort effect). The probability to have a job increases with the level of education. And, females that are single and females with children have a smaller employment probability than their counterparts. Past cannabis use has a positive effect on the employment rate (significantly different from zero at a 10% level), while past cocaine use has a significant negative effect on the employment rate. Finally, conditional on the effect of the observed characteristics there is a significant negative correlation between the two probabilities. There is a group representing 24% of the individuals that has a high probability to be a cannabis user and a low probability to have a job; and there is a group of 76% of the individuals that has a low probability to be a cannabis user and a high probability to have a job. As indicated in the bottom two raws of the table we cannot reject the hypothesis that there is correlation through unobserved heterogeneity. And, we cannot reject that past cocaine use has a negative effect on the employment probability.

Many of the parameter estimates for males are similar to those for females. Higher educated males and males with children have a lower probability to be a current cannabis user while single males and males with parents that ever used cannabis have a higher probability to be a cannabis user than their counterparts. The growth in employment opportunities in the second half of the 1990s is also present for males. Age has a positive but diminishing effect on the employment rate (the calculated maximum is age 70), while higher educated and non-single males have a higher employment rate than their counterparts. Our main variables of interest, past cannabis use and past cocaine use have a significant negative effect on the employment rate. Condi-

tional on the observed characteristics there is a negative correlation between current cannabis use and employment rate through unobserved characteristics, but the Likelihood Ratio test for absence of unobserved heterogeneity is not significantly different from zero.

The parameter estimates in Table 4 differ from those in Table 3 in the sense that in the starting rate analysis it was possible to identify three mass points in the distribution of unobserved heterogeneity for both males and females while in the analyses presented in Table 4 we could only identify two mass points for females[20] while for males the absence of unobserved heterogeneity could not be rejected. Furthermore, it could that our assumption that past cannabis use and past cocaine use is exogenous with respect to the employment rate is not valid. We address these two issues in the next section.

# 6 Cannabis, cocaine and jobs reconsidered

To distinguish between causal effects from drug use to employment rates and correlation between drugs use and employment rates because of joint unobserved determinants we combine the bivariate starting rate model for cannabis and cocaine with a univariate analysis of employment rates. The analysis of bivariate starting rates allows us to identify unobserved components (random effects), which we try to relate to unobserved components in the determinants of the employment rates. To allow for unobserved heterogeneity affecting the employment rates and current cannabis use three mass points are included in the employment equation. The associated probabilities are denoted as follows:

$$\begin{aligned} \Pr\left(v_a \right. &= \left. v_{1a}, v_b = v_{1b}, v_e = v_{1e}, v_c = v_{1c}\right) = p_1 \\ \Pr\left(v_a \right. &= \left. v_{1a}, v_b = v_{2b}, v_e = v_{2e}, v_c = v_{2c}\right) = p_2 \\ \Pr\left(v_a \right. &= \left. v_{2a}, v_b = v_{2b}, v_e = v_{3e}, v_c = v_{3c}\right) = p_3 \end{aligned} \tag{7}$$

[20] We investigated whether we could identify a third mass point, but this was not possible. Apparently, the presence of unobserved heterogeneity is captured by the introduction of two mass points.

The parameter estimates are shown in Table 5. Since the parameters of the starting rates and most of the parameters of the current cannabis use probability and the employment rate are very similar to those presented in previous tables we focus the discussion on the effects of past cannabis use, past cocaine use and the presence of unobserved heterogeneity.

For females the distribution of the unobserved heterogeneity is very similar to the one presented in Table 3. There are three points of support. There is a group of 23.6% that has a high starting rate for cannabis, a high starting rate for cocaine, a high probability to be a current cannabis user and a low probability to have a job. There is also a group of 60.1% that has a low starting rate for cannabis, a low starting rate for cocaine, a low probability to be a current cannabis user and a high probability to have a job. The third and smallest group has an intermediate position. What is obvious is that for 83.7% of the females there is a perfect negative correlation between on the one hand starting rates for cannabis and cocaine and current cannabis use and on the other hand the probability to have a full time job. Because of this strong negative correlation between drug use and employment probability the direct effect of past drug use on current employment rate changes. As shown in Table 5 past cannabis use has a significant positive effect on the employment rate of females while past cocaine use has an insignificant positive effect. From the Likelihood Ratio test statistics shown in the bottom part of the table it appears that we cannot rule out the presence of unobserved heterogeneity in the current cannabis use probability and employment rate. And, we cannot reject the hypothesis that past cannabis use has a positive effect on the employment rate of females.

For males there are similar estimation results as for females. For about 80% of the males there is a negative correlation between on the one hand starting rates for cannabis and cocaine and current cannabis use and on the other hand the probability to have a full time job. Because of this the effects of past cannabis use and past cocaine use on the employment rate are no longer significantly different from zero. As shown by the Likelihood Ratio statistic in the bottom part of the table we cannot reject the hypothesis that there is no direct effect of past cannabis and cocaine use on the employment

rate of males.

All in all we longer find detrimental effects of cannabis and cocaine on the employment rates of female and male individuals.

# 7 Conclusions

This paper deals with the possible detrimental effects of the use of cannabis and cocaine on the employment position of individuals. Results from previous studies are inconclusive about these effects. Some studies find that there are detrimental effects but other studies find no effect and some studies even find a positive effect of cannabis use. If there are unobserved determinants that affect cannabis and cocaine use that are correlated with unobserved determinants of the employment rate one has to account for selectivity. The main issue in all studies is how to correct for this possible selectivity in the use of cannabis and cocaine. Previous studies have used variables relating to past family situation, parental education and local drug prices as instruments. This study uses an alternative approach where the heterogeneity in starting rates of cannabis and cocaine use are related to unobserved heterogeneity in the employment rates. This paper focuses on prime age individuals living in Amsterdam. For females we find that there is a positive causal effect of past cannabis use on the employment rate. For males past use of cannabis and cocaine is correlated with lower employment rates. However, the fact that individuals that have used cannabis or cocaine are less likely to be employed has to do with (unobserved) personal characteristics and not with a causal effect. After correcting for unobserved personal characteristics there is no negative effect of cannabis use or cocaine use on employment rate of males.

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# 8 Appendices

## 8.1 Appendix 1: Information about the dataset

### 8.1.1 General set-up

CEDRO, the Center for Drug Research of the University of Amsterdam has collected data on drug use in 1987, 1990, 1994, 1997 and 2001 (see Abraham et al. (2003) for a detailed description). In this paper the surveys of 1987 and 1990 are not included in the analysis. The surveys of 1987 and 1990 are not used because there is no information about parental cannabis use. The analysis in this paper is based on the last three surveys. There are some differences between the surveys, but the information used in this paper is collected consistent through time. The data on drug use are based on self-reported information, which is the norm for analyses of drug consumption. The survey population is defined as all persons in the Municipal Population Registry of Amsterdam.

In 1994 two interview methods were used, a written and a computer assisted version (using laptop computers where the interviewer directly typed in the answers). The sample was randomly subdivided into two equal sized samples. It turned out that the interview method did not affect the answers to the questions. The 1997 survey was fully computer assisted. The 2001 survey was based on a mixture of methods. Respondents could choose between a paper questionnaire, a computer assisted face-to-face interview, an interview per telephone, via their own computer on the Internet or on a compute disk (floppy disk by mail). The non-response in 1994 49.2%, in 1997 48.1%, and in 2001 60.

The available data refer to all inhabitants of Amsterdam of 12 years and older. We reduced this sample by using a number of criteria. Because the focus of the paper is on wages of employed individuals we only consider individuals who were between age 26 and 50 at the time of the survey. The individuals in this age category have finished their education and have made the choice about whether or not to participate in the labor market. Because some studies find individuals from ethnic minority groups to underreport

drug consumption we focus on individuals born in the Netherlands with a Dutch nationality. We did the analyses separately for males and females. After removing observations with incomplete information the net samples contain 2308 females and 2057 males. Information with respect to working hours is available in categories. For the surveys of 1994 and 1997 the categories are (in weekly hours excluding overtime payments): $<$ 8, 8-20, 20-32, $>$32. For the survey of 2001 the categories are: 1, 2-10, 11-20, $>$20. In the analysis we assume that a full-time job refers to a working time of more than 20 hours per week.

### 8.1.2 Explanatory variables

In the analysis the following explanatory variables are used:

- Age: Age of individuals at the time of the survey.
- Secondary education: Dummy variable with a value of 1 if the individual attended secondary general or vocational education, and a value of 0 otherwise. Secondary education refers to intermediate vocational or secondary general education.
- Higher education: Dummy variable with a value of 1 if the individual attended higher vocational or academic education, and a value of 0 otherwise. Since there are three dummy variables for education the overall reference group consists of individuals with only basic education.
- Single: Dummy variable with a value of 1 if the individual is living alone and a value of 0 if the individual is part of a multi-person household.
- Children: Dummy variable with a value of 1 if the individual has children and a value of 0 otherwise.
- Full-time: Dummy variable with a value of 1 if the individual has a regular job of at least 20 hours per week and a value of 0 otherwise.
- Year 1997 (2001): Dummy variable with a value of 1 if the individual participated in the survey of 1997 (2001) and a value of 0 otherwise.

- Birth year: Year of birth, calculated as (year of survey − age − 1950)/10
- Cannabis use parents: one or both parents have ever used cannabis
- Past use of cannabis (cocaine): Life time prevalence cannabis (cocaine) = 1
- Recent use of cannabis (cocaine): Last year prevalence cannabis (cocaine) = 1

## 8.2 Appendix 2. Bivariate probit estimates

If we use a bivariate probit specification we find

$$\text{past cannabis use, no current use} \quad : \quad \Phi_2(x\beta_e + \delta_c, -x\gamma_2; \rho) \tag{8}$$

$$\text{past and current cannabis use} \quad : \quad \Phi_2(x\beta_e + \delta_c, x\gamma_2; \rho) \tag{9}$$

$$\text{no past cannabis use:} \quad \Phi(x\beta_e) \tag{10}$$

the situation where the individual has no job are equivalent. The parameters are estimated with maximum likelihood and are shown in Table 6 and are very similar to those presented in Table 4 where a bivariate logit specification is used. Higher educated individuals, non-single individuals, individuals with children and individuals who do not have parents that used cannabis have a lower cannabis use than their counterparts. Conditional in their observed and unobserved characteristics, the employment rate is higher in 1997 and 2001 than in 1994. Age has a nonlinear effect on the employment rate. Education has a significant positive effect on the employment rate and both male and female singles have a smaller probability to have a (full-time) job. For females the presence of children also reduces the employment rate. Furthermore, for prime age females there is a positive employment effect of past cannabis use and a negative employment effect of past cocaine use. For prime age males past cannabis use and past cocaine use both have a negative effect on the employment rate. Finally, conditional on the effects of the observed characteristics there is a significant negative correlation through unobserved

determinants between recent cannabis use and employment rate. Those that use cannabis have a smaller probability to have a job; or in other words those that have a small probability to have a job have a high probability to use cannabis. If there is causality, it is not possible to draw conclusions concerning the direction of causality.

**Table 1 The use of cannabis and cocaine**[a)]

| Cannabis | Cocaine | Females | Males |
|---|---|---|---|
| Ever | − | 47.8 | 57.9 |
| − | Ever | 12.4 | 17.3 |
| Ever | Ever | 12.2 | 16.7 |
| Ever | Never | 35.6 | 41.1 |
| Never | Ever | 0.2 | 0.6 |
| Never | Never | 52.0 | 41.6 |
| | | 100.0 | 100.0 |
| Last year | Last year | 1.5 | 3.6 |
| Last year | Past | 2.8 | 6.4 |
| Last year | Never | 6.2 | 10.9 |
| Last year | − | 10.5 | 20.9 |
| − | Last year | 2.3 | 4.3 |
| $\geq$ 25 times | $\geq$ 25 times | 1.9 | 4.7 |
| $\geq$ 25 times | $<$ 25 times | 5.5 | 7.8 |
| $\geq$ 25 times | Never | 10.0 | 15.2 |
| $\geq$ 25 times | | 17.4 | 27.7 |
| | $\geq$ 25 times | 2.5 | 5.6 |
| Last month | − | 6.2 | 12.8 |
| − | Last month | 1.0 | 1.8 |

[a)] Sample of 2308 females and 2057 males age 26-50

**Table 2 Characteristics different types of drug users**

| | Age | High educ (%) | Single (%) | Child (%) | Parents cannabis (%) | Employment full-time (%) | Employment total (%) | N |
|---|---|---|---|---|---|---|---|---|
| **Females** | | | | | | | | |
| All | 36.7 | 48.5 | 41.5 | 41.4 | 7.8 | 63.9 | 76.2 | 2308 |
| No cannabis no cocaine | 37.6 | 38.2 | 33.7 | 47.5 | 1.8 | 58.5 | 72.8 | 1199 |
| Cannabis ever | 35.6 | 59.6 | 50.0 | 34.8 | 14.5 | 69.8 | 79.8 | 1103 |
| Cannabis frequent | 35.8 | 56.6 | 54.6 | 34.4 | 23.7 | 67.1 | 77.3 | 401 |
| Cannabis recent | 34.2 | 52.2 | 60.5 | 21.3 | 22.2 | 62.1 | 72.0 | 243 |
| Cocaine ever | 36.2 | 55.7 | 56.8 | 36.6 | 20.6 | 62.7 | 74.6 | 287 |
| Cocaine frequent | 36.7 | 38.6 | 52.6 | 42.1 | 31.6 | 52.6 | 61.4 | 57 |
| Cocaine recent | 34.7 | 46.3 | 61.1 | 29.6 | 25.9 | 70.4 | 81.5 | 54 |
| **Males** | | | | | | | | |
| All | 36.6 | 48.9 | 38.1 | 30.5 | 7.2 | 83.6 | 87.9 | 2057 |
| No cannabis no cocaine | 37.3 | 42.4 | 30.2 | 38.2 | 1.5 | 87.4 | 90.1 | 855 |
| Cannabis ever | 36.0 | 53.2 | 43.3 | 25.0 | 11.4 | 81.0 | 86.4 | 1190 |
| Cannabis frequent | 36.0 | 44.6 | 49.0 | 24.8 | 16.9 | 76.6 | 82.4 | 569 |
| Cannabis recent | 34.7 | 45.5 | 57.1 | 14.9 | 17.4 | 73.8 | 80.2 | 429 |
| Cocaine ever | 37.0 | 45.5 | 50.8 | 20.2 | 18.3 | 71.3 | 76.4 | 356 |
| Cocaine frequent | 36.9 | 30.2 | 60.3 | 25.0 | 22.4 | 61.2 | 67.2 | 116 |
| Cocaine recent | 35.2 | 38.2 | 66.3 | 11.2 | 20.2 | 65.2 | 70.8 | 89 |

**Table 3 Parameter estimates starting rates cannabis and cocaine**[a)]

| | Females | | Males | |
|---|---|---|---|---|
| | Cannabis | Cocaine | Cannabis | Cocaine |
| Year 1997 | 0.06 (0.4) | -0.06 (0.3) | 0.29 (2.4)* | 0.26 (1.5) |
| Year 2001 | -0.03 (0.2) | -0.02 (0.1) | -0.01 (0.1) | -0.20 (1.1) |
| Secondary education | 1.02 (4.4)* | 0.88 (3.2)* | 0.52 (3.2)* | 0.18 (0.8) |
| Higher education | 1.19 (7.1)* | 0.75 (3.1)* | 0.19 (1.2) | -0.31 (1.5) |
| Birth year | 0.45 (5.3)* | 0.16 (1.1) | 0.41 (5.5)* | -0.04 (0.4) |
| Cannabis use parents | 1.93 (5.5)* | 1.51 (5.1)* | 1.69 (5.3)* | 1.86 (5.7)* |
| Period 2 | 2.02 (12.1)* | 1.11 (6.3)* | 2.17 (18.4)* | 1.37 (9.2)* |
| Period 3 | 1.98 (7.3)* | 0.93 (4.3)* | 2.17 (12.2)* | 1.11 (5.8)* |
| Period 4 | 0.39 (1.0) | -0.75 (2.8)* | 0.77 (2.7)* | -0.06 (0.3) |
| Mass points $\lambda_a, \lambda_b$ | -2.75 (7.3)* | -5.73 (25.8)* | -2.78 (11.3)* | -5.24 (19.2)* |
| Probability $\alpha_1$ | -0.88 (3.4)*[b)] | | -0.68 (4.1)* | |
| Probability $\alpha_2$ | -1.75(2.5)* | | -1.43 (3.9)* | |
| -Loglikelihood | 5904.6 | | 6284.8 | |
| $N$ | 2308 | | 2057 | |

[a)] 2308 females and 2057 males; absolute $t$-values in parentheses; * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] The probabilities are (%)

| | $p_1$ | $p_2$ | $p_3$ |
|---|---|---|---|
| Females | 26.1 | 10.9 | 63.0 |
| Males | 31.9 | 15.1 | 53.0 |
| Inclination towards | | | |
| Cannabis | high | high | low |
| Cocaine | high | low | low |

**Table 4 Estimation results bivariate logits drug use - employment rates**[a)]

| | Females | | Males | |
|---|---|---|---|---|
| | Cannabis currently | Full-time job | Cannabis currently | Full-time job |
| Year 1997 | 1.61 (2.2)* | 0.68 (5.8)* | -0.37 (1.1) | 0.70 (4.6)* |
| Year 2001 | 0.32 (0.5) | 0.56 (4.9)* | -0.51 (1.3) | 0.89 (5.7)* |
| Age | 0.23 (0.5) | 0.20 (2.4)* | -0.14 (0.5) | 0.26 (2.4)* |
| $\text{Age}^2/100$ | -0.44 (0.7) | -0.26 (2.3)* | 0.09 (0.3) | -0.38 (2.7)* |
| Secondary education | -0.95 (1.1) | 1.03 (7.8)* | 0.01 (0.0) | 0.10 (0.6) |
| Higher education | -3.00 (2.1)* | 1.56 (12.8)* | -0.89 (1.8) | 0.68 (4.2)* |
| Single | 0.67 (1.1) | -0.32 (3.1)* | 1.41 (2.5)* | -0.64 (4.5)* |
| Children | -3.17 (2.9)* | -0.93 (8.6)* | -0.91 (2.8)* | 0.09 (0.5) |
| Cannabis use parents | 2.73 (1.9) | - | 1.54 (1.9) | - |
| Past cannabis ($\delta_{ca}$) | - | 0.21 (1.9) | - | -0.39 (2.6)* |
| Past cocaine ($\delta_{co}$) | - | -0.39 (2.3)* | - | -0.65 (3.9)* |
| Mass points $\lambda_c, \lambda_e$ | -8.31 (3.3)* | 0.48 (2.4)* | -4.40 (2.5) | 0.43 (1.7) |
| Probability $\alpha$ | -1.16 (9.1)* | | -0.12 (0.3) | |
| -Loglikelihood | 1856.1 | | 1557.8 | |
| LR test | | | | |
| $\lambda_c = \lambda_e = 0$ | 14.2* | | 6.0 | |
| $\delta_{ca} = \delta_{co} = 0$ | 6.8* | | 29.4* | |

[a)] See Table 3 footnote a.

**Table 5 Results joint estimates**[a)]

| | **Females** | | **Males** | |
|---|---|---|---|---|
| | **Cannabis** | **Full-time** | **Cannabis** | **Full-time** |
| Year 1997 | 0.48 (2.3)* | 0.72 (5.6)* | -0.29 (1.4) | 0.69 (4.6)* |
| Year 2001 | 0.18 (0.9) | 0.57 (4.7)* | -0.28 (1.3) | 0.89 (5.6)* |
| Age | -0.06 (0.4) | -0.06 (0.4) | -0.20 (1.4) | 0.26 (2.4)* |
| $\text{Age}^2/100$ | 0.03 (0.2) | -0.28 (2.4)* | 0.18 (1.0) | -0.38 (2.7)* |
| Secondary education | -0.30 (1.1) | 0.96 (6.7)* | 0.18 (0.7) | 0.08 (0.5) |
| Higher education | -0.66 (2.6)* | 1.51 (11.3)* | -0.48 (2.1) | 0.68 (4.2)* |
| Single | 0.36 (2.1)* | -0.31 (2.9)* | 0.75 (4.3)* | -0.63 (4.4)* |
| Children | -0.87 (4.3)* | -0.95 (8.2)* | -0.58 (2.8)* | 0.10 (0.6) |
| Cannabis use parents | 0.61 (2.5)* | - | 0.96 (3.3)* | - |
| Past cannabis | - | 0.52 (2.1)* | - | -0.34 (1.2) |
| Past cocaine | - | 0.41 (1.0) | - | -0.44 (1.6) |
| Mass points $\lambda_{2c}, \lambda_{2e}$ | -2.83 (1.6) | 1.59 (2.3)* | -3.54 (3.0)* | 0.56 (1.3) |
| Mass points $\lambda_{3c}, \lambda_{3e}$ | -0.77 (2.6)* | 1.31 (2.7)* | -1.32 (4.7)* | 0.36 (0.9) |
| **Starting rates** | **Cannabis** | **Cocaine** | **Cannabis** | **Cocaine** |
| Year 1997 | 0.02 (0.1) | -0.15 (0.7) | 0.29 (2.4)* | 0.25 (1.4) |
| Year 2001 | -0.05 (0.4) | -0.08 (0.3) | 0.03 (0.2) | 0.23 (1.1) |
| Secondary education | 1.07 (5.0)* | 0.94 (3.4)* | 0.29 (2.4)* | 0.22 (1.0) |
| Higher education | 1.21 (7.1)* | 0.80 (3.4)* | 0.51 (3.2)* | -0.29 (1.4) |
| Birth year | 0.47 (6.4)* | 0.17 (1.2) | 0.40 (4.9)* | -0.06 (0.5) |
| Cannabis use parents | 2.01 (6.9)* | 1.43 (5.6)* | 1.70 (5.7)* | 1.75 (5.5)* |
| Period 2 | 2.06 (14.1)* | 1.14 (6.8)* | 2.18 (19.0)* | 1.40 (9.8)* |
| Period 3 | 2.05 (9.2)* | 0.99 (4.8)* | 2.18 (12.2)* | 1.19 (6.6)* |
| Period 4 | 0.49 (1.5) | -0.67 (2.5)* | 0.77 (2.6)* | 0.07 (0.3) |
| $\lambda_a, \lambda_b$ | -2.87 (9.0)* | -3.78 (10.2)* | -2.77 (10.8)* | -3.59 (10.7)* |
| Probability $\alpha_1$ | -0.98 (4.6)*[b)] | | -0.84 (5.6)* | |
| Probability $\alpha_2$ | -1.35 (3.8)* | | -1.20 (4.4)* | |
| -Loglikelihood | 7745.5 | | 7795.8 | |
| LR test | | | | |
| $\lambda_{2c} = \lambda_{2e} = \lambda_{2c} = \lambda_{2e} = 0$ | 22.3* | | 79.6* | |
| $\delta_{ca} = \delta_{co} = 0$ | 7.2* | | 4.4 | |

[a)] See Table 3 footnote a.

[b)] The probabilities are (%)

| | $p_1$ | $p_2$ | $p_3$ |
|---|---|---|---|
| Females | 23.6 | 16.3 | 60.1 |
| Males | 27.2 | 19.0 | 53.9 |
| Inclination towards | | | |
| Cannabis | high | high | low |
| Cocaine | high | low | low |
| Probability of | | | |
| Current cocaine use | high | low | low |
| Full time job | low | high | high |

**Table 6 Estimation results bivariate probits drug use - employment rates**[a)]

| | Females | | Males | |
|---|---|---|---|---|
| | Cannabis Present | Full-time job | Cannabis Present | Full-time job |
| Year 1997 | 0.26 (2.4)* | 0.40 (5.8)* | -0.11 (1.2) | 0.39 (4.7)* |
| Year 2001 | 0.12 (1.2) | 0.33 (4.9)* | -0.14 (1.5) | 0.49 (5.8)* |
| Age | 0.02 (0.3) | 0.12 (2.5)* | -0.02 (0.3) | 0.14 (2.4)* |
| $Age^2/100$ | -0.05 (0.5) | -0.16 (2.4)* | -0.02 (0.2) | -0.21 (2.7)* |
| Secondary education | -0.22 (1.6) | 0.63 (8.0)* | 0.03 (0.3) | 0.05 (0.6) |
| Higher education | -0.40 (3.1)* | 0.94 (13.0)* | -0.25 (2.4)* | 0.37 (4.2)* |
| Single | 0.23 (2.5)* | -0.20 (3.2)* | 0.41 (4.9)* | -0.37 (4.2)* |
| Children | -0.44 (4.3)* | -0.44 (4.3)* | -0.33 (3.2)* | -0.04 (0.4) |
| Cannabis use parents | 0.34 (2.9)* | - | 0.43 (3.6)* | - |
| Past cannabis ($\delta_{ca}$) | - | 0.12 (1.8) | - | -0.22 (2.7)* |
| Past cocaine ($\delta_{co}$) | - | -0.22 (2.3)* | - | -0.35 (3.7)* |
| $\rho$ | -0.15 (2.5)* | | -0.13 (2.2)* | |
| -Loglikelihood | 1859.8 | | 1558.6 | |
| LR test | | | | |
| $\rho = 0$ | 6.0* | | 4.6* | |
| $\delta_{ca} = \delta_{co} = 0$ | 6.6* | | 33.8* | |

[a)] See Table 3 footnote a.

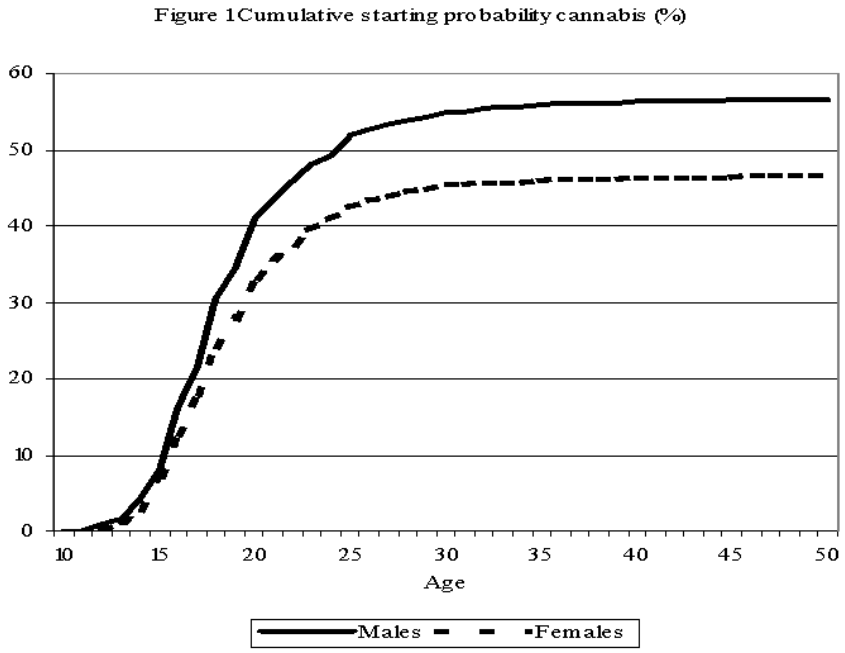
Figure 1Cumulative starting probability cannabis (%)
60
50
40
30
20
10
0
10
15
20
25
30
35
40
45
50
Age
Males
Females

Figure 1:

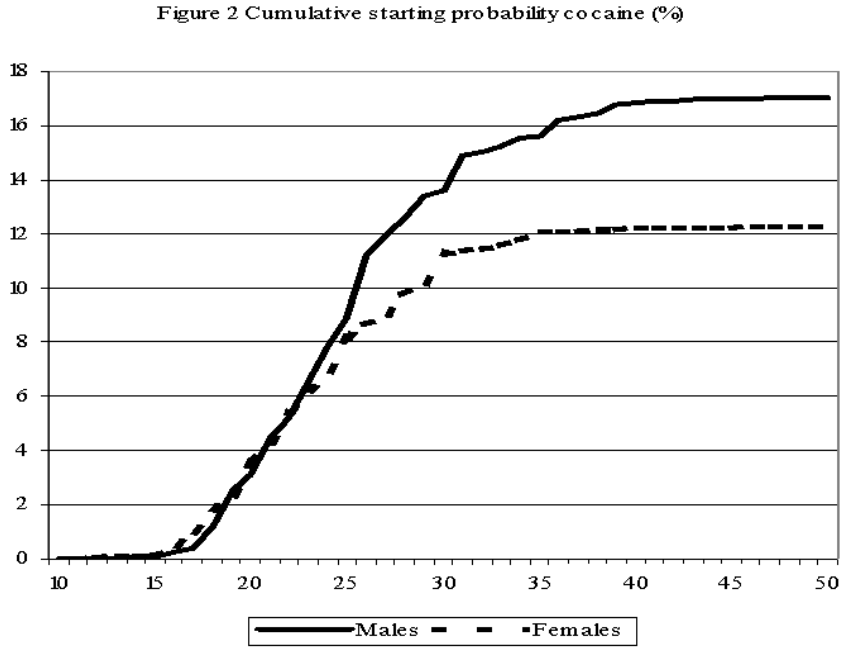
Figure 2 Cumulative starting probability cocaine (%)
18
16
14
12
10
8
6
4
2
0
10
15
20
25
30
35
40
45
50
Males
Females

Figure 2: