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CANNABIS, COCAINE AND WAGES OF PRIME AGE MALES

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Abstract

This paper uses a dataset collected among inhabitants of Amsterdam, to study whether wages of prime age male workers are affected by the use of cannabis and cocaine. The analysis shows that cocaine use and infrequent cannabis use do not affect wages. Frequent cannabis use has a negative wage effect. The age of onset is also important. The earlier current cannabis users have started to use cannabis the larger the negative impact on their wage.

Keywords: drugs, wages, cannabis, cocaine

JEL codes: C41, D12, I19

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1 Introduction

The use of illicit drugs is often related to detrimental health effects of its users. Sometimes a health-related distinction is drawn between hard drugs and soft drugs. 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 are supposed to cause far fewer health problems. However, cannabis use is sometimes also related to school dropout and truancy (Roebuck et al., 2004). Illicit drug use may have a negative effect on labor productivity because of health-related high absence rates, because drug users are more likely to face a workplace accident or because they build up less human capital. If there is a negative effect on labor productivity illicit drug use may result in lower wages.

Although the negative wage effect of illicit drug use is plausible, results from empirical research are inconclusive. Even if based on the same dataset some studies find such negative effects but other studies find no wage effects or even positive wage effects. A common problem in these studies is that wages and drug use are both influenced by factors that are unobserved by the researcher. The traditional solution to this problem is to find suitable instrumental variables that affect the use of drugs but have no direct effect on wages. Frequently used instrumental variables are religious attendance, number of dependents and parental education. As will be discussed in more detail below there has been some doubt on the validity of these instrumental variables. Therefore, additional research on the matter is welcome. The relevance of research on the wage effects of the use cannabis and cocaine goes beyond curiosity about the determinants of wages. In many countries the use of cannabis and cocaine is illegal because of possible detrimental effects. If there is a causal negative effect of drugs use on wages then this strengthens the idea that drugs use is harmful. If on the other hand there is no effect or even a positive effect of drugs use on wages this means that there is one less reason to be concerned about it.

In the Netherlands cannabis use is quasi-legalized since cannabis can easily be bought and the possession of small quantities of cannabis is no offence. Within the Netherlands it is especially the capital Amsterdam that has a reputation as a city with a high drug use prevalence. In 2001 38 % of the Amsterdam population of 12 years and older had previously used cannabis

and 10 % had previously used cocaine.[1] This paper is on the wage effects of the use of cannabis and cocaine for prime age males in Amsterdam. The empirical analysis in this paper is based on data that were collected by the Center for Drug Research (CEDRO) of the University of Amsterdam in surveys in 1994, 1997 and 2001. As most of the previous studies the current study exploits cross sectional data which by nature makes it difficult to address the issue of causality. The main contribution of this paper to the literature on the relationship between illicit drug use and wages is threefold. First, the study is based on data collected in an environment in which at least cannabis use is quasi-legalized. Previous studies are done for countries in which the use of cannabis and cocaine is prohibited. This may lead to different response behavior, i.e. some individuals may be reluctant to report illegal activities. The second novel element of the study is the availability of information about cannabis use of parents which can be used as an instrumental variable for illicit drug use. The third contribution is the use of information about the age of onset of drug use, which makes it possible to study the wage impact of the duration of drug use.

The paper is set up as follows. Section 2 gives an overview of previous studies on the wage effects of illicit drug use. Section 3 presents stylized facts about the use of cannabis and cocaine and about wages of prime age males living in Amsterdam. Section 4 presents the empirical analysis of the wage effects of the use of cannabis and cocaine. It appears that cannabis use has a negative effect on wages while cocaine use has no *additional* negative wage effects. The negative wage effects of cannabis use are related to frequent use. The age of onset of cannabis use of current cannabis users determines the size of the wage effect. Section 5 concludes.

2 Previous studies on illicit drugs and wages

Although the negative effect of illicit drug use on productivity seems plausible, it is not often found in empirical research.[2] All U.S. studies are based on the National Longitudinal Survey on Youth (NLSY). The studies differ in terms of the specification of the dependent variable,

[1] Average for the Netherlands this was 17 % for cannabis and 3 % for cocaine (Abraham et al., 2003).

[2] 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 (2004) for an overview of this literature.

the specification of drugs use, the specific NLSY waves used, the individuals of whom the wage effects are analyzed, the estimation procedure and perhaps most important the instrumental variables used.

Kaestner (1991) uses the 1984 wave of the NLSY to study the wage effects of cannabis and cocaine for young adults. He accounts for endogeneity by using a two-stage least squares approach with nonwage income, the frequency of past religious attendance, the number of dependents, and the number of past delinquent acts as instrumental variables. He finds that increased frequency of use of cocaine or cannabis is associated with higher wages. He attributes this surprising result to a possible underreporting by heavy drug users or by the fact that the analysis does not account for unobservable variables like the individual's subjective rate of time preference and the demand for health care. So, it could be that the negative health consequences of drug use are offset by an increase in health care.

Gill and Michaels (1992) use the 1980 and 1984 waves of the NLSY. They estimate wage equations accounting for potential selectivity by using self-esteem, children and parental education as instrumental variables. They also find a positive relation between wages of males and females and the use of illicit drugs. They attribute this to the possibility that illicit drug use may increase productivity because it helps workers to deal with attitudinal and emotional difficulties.

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 positive wage effect while cocaine use has no significant wage effect.[3] 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) extends his earlier analysis using the 1984 and 1988 waves of the NLSY. He uses the same instrumental variables as before but now performs a panel (fixed effects) analysis to account for unobserved heterogeneity. The parameter estimates are not very precise and many estimated effects are not significantly different from zero. Kaestner now finds that among men, the wage effects of cannabis and cocaine are negative. Also, among women, the

[3]They note that long-term and on-the-job use of cannabis has a negative wage effect.

wage effects of lifetime cannabis use are negative. But, surprisingly among women, the wage effects of recent cannabis use and of cocaine use are positive. A possible explanation for the variety in results suggested by Kaestner is that some drug users choose jobs in which their drug use has little impact on their productivity, but others do not.

MacDonald and Pudney (2000) use the British Crime Survey to estimate a joint model covering past and current drug use together with unemployment and occupational attainment.[4] Occupational attainment is assumed to be a proxy for wages. Instrumental variables used are religious attendance and housing tenure. They conclude that there is little evidence of a strong relationship between illicit drug use and occupational attainment for those at work.

All in all, the results of previous studies are not conclusive. 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. As the corresponding researchers themselves indicate, it is difficult to explain why for example cannabis use would have positive wage effects. It could be that the instrumental variables used are insufficient to account for selectivity in drug use. It is not clear that for example religious attendance affects drug use but not wages. Nor is it clear that parental education does not directly affect wages of children while it does has an effect on drug use of the children. One of the explanations given by Kaestner (1991) for the positive effects of cannabis use is underreporting, i.e. if heavy users of drugs severely underreport their usage and are also doing poorly in the labor market this creates on upward bias in the estimated wage effects. Not much is known yet about the effects of cannabis use. Macleod et al. (2004) for example conclude on the basis of an overview on 48 longitudinal population studies that the only fairly consistent association is the one between cannabis use and lower educational attainment. Less consistent associations are found between cannabis use and both psychological health problems and problematic behavior.

[4]MacDonald and Pudney (2001) is a strongly overlapping study with similar conclusions.

3 Cannabis, cocaine and wages in Amsterdam

3.1 Drugs policy

As indicated in the introduction, 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.[5] 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 use 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 possession of hard drugs is a crime. However, since 1976 the possession of a small quantity of soft drugs for personal use is no offence.

3.2 The data

The data are collected in Amsterdam, which has a population of 700.000 inhabitants and around 300 recognized, so-called 'coffee-shops' were soft drugs can be purchased.[6] The data are collected in 1994, 1997, and 2001 and refer to all inhabitants of Amsterdam of 12 years and older (see Abraham et al. (2003) for a detailed description). 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. Because the paper is on wages the focus is on prime age individuals. After age 25 most individuals have finished their education and have made the choice about whether or not to participate in the labor market. After age 50 employment rates start to decline due to inflow of individuals into a disability status and into early retirement schemes. Therefore,

[5]See Ministry of Health, Welfare and Sport (1997); an international perspective on Dutch drug policy is given in Boekhout van Solinge (1999).

[6]One of the rules under which these retail outlets are allowed to operate is the rule that they cannot advertise selling cannabis. That is why they are called 'coffee shops'. They can however print a big cannabis leave on their shop window.

the analysis is on individuals aged 26 to 50 years. The surveys have information concerning the net monthly earnings of individuals specified in guilders (1 guilder is about 0.44 Euro). This information is available in categories of unequal size and is the same for all years: up to 750, 750-1249, 1250-1499, 1500-1999, 2000-2499, 2500-2999, 3000-3999, 4000-4999, $\geq$ 5000. Information with respect to working hours is also available in categories. For the surveys of 1994 and 1997 the categories are (in weekly hours excluding overtime payments): 1-8, 8-20, 20-32, 32+. For the survey of 2001 the categories are: 1, 2-10, 11-20, 20+. In the analysis a full-time job is assumed to be a job of more than 20 hours per week. For males this may not be an unreasonable assumption since most of the males work 36-40 hours per week conditional on working more than 20 hours per week.[7] For females this set-up is less suitable as there are many females that have a so called 'large' part-time job of 32 hours per week. Therefore, for females monthly information about hourly wages is very imprecise. In the wage equations that have been estimated for females there was no significant difference between wages of 1994 and wages of 1997, which there was for males. Furthermore, there were clear differences in the returns to education for females compared to males. The returns to education for males are comparable to other studies that have more precise information about hourly wages (see Van Ours 2002). All in all, the wage information for females is insufficient accurate. Therefore, females are omitted from the analysis. Furthermore, because some studies find individuals from ethnic minority groups to underreport drug consumption individuals not born in the Netherlands or without a Dutch nationality are omitted. After removing observations with incomplete information the net sample contains 2057 prime age males of which 1589 are full-time employed with net a monthly wage of at least 1500 guilders.

3.3 Stylized facts drug use

Tables 1 and 2 give an impression about the characteristics of the use of cannabis and cocaine among prime age males in Amsterdam. Table 1 shows that the lifetime prevalence for this category of males is 58.2 % for cannabis and 17.5% for cocaine. There are various combinations of use. As shown about 17% of the males has used both cannabis and cocaine, about 41% only

[7]Still, to be sure individuals with a net monthly wage of less than 1500 guilders (about 660 Euros) were assumed to be non-employed.

used cannabis and less than 1% used cocaine but no cannabis. Finally about 41% never used cannabis or cocaine. Last year prevalence of cannabis is 20.8%, last year prevalence of cocaine is 4.4%. So, the last year prevalence numbers are substantially smaller than lifetime prevalence numbers. Last month prevalence are again substantially smaller than last year prevalence numbers. Last month prevalence for cannabis is 12.8%, last month prevalence for cocaine is 1.8%. The difference between last year and last month prevalence does not necessarily refer to consumers that stopped using cannabis or cocaine in the past year. It could just be that for some users the calendar time frequency of use is not that high i.e. below once a month. Therefore, last year use is considered to be recent use and last month use is equivalent to current use (see also European Monitoring Center for Drugs and Drug Addiction, 2002). Past use is use that occurred at least one year before the survey. The table also shows to which extent recent cannabis users also use cocaine recently. For about 4% of the males this is the case. A further 6% is recent cannabis user and has used cocaine in the past. The remaining 10% is a recent cannabis user but has never used cocaine. Table 1 shows that a substantial part of the users has had frequent use. For cannabis about 28% of the prime age males has used more than 25 times, for cocaine this is almost 6%. The table also shows that about 5% of the males have used both cannabis and cocaine more than 25 times. About 8% of the individuals has had frequent cannabis use but infrequent cocaine use. Finally, about 15% has used cannabis more the 25 times, but has never used cocaine. The joined (or separate) use of cannabis and cocaine for full-time employed males differs somewhat from the numbers for all individuals but the differences are not that large.

Table 2 presents several characteristics of recent users of cannabis and cocaine. As shown, recent cannabis and cocaine users are somewhat younger than non-users. With respect to education there are small differences. Of the recent cannabis users about 83% has a secondary or higher education, while of the non-cannabis users this is 78%. Of the recent cocaine users about 78% has a secondary or higher education, while of the others this is 79%. The main differences between the groups concern marital status, presence of children and parental cannabis use. Both recent cannabis users and recent cocaine users are above average single, are less likely to have children and are much more likely to have parents that previously used cannabis. On average 7% of the prime age males in the sample had parents that previously used cannabis. For recent cannabis users this is 16% and for recent cocaine users this is 22%. Finally, there

are clear differences with respect to the average wage of the different groups of males. Both for recent cannabis users and recent cocaine users the wage is below average.

4 Empirical analysis

At first the focus in the analysis is on the wage effects of recent cannabis use. Later on, other indicators of drug use will be included in the analysis. In order to establish the wage effects of recent cannabis use three possible correlated processes have to be taken into account: the choice of employment status, the choice of drug use, and the wage outcome. The choice of employment status can be specified in terms of the latent variable e^* which is assumed to depend on personal characteristics y of individual i:

$$e_i^* = \alpha' y_i + u_i \tag{1}$$

where e_i=1 if $e_i^* \geq 0$ and e_i=0 otherwise. Furthermore, α is a vector of parameters of interest (including a constant) and u_i is an error term.

In the same way the choice of recent cannabis use can be specified in terms of the latent variable c^* that is dependent on personal characteristics z of individual i:

$$c_i^* = \gamma' z_i + v_i \tag{2}$$

where γ is a vector of parameters of interest (including a constant) and v_i is an error term.

Finally, because the actual wage is not observed but there is only information about wage intervals also the logarithm of a latent wage variable w^* depends on personal characteristics x of individual i:

$$\ln w_i^* = \beta' x_i + \delta c_i + \varepsilon_i \tag{3}$$

where β is a vector of parameters of interest (including a constant), δ represent the wage effect of recent cannabis use, and ε_i is the error term.

The empirical analysis starts with the determinants of drug use and employment status. The personal characteristics include age, age^2, educational level, marital status, presence of children and parental cannabis use.[8] After that, the wage effects of drugs use are studied in

[8]The definitions of the variables are given in appendix A.

more detail. In the analysis of the wage effects of drug use initially the interval nature of the wage information is ignored and log-wage regressions are done. Later on, the analysis accounts for the wage intervals.

4.1 Determinants of drug use

To investigate the existence of unobserved personal characteristics affecting both employment status and drugs use the correlation between u_i and v_i is estimated in the context of a bivariate probit model, implying $(u_i, v_i) \sim$ (0,0,1,1,ρ), where ρ represents the correlation between the error terms. So, for individuals that have used cannabis recently and have a job $\Pr(c_i = 1, e_i = 1) = \Phi_2[\gamma' z_i, \alpha' y_i, \rho]$ where Φ_2 is the symbol for a bivariate probit and other combinations are specified similarly.

The first two columns of Table 3 show the parameter estimates for employment status and recent cannabis use. Conditional on the personal characteristics cannabis use is the same in all survey years. Age does not have a significant effect on drug use while the probability to have recently used cannabis is not affected by educational level either. Single males have a higher probability of cannabis use than individuals with a partner. Males with children have a lower probability of use. Finally, parental cannabis use has a large and significant positive effect on cannabis use of their children. Apparently, cannabis use of prime age male workers is partly determined by the family situation where there is a smaller probability of use for individuals with a partner and children and partly determined by the own past family situation since parental cannabis use has a positive effect. Furthermore, it appears that the probability to have a job was larger in 1997 and 2001 than in 1994. Higher educated males and non-single males have a higher probability to be employed than their counterparts have. Finally, it appears that conditional on the effects of the personal characteristics there is no correlation between cannabis use and employment status. As indicated the hypothesis that ρ is equal to zero cannot be rejected.

The third and fourth column of Table 3 show similar bivariate probit estimates for recent cocaine use and employment status. Cocaine use has increased between 1994 and 1997 but not between 1997 and 2001. Other significant effects are similar to cannabis use: single males without children having parents that used cannabis are more likely to be cocaine users than

their counterparts. The parameter estimates for the employment equation are very similar as before. Again, the hypothesis that ρ is equal to zero cannot be rejected.

Apparently recent cannabis use and employment status are independent conditional on the personal characteristics. The same holds for recent cocaine use and employment status. Furthermore, Table 3 indicates that there is no causal effect from recent cannabis use or recent cocaine use on the employment status of individuals.[9]

4.2 Log-wage regressions

Initially, the interval nature of the wage information is ignored by using the mid points of the intervals and assuming that the wage for the highest interval is equal to 5500 guilders (about 2420 Euro). If the error terms in equation (3) are independent of the error terms in equations (1) and (2) the error terms of equation (3) simple follow a normal distribution $\varepsilon_i \sim N[0, \sigma_\varepsilon^2]$. Then, after replacing w_i^* by w_i equation (3) can be estimated using OLS. The OLS parameter estimates are shown in the first column of Table 4. It appears that the (nominal) wage in 1997 was 8.5% higher than in 1994, while in 2001 it was 17.0% higher than in 1994. Furthermore, age has a positive but non-linear effect on the wage; the maximum wage is attained at age 50 (which is at the border of the age range of the sample). Prime age males with secondary education earn 10.2% more than otherwise identical males with lower education. For males with higher education the wage is 28.8% higher than for males with lower education.[10] Males with a partner earn 8.2% more than their single counterparts, which could be an indication of the so called "marriage premium". Finally, it appear that males that have recently used cannabis earn 6.9% less than males that did not use cannabis recently (if at all).

A simple way to correct for potential selectivity in the employment status is to include the inverse Mill's ratio based on a probit estimate of the employment status. The second column of Table 4 shows parameter estimates in which potential selectivity in the employment status is accounted for. As shown the selectivity term does not have a significant effect on the wage. Therefore, the issue of potential selectivity in the employment status is ignored in the remainder

[9] In Van Ours (2005) the employment effects of the use of cannabis and cocaine are investigated in more detail.

[10] This is in line with estimates based on more precise wage information (see Van Ours 2002).

of the paper.

So, if cannabis use is assumed to be exogenous to the wage it has a negative wage effect of about 7%. However, it is possible that there are unknown factors that influence both cannabis use and wages, perhaps due to a characteristic like attitude towards career making. Those that are more likely to use cannabis are less likely to pursue a career and therefore have lower wages. If this is the case the parameter estimates in column (1) of Table 4 may overestimate the negative effect of cannabis use. To identify the causal effect of cannabis use on the wage one needs instrumental variables that influence cannabis use but have no direct effect on the wage. As shown before cannabis use is not affected by age and education but only by family characteristics including parental cannabis use. Apparently it is easier for children to start using cannabis if their parents have already done so. Perhaps this has something to do with parents signaling that the use of cannabis is harmless or without great risks. Since there is no immediate reason to think that parental cannabis use will have a direct effect on wages of their children this is an excellent instrumental variable. The third column of Table 4 shows two stage least squares parameter estimates where parental cannabis use is used as an instrumental variable for recent cannabis use. As shown the parameter estimates for the non-drug variables are hardly affected but now the wage effect of recent cannabis use is very large. According to the estimates presented recent cannabis use causes the wage to be reduced by 40.5%.

The fourth and fifth column of Table 4 show maximum likelihood parameter estimates when the log-wage equation and the recent cannabis equation are estimated jointly assuming $(v_i, \varepsilon_i) \sim (0,0,1,\sigma_\varepsilon^2,\rho)$. Again, the non-drug parameters in the wage equation are hardly different from before, but the negative wage effect of recent cannabis use is estimated to be 29.3%. Furthermore, as shown there is a significant correlation between the error terms suggesting that selectivity does matter.

The big wage effects of recent cannabis use shown in columns (3) and (4) of Table 4 seem highly implausible. The results suggest that prime age males that have for unknown reasons a higher wage than other observationally equivalent males are more likely to use cannabis. In an OLS set-up the negative wage effect would therefore be substantially underestimated. After correction for this selectivity a substantial negative wage effect of cannabis use is found. Such a finding is in line with research on the wage effects of alcohol use in which after accounting

for selectivity using instrumental variables also huge effects are found.[11]. The fact that after correcting for selectivity the wage effect is so large may indicate that the use of mid-point wage estimates in stead of wage intervals biases the parameter estimates. Or, the specific use of the instrumental variable may lead to a bias. Both possibilities are investigated in more detail in the next subsection.

4.3 Wage intervals

Instead of using mid points of wage intervals the wage equation can also be based on the observed wage intervals:

$$\begin{aligned} w_i &= 1 \qquad \text{if} \qquad 1500 \leq w_i^* < 2000 \\ w_i &= 2 \qquad \text{if} \qquad 2000 \leq w_i^* < 2500 \\ &(...) \\ w_i &= 6 \qquad \text{if} \qquad w_i^* \geq 5000 \end{aligned} \tag{4}$$

If the error terms follow a normal distribution $\varepsilon_i \sim N[0, \sigma^2]$ and the specification is similar to an ordered probit model with known threshold values this leads to the following likelihood contribution for individual i in wage category k ($k = 1, ..6$):

$$L_{i,k} = \Phi[\frac{U_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}] - \Phi[\frac{L_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}] \tag{5}$$

where, U_k is the logarithm of the upper limit of wage category k and L_k is the logarithm of the lower limit of this wage category.

Maximum likelihood parameter estimates based on this specification are shown in the first column of Table 5. Comparing the first columns of Tables 4 and 5 with each other it is clear that the parameter estimates are not much affected by the choice of mid-point estimates or wage intervals. As before recent cannabis use has a negative wage effect of about 7%.

[11] Auld (1998) for example finds that alcohol drinking generates a wage premium of about 10% while smoking reduces the wage with about 8% if the estimates are done with OLS. After using instrumental variables to account for possible selectivity he finds a wage premium of alcohol of 25-50% and a wage penalty of smoking of about 30%. Studies by Zarkin et al. (1998), Heien (1996), and Van Ours (2004) find similar large wage effects when instrumental variables are used

In the same way as before selectivity of drug use has to be taken into account. Two alternatives are investigated. The first model is similar to the one used in the previous section assuming that the error terms in the wage equation and the drug use equation are from a bivariate normal distribution. The second model relates wages and drug use assuming that there are correlated individual random effects.

4.3.1 Bivariate normal distribution

In case the error terms come from a bivariate normal distribution the contributions to the likelihood are similar to those of a bivariate probit model taking into account that one of probits has an ordered specification. The likelihood contribution for individual i in wage category k ($k = 1, ..6$) who used cannabis recently is

$$L_{i,k} = \Phi_2[\frac{U_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}, \gamma' z_i, \rho] - \Phi_2[\frac{L_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}, \gamma' z_i, \rho] \tag{6}$$

and the other combinations of wage intervals and (non) recent use of cannabis are specified similarly.

The maximum likelihood parameter estimates are shown in columns (2) and (3) of Table 5. From this it appears that most of the parameter estimates are hardly affected by the introduction of the correlation between the error terms. The main parameter of interest however changes a lot. After accounting for selectivity the negative wage effect of recent cannabis use is found to be 21.8%. Note however, that although the estimated correlation coefficient ρ is positive and significantly different from zero a likelihood ratio test indicates that the hypothesis that ρ is in fact zero cannot be rejected. All in all it does not seem to matter much whether mid-points of intervals or interval ranges themselves are use in the analysis. Nevertheless at a 5% level the correlation between the error terms, i.e. the selectivity cannot be rejected in the analysis based on mid-points of wage intervals while it can be rejected on the basis of the wage interval estimates.

4.3.2 Correlated random effects

An alternative to the use of a bivariate normal distribution of error terms is the use of correlated random effects. The idea is that the unobserved components affecting recent cannabis use are

from a discrete distribution with (for example) two points of support. If the cannabis use equation contains a constant then the additional point of support is μ_1. The unobserved components affecting the wage of individuals are also from a discrete distribution with two points of support. Here, if there is a constant in the wage equation the additional point of support is μ_2. This means that conditional on the observed personal characteristics there are two types of individuals that differ in their wage (high/low) and there are two types of individuals that differ in the current cannabis use (high/low). So, there could be four types of individuals high wage - high cannabis use, high wage - low cannabis use, low wage - high cannabis use, low wage - low cannabis use. Then, there is a probability p_1 that the mass points are [0,0], a probability p_2 that they are [μ_1,0], a probability p_3 that they are [0, μ_2] and a probability p_4 that the mass points are [μ_1, μ_2], where $\Sigma_{j=1}^{4}\ p_j = 1$. However, it is also possible that there is perfect correlation between the unobserved characteristics so that for example p_1=p_4=0 and there are only two types of individuals for example high wage - low cannabis use, low wage - high cannabis use. In that case a negative correlation between wage and cannabis use could be caused by unobserved personal characteristics and not by a causal effect of cannabis on wage.

The main advantage of using correlated random effects instead of a bivariate normal distribution of error terms is the increased flexibility. In the bivariate normal distribution one additional parameter is estimated to account for selectivity. In the correlated random effects approach there are at least three parameters (in case of perfectly correlated individual random effects: 2 mass points and one probability parameter).

Assuming that both wages and recent cannabis use are influenced by individual random effects that come from a distribution with four points of support the likelihood specification for individual i in wage category k ($k = 1, ..6$) who used cannabis recently is the following:

$$\begin{aligned}
L_{i,k} = p_1(\Phi[\frac{U_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}] - \Phi[\frac{L_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}])\Phi[\gamma' z_i] \\
+p_2(\Phi[\frac{U_k - \beta' x_i - \delta c_i - \mu_1}{\sigma_\varepsilon}] - \Phi[\frac{L_k - \beta' x_i - \delta c_i - \mu_1}{\sigma_\varepsilon}])\Phi[\gamma' z_i] \\
+p_3(\Phi[\frac{U_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}] - \Phi[\frac{L_k - \beta' x_i - \delta c_i}{\sigma_\varepsilon}])\Phi[\gamma' z_i + \mu_2] \\
+p_4(\Phi[\frac{U_k - \beta' x_i - \delta c_i - \mu_1}{\sigma_\varepsilon}] - \Phi[\frac{L_k - \beta' x_i - \delta c_i - \mu_1}{\sigma_\varepsilon}])\Phi[\gamma' z_i + \mu_2]
\end{aligned} \tag{7}$$

where μ_1 and μ_2 represent the random effects and the p's represent the mixing distribution.[12]. The probabilities are specified as a multinomial logit so for $j = 1, ..4$, $p_j = \exp(\alpha_j)/\Sigma_{j=1}^{n} \exp(a_j)$, normalizing $a_4 = 0$.

Table 6 presents parameter estimates based on this likelihood specification. As shown a discrete distribution of unobserved heterogeneity with 3 points of support can be identified. Conditional on the effects of the observed personal characteristics there is a group of 6% of the individuals that has both a high wage and a high recent cannabis use, 59% has a high recent cannabis use and a low wage, and 35% has a low recent cannabis use and a low wage. The difference in wages are quite large, the high wage group earns twice as much as the low wage group. But, the difference in cannabis use is insignificant. Indeed as the lower part of the table shows it appears that independence between the drugs use equation and the wage equation cannot be rejected.[13] The parameter estimates for the non-drug variables are not much different from the parameter estimates in Table 3 and Table 4. Estimating a drug use equation and a wage equation simultaneously does not affect the estimated parameters a lot.

The main conclusion from Table 6 is that if random effects are introduced in the wage equation selectivity is no longer an issue. Recent cannabis use can be considered exogenous to the wage.

4.4 Sensitivity analysis

Questions that remain are whether or not it matters if there was cocaine use, how frequent the use of cannabis was, and whether or not it matters how recent the use of cannabis was. To investigate these questions the analysis is extended by including cocaine use and other measures of cannabis use in the analysis. Based on the results in the previous subsection drug use indicators are assumed to be exogenous to the wage.[14] The additional parameter estimates are given in Table 7. Because all the other parameters are hardly affected by the introduction of different drug variables this table only reports the wage effects of the drug variables. For

[12]Note that there are no random effects if $\mu_1 = \mu_2 = 0$. Note also that in this case the probabilities are not identified

[13]The Likelihood Ratio statistic testing for the presence of correlation between the error terms equals 1.4.

[14]Parameter estimates according to the set-up of Table 6 performed for each of the drug variables confirm this assumption.

reasons of comparison the first lines reproduce the wage effects that were also presented in Table 6.

The second estimate reported in Table 7 indicates that the hypothesis that recent cocaine use does not affect wages cannot be rejected. The third estimate shows that lifetime cannabis use has a negative effect on wage while lifetime cocaine use has not. The effect of lifetime cannabis use is substantially smaller than the effect of recent cannabis use which suggests that past cannabis use may not have a big effect. Indeed, as the fourth estimate shows the hypothesis that past cannabis use does not have a wage effect cannot be rejected.

In the fifth estimate frequent cannabis use (more than 25 times ever) is one of the explanatory variables. It turns out that frequent cannabis use has a significant negative wage effect (8.9%). So, apparently not only recent cannabis use but also frequent cannabis use has a negative wage effect. The sixth estimate shows that infrequent cannabis use has no wage effects.

The seventh estimate distinguishes between frequent recent cannabis use and frequent cannabis use in the past. As shown frequent cannabis use in the past has a somewhat smaller negative wage effect than frequent and recent use. Because there is no information about the timing of the frequent use (at what stage of life frequent use occurred) it is not possible to give an indication of the speed by which the negative wage effect disappears after the individual stops using cannabis. It may be that frequent cannabis use in the past was damaging to the early career but this has been repaired later on. Nevertheless, from a likelihood ratio test comparing fifth and the seventh estimate (value = 2.0) it appears that frequent use has the same wage effects for current users and past users.

Last but not least, the eight estimate investigates to what extent the age of onset of cannabis use is relevant. This estimate only concerns recent cannabis users. The assumption is that they have been cannabis users from the age of onset to their current age. This of course may not be true because they may have stopped used cannabis for a while. Nevertheless, it is remarkable that the age of onset has a significant wage effect for recent cannabis users. From the parameter estimates one may conclude that recent cannabis users that started using at age 15 experience a negative wage effect of 10.2%, while individuals that started using at age 25 experience a

negative wage effect of 2.2%.[15]. The finding that the age of onset affects the wage support the idea that cannabis use is exogenous to the wages. After all, if there are unobserved personal characteristics that affect both cannabis use and wages then there is no particular reason why the duration of cannabis use would affect the wage.

To investigate the robustness of our main results a number of additional sensitivity analyses are performed. First, the estimates are done separately for each of the three datasets (1994-1997-2001). On the basis of a likelihood ratio test comparing the separate estimates with a pooled estimate, the parameter estimates turn out to be the same for each of the datasets. This is especially reassuring for the 2001 dataset since the 2001 survey has a larger non-response than other surveys. Second, the two lowest wage categories that were omitted to avoid mixing up wage effects and working time effects are introduced in the analysis. Then, the parameter estimates are basically the same as before. Third, explanatory variables in the drug use equations that may not be exogenous to drug use (education and family characteristics) are omitted. This does not affect the overall estimation results, which makes sense since the effect of selectivity seems to be absent anyway. Fourth, it is investigated whether the negative wage effect of current cannabis is age dependent, i.e. whether the negative wage effect is smaller for example for older workers. This turned out not to be the case.

Fifth, and final the effects of smoking of cigarettes are investigated. The negative wage effects of smoking are in the order of 10% (see Van Ours, 2004). Because there is a large overlap between smoking tobacco and smoking cannabis use it may be that the negative wage effect of cannabis use is in reality related to the smoking of tobacco. Therefore tobacco smoking indicators are added as additional explanatory variables in the wage equation. This did not affect the wage effects of cannabis use.

5 Conclusions

This paper investigates the wage effects of cannabis use and cocaine use for prime age male workers living in Amsterdam. The relevance of research on the effects of the use cannabis and

[15]The age of onset for cannabis use is usually between 17 and 22 years. Few individuals start using cannabis before age 17 and few start after age 25. Note that the average age of onset in the current sample of prime age males was 19.1 years

cocaine goes beyond curiosity about the determinants of wages. After all, in many countries the use of cannabis and cocaine is illegal because of detrimental physical or psychical health effects. If there is a causal negative effect of drugs use on wages then this strengthens the idea that drugs use is harmful. If on the other hand there is no effect or even a positive effect of drugs use on wages this means that there is one less reason to be concerned about it. Unfortunately previous research predominantly from the US is inconclusive about the wage effects of the use of cannabis and cocaine. Some studies find negative effects, others find no effects or even positive effects. The variety in results is all the more striking since the main studies are based on the same dataset. The difference in outcomes is mainly due to differences in the set-up of the analysis. Cross-section studies usually find a positive wage effect while the only panel study finds negative wage effects. The explanation for the finding that cannabis and cocaine use have positive wage effects is threefold. First, it may be that the analyses performed insufficiently account for selectivity in drugs use. Instead of causality only correlation is measured. Second, there may be a data problem if the response of drugs users is selective. After all, the questions on drugs use refer to illegal behavior. Third, the indicators of drug use are somewhat limited. The indicators concern dummy variables for recent use, or lifetime use or they refer to current intensity of use. The studies performed do not account for the duration of drugs use.

This study has three distinguishing characteristics. First, the institutional setting is different. The data are collected in an environment where the use of cannabis is quasi-legalized and the possession of a small quantity of cannabis is no offence. Therefore, there is no reason to assume that reported behavior deviates from actual behavior. Second, the data analyzed also contain information about parental cannabis use. This information is quite unique and offers the possibility to study the determinants of drug use in more detail and account for possible selectivity in drug use. Third, there is information about the age of onset of drug use which allows the analysis to account for the duration of exposure to drug use.

One of the main conclusions from the empirical analysis is that cannabis use and cocaine use are exogenous to the wage. The analysis shows that cocaine use does not affect wages. Since almost all cocaine users also use cannabis this means that cocaine use has no wage effect *in addition to* the wage effect of cannabis. Infrequent cannabis use has no negative wage effect either. However, frequent cannabis use has a negative wage effect, irrespective of whether there was recent cannabis use or cannabis use in the past. Furthermore, it appears that recent

cannabis users that started to use cannabis early in their life experience a larger wage loss than individuals that started only recently. The age of onset gives information about the possible endogeneity of cannabis use. After all, if there are unobserved personal characteristics that affect both cannabis use and wages then there is no reason why the duration of cannabis use would affect the wage. So, the finding that the age of onset matters supports the finding that cannabis use is indeed exogenous to the wage.

It is not clear why cocaine use has no negative wage effect while cannabis use does. It could have to do with the age of onset. After all, individuals usually start using cocaine when they are already in their twenties and their career may not be influenced by it. It is also not clear why frequent cannabis use has a negative wage effect. It could be related to health but an overview study of 48 longitudinal study on the effects of cannabis and other illicit drug use on psychological health problems and problematic behavior is inconclusive (Macleod et al., 2004). It could also be that cannabis users have a high rate of time preference, which induces them to make fewer investments in human capital. As indicated in the introduction Roebuck et al. (2004) find that cannabis use have a higher probability of school dropout and truancy. Although the analysis accounts for differences in educational attainment and still finds a negative wage effect of recent cannabis use, it may be that other types of human capital investments than regular education are affected.

It is striking that the magnitude of the negative wage effect of cannabis use is comparable to that of smoking. In this respect the finding that cannabis use has a negative wage effect does not provide an argument to change the Dutch soft drugs policy of making cannabis easy available for recreational use. After all, individuals are free to smoke tobacco despite the negative health effects. There is no particular reason to treat cannabis use different from tobacco use.

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Appendix A. Variables used in the analysis

- 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 job of at least 20 hours per week and a value of 0 otherwise.
- Wage: Net monthly wage based on a classification in classes in Dutch guilders per month (1 Dutch guilder is equal to 0.44 Euro). The classification is the same for all years: up to 750, 750-1249, 1250-1499, 1500-1999, 2000-2499, 2500-2999, 3000-3999, 4000-4999, $\geq$ 5000.
- 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.
- Cannabis use parents: Dummy variable with a value of 1 if one or both parents have ever used cannabis and a value 0 otherwise.
- Frequent use of cannabis (cocaine): Dummy variable with a value of 1 if the individual used cannabis (cocaine) more than 25 times ever and a value of zero otherwise.
- Recent use of cannabis (cocaine): Last year prevalence cannabis (cocaine) = 1.

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

Cannabis	Cocaine	All males	Employed males
Ever	–	58.2	56.5
–	Ever	17.5	14.7
Ever	Ever	16.9	14.2
Ever	Never	41.3	42.2
Never	Ever	0.6	0.5
Never	Never	41.2	43.1
		100.0	100.0
Last year	Last year	3.7	2.9
Last year	Past	6.3	4.8
Last year	Never	10.8	10.8
Last year	–	20.8	18.5
–	Last year	4.4	3.5
$\geq$ 25 times	$\geq$ 25 times	4.7	3.3
$\geq$ 25 times	up to 25 times	7.9	7.1
$\geq$ 25 times	Never	15.2	15.2
$\geq$ 25 times	–	27.8	25.6
–	$\geq$ 25 times	5.6	4.0
Last month	–	12.8	10.8
–	Last month	1.8	1.3

[a)] Sample of 2057 males age 26 to 50 of which 1589 are full-time employed workers.

Table 2 Characteristics different types of drug users [a)]

	Recent cannabis use		Recent cocaine use		
	No	Yes	No	Yes	Average
Age (years)	36.9	34.1	36.5	34.2	36.4
Secondary education (%)	25	31	26	30	26
Higher education (%)	53	52	53	48	53
Single (%)	30	57	34	69	35
Children (%)	35	13	31	11	31
Cannabis parents (%)	4	16	6	22	7
Wage (guilders) [b)]	3470	3111	3411	3204	3404
No of observations	1295	294	1535	54	1589

[a)] Employed males.

[b)] Net monthly wage based on mid points of wage intervals assuming the wage in the highest interval equals 5500 guilders; note that 1 guilders = 0.44 Euro.

Table 3 Determinants of recent cannabis use and employment status[a)]

	(1) Recent cannabis use	(2) Employed	(3) Recent cocaine use	(4) Employed
Constant	-1.22(1.2)	0.40 (0.4)	-2.99 (1.7)	0.23 (0.2)
Year 1997	0.04 (0.5)	0.24 (3.2)*	0.37 (2.8)*	0.24 (1.9)
Year 2001	-0.02 (0.3)	0.40 (5.2)*	0.32 (2.0)*	0.41 (3.5)*
Age	0.03 (0.6)	0.03 (0.6)	0.07 (0.7)	0.04 (0.7)
Age^2/100	-0.07 (0.9)	-0.07 (1.0)	-0.10 (0.7)	-0.07 (0.9)
Secondary education	0.16 (1.8)	-0.04 (0.6)	-0.20 (1.4)	-0.08 (0.8)
Higher education	-0.05 (0.6)	0.33 (4.0)*	-0.37 (2.4)*	0.32 (2.6)*
Single	0.42 (5.7)*	-0.28 (3.0)*	0.42 (2.9)*	-0.33 (2.4)*
Children	-0.36 (4.0)*	-0.08 (0.9)	-0.40 (2.4)*	-0.05 (0.5)
Cannabis parents	0.80 (7.0)*	-	0.48 (1.9)*	-
Recent cannabis use	-	-0.53 (1.3)	-	-
Recent cocaine use	-	-	-	-0.34 (0.1)
ρ	0.12 (0.5)[b)]		-0.06 (0.0)[c)]	
-loglikelihood	1998.1		1378.8	

[a)] Bivariate probit estimates on 2057 prime age male workers; absolute t-values in parentheses; a * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] If ρ is imposed to be zero the value of the loglikelihood becomes 1998.3; the likelihood-ratio test comparing the two loglikelihoods is equal to 0.4 so it is clear that the hypothesis that ρ equals zero cannot be rejected at conventional levels of significance.

[c)] The likelihood-ratio test comparing this estimate with an estimate in which ρ is imposed to be zero is equal to 0.01 so it is clear that the hypothesis that ρ equals zero cannot be rejected at conventional levels of significance.

Table 4 Determinants of log-wages; part I[a)]

	(1)[b)]	(2)[b)]	(3)[c)]	(4)[d)]	
	log-wage	log-wage	log-wage	log-wage	cannabis
Constant	6.910 (31.6)*	6.709 (24.2)*	6.992 (28.9)*	6.940 (31.3)*	-2.13 (1.7)
Year 1997	0.085 (4.8)*	0.123 (3.3)*	0.091 (4.7)*	0.088 (4.9)*	0.03 (0.3)
Year 2001	0.170 (10.1)*	0.231 (4.1)*	0.178 (9.4)*	0.173 (10.0)*	0.02 (0.2)
Age	0.041 (3.5)*	0.046 (3.7)*	0.041 (3.2)*	0.041 (3.4)*	0.08 (1.1)
Age^2/100	-0.041 (2.6)*	-0.050 (2.8)*	-0.044 (2.5)*	-0.042 (2.6)*	-0.13 (1.4)
Secondary education	0.102 (5.3)*	0.093 (4.5)*	0.117 (5.1)*	0.108 (5.4)*	0.20 (1.7)
Higher education	0.288 (16.6)*	0.340 (7.2)*	0.289 (14.6)*	0.289 (16.0)*	0.04 (0.4)
Single	-0.082 (5.3)*	-0.125 (3.0)*	-0.027 (0.9)	-0.059 (3.1)*	0.48 (5.7)*
Recent cannabis use	-0.069 (3.4)*	-0.119 (2.4)*	-0.405 (2.6)*	-0.210 (3.0)*	-
Cannabis parents	-	-	-	-	0.81 (6.2)*
Children	-	-	-	-	-0.39 (3.6)*
Employment[e)]	-	0.364 (1.2)	-	-	-
ρ	-	-	-	0.29 (2.2)[f)]	
$\overline{R}^2$	0.271	0.271	0.189		
-loglikelihood				913.4	

[a)] Estimates on mid-points of wage intervals; based on 1589 full-time employed prime age male workers; absolute t-values in parentheses; a * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] Ordinary least squares estimates; t-values based on robust standard errors.

[c)] Two stage least squares estimates using parental cannabis use as an instrumental variable for recent cannabis use; t-values based on robust standard errors.

[d)] Maximum likelihood estimate.

[e)] Inverse Mill's ratio based on univariate probit estimate of employment status with explanatory variables as used in Table 3.

[f)] The likelihood ratio statistic comparing this estimate with the estimate in which $\rho = 0$ is equal to 4.0, which indicates that the hypothesis that there is correlation between the error term of the wage equation and the recent cannabis use equation cannot be rejected (95% critical χ^2=3.8).

Table 5 Determinants of log-wages; part II[a)]

	(1) Log-wage	(2) Log-wage	(3) Recent cannabis use
Constant	6.817 (27.6)*	6.853 (27.4)*	-2.14 (1.7)
Year 1997	0.092 (4.7)*	0.094 (4.8)*	0.03 (0.3)
Year 2001	0.186 (9.8)*	0.190 (9.8)*	0.02 (0.2)
Age	0.044 (3.3)*	0.044 (3.2)	0.08 (1.1)
$\text{Age}^2/100$	-0.043 (2.4)*	-0.044 (2.4)*	-0.13 (1.4)
Secondary education	0.110 (5.3)*	0.117 (5.4)*	0.19 (1.7)
Higher education	0.317 (16.4)*	0.318 (15.9)*	0.04 (0.3)
Single	-0.087 (5.0)*	-0.064 (3.1)*	0.47 (5.7)*
Children	-	-	-0.40 (3.6)*
Cannabis parents	-	-	0.80 (6.1)*
Recent cannabis use	-0.074 (3.4)*	-0.218 (3.2)*	-
σ_ε	0.302 (42.2)*	0.302 (36.6)*	-
ρ		0.27 (2.4)* [b)]	
-loglikelihood	2496.5	3180.1	

[a)] Maximum likelihood estimates on wage intervals assuming a bivariate normal distribution of error terms; 1589 full-time employed prime age male workers; absolute t-values in parentheses; a * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] The likelihood-ratio test comparing this estimate with an estimate in which ρ is imposed to be zero is equal to 3.5 so it is clear that the hypothesis that ρ equals zero cannot be rejected (95% critical χ^2=3.8).

Table 6 Determinants of log-wages; part III[a)]

	(1) Log-wage	(2) Recent cannabis use
Constant	7.606 (24.5)*	-1.88 (1.3)
Year 1997	0.090 (4.6)*	0.03 (0.3)
Year 2001	0.186 (9.9)*	0.01 (0.1)
Age	0.040 (3.0)*	0.08 (1.0)
$Age^2/100$	-0.039 (2.1)*	-0.15 (1.4)
Secondary education	0.104 (5.1)*	0.19 (1.4)
Higher education	0.300 (13.2)*	0.00 (0.0)
Single	-0.085 (4.9)*	0.57 (4.0)*
Children	-	-0.46 (3.3)*
Cannabis parent	-	0.95 (2.9)*
Recent cannabis use	-0.098 (3.7)*	-
σ_ε	0.27 (20.5)*	-
Mass points	-0.718 (4.1)*	-1.71 (1.0)
α_1	-1.77 (1.9)	
α_2	0.53 (0.5)	
α_3	$-\infty$	
-loglikelihood	3173.4	
Uncorrelated mass points		
Recent cannabis use	-0.082 (3.8)*	-
-loglikelihood	3174.1	
No mass points[b)]		
Recent cannabis use	-0.074 (3.4)*	-
-loglikelihood	3181.8	

[a)] Maximum likelihood estimates on wage intervals assuming correlated random effects; 1589 full-time employed prime age male workers; absolute t-values in parentheses; a * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] See Table 5 column (1).

Table 7 Wage effects of drug use; sensitivity analysis[a)]

		Parameter	-loglikelihood
I.	Recent cannabis use[b]	-0.074 (3.4)*	2496.5
II.	Recent cannabis use	-0.078 (3.3)*	2496.4
	Recent cocaine use	0.023 (0.5)	
III.	Lifetime cannabis use	-0.043 (2.5)*	2497.1
	Lifetime cocaine use	-0.032 (1.2)	
IV.	Recent cannabis use	-0.089 (3.8)*	2494.9
	Past cannabis use	-0.032 (1.8)	
V.	Frequent cannabis use	-0.092 (4.8)*	2490.4
VI.	Frequent cannabis use	-0.097 (4.7)*	2490.1
	Infrequent cannabis use	-0.012 (0.7)	
VII.	Cannabis frequent-recent	-0.113 (4.5)*	2489.5
	Cannabis frequent past	-0.070 (2.8)*	
VIII.	Recent cannabis use	-0.222 (3.1)*	2493.8
	. x age of onset	0.008 (2.1)*	

[a)] 1589 full-time employed prime age male workers; based on wage intervals estimates assuming drug use is exogenous to the wage; the parameter estimates of the non-drug variables are not reported because they are very similar to those presented in Table 5; absolute t-values in parentheses; a * indicates that the coefficient is at a 5% level significantly different from zero.

[b)] See also Table 5 column (1).