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IDoes Performance Pay Increase Alcohol and Drug Use?

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Using a panel of young workers, we show cross-sectional evidence of greater alcohol and illicit drug use among those paid performance pay. Recognizing that this likely reflects worker sorting, we first control for risk and ability proxies. We then control for worker fixed effects and finally for worker-employer match fixed effects. These estimates continue to indicate that the risk of substance use increases when workers are moved to performance pay. While robustness tests examine heterogeneous responses, our evidence fits conjectures that stress and effort increase with performance pay as does the spillover coping mechanism of alcohol and drug use.

Keywords: Performance Pay; Alcohol; Drugs; Sorting

JEL Codes: I12, J33

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1. Introduction

Performance pay can increase productivity by aligning the interests of workers and firms. It can also serve to attract the best talent. Indeed, both survey and experimental evidence support these claims (on productivity see, among others, Banker et al. 1996, Lazear 2000 , Bandiera et al. 2005, Gielen et al. 2010, Heywood et al. 2011 and on sorting for talent see Lazear 2000, Cadsby et al. 2007, Dohmen and Falk 2011 and Shaw 2015). Yet, performance pay also has the potential of creating unintended costs borne by workers, firms and society. These include reductions in product quality, reduced maintenance, wasted materials and failure to share valuable information (Freeman and Kleiner 2005). Perhaps most prominent among these costs, ever since Adam Smith's discussion of piece rates, stands the risk of reduced worker health. Despite a now sizeable literature on the health consequences of performance pay, the conjecture that performance pay increases alcohol and illicit drug use has not been explored. We find this surprising both because work stress has been seen as a cause of alcohol and drug use in the medical literature and because the societal costs and health consequences associated with alcohol and drug use are enormous.

We use broad US survey evidence on a cohort of younger workers to confirm a close association between performance pay receipt and alcohol/drug use. We demonstrate that for alcohol and the two classes of illicit drugs identified in the survey (marijuana and hard drugs) that the risk of use remains greater for performance pay workers after controlling for demographic characteristics, occupation and industry controls. We recognize that such a correlation may reflect worker sorting on ability and/or risk preferences. The same workers with low risk aversion attracted to alcohol and drugs are also likely to be attracted to performance pay (Grund and Sliwka 2010). Thus, much of our contribution consists of

eliminating the likely suspects of statistical contamination and showing that the correlation strongly persists. First, we include proxies for risk preferences and for ability and incorporate sophisticated error structures. Second, we use the panel structure of the survey to hold constant individual worker fixed effects to control for time invariant worker influences that could include unmeasured risk preferences or ability. Third, we recognize that changes in unmeasured worker characteristics can lead to both job change (and so a change in performance pay receipt) and to a change in alcohol or drug use. We respond by controlling for job match fixed effects. Thus, we examine the change in individual workers' alcohol and drug use as their employer changes their performance pay status.

This comprehensive effort to control for worker sorting provides compelling evidence and allows us to explore some of the distributional consequences. In particular, we show that the link between performance pay and alcohol and drug use holds strongly for white men, white women and for nonwhite women. The results are substantially attenuated if not absent for nonwhite men. While uncertain as to reason, nonwhite males are often identified as having the greatest baseline stress and so that associated with performance pay may be less determinative. We also confirm that the pattern on use (yes/no) is matched by count variable estimates on the number of times that alcohol and drugs are used over a given period and that it does not merely reflect depressive moods of workers (as self-reported).

Thus, our study is the first to examine the relationship between performance pay and alcohol and illicit drug use. It does so in a fashion that takes very seriously the threat from the many dimensions of worker sorting. It presents a robust and persistent finding that those who are newly exposed to performance pay, increase their likelihood of consuming both alcohol and drugs. This is timely evidence given the broad trend towards performance pay in the US

over past decades (Lemieux et al, 2009), and ongoing concerns regarding the cost of substance misuse.

Alcohol and illicit drug abuse disrupts families, workplaces and communities. The aggregate cost in lost earnings, diminished productivity, health expenditures and crime exceeds $442 billion per year in the United States.[1] Over 88 thousand deaths per year are associated with alcohol use and the CDC (2016) claims the social costs of alcohol should add over two dollars to every drink served in the country. The US Justice Department puts the number of illicit drug users in the US at nearly 22 million and finds that illicit drugs account for over 1 million emergency room visits per year (NDIC 2011). Thus, the use of alcohol and drugs is associated with substantial societal costs.

Employers broadly recognize these costs and their impact on firm performance. This is evidenced by employer drug testing, health insurance provisions that penalize such risky behaviors and expensive employee assistance programs designed to connect workers with treatment resources (see McGurie and Ruhm 1993). Yet, when setting compensation procedures other issues may be paramount and managers may not be focusing on such worker behavior. As a consequence, our findings on performance pay are important. First, they suggest that the benefits to firms of increased productivity and talent may be partially offset by higher absence and health insurance costs associated with alcohol and drug use. Second, the associated costs are unlikely to be borne entirely by the firms as spillovers into family and community seem likely. As a consequence, this may provide a rationale for public intervention to monitor and perhaps even regulate the use or intensity of performance pay. Third, what appears to be a large earnings return for performance pay (Seiler 1984, Parent 1999, Pekkarinen

[1] This reflects $249 billion per year in alcohol related costs (CDC 2016) and $193 billion per year in drug related costs (NDIC 2011).

and Ridell 2008 and Green and Heywood 2016) may reflect not only productivity gains but may be, in part, a compensating differential for the stress and the associated risk of alcohol and drug use. This is not a statement that workers are necessarily made worse off by performance pay; only that it appears associated with increased use of alcohol and drugs. This more modest statement represents only a part of any overall evaluation.[2]

The next section sets the context by summarizing the empirical evidence on the relationship between performance pay and worker health. We pay particular attention to those relatively few studies that have gone beyond work place injury to examine measures of longer term health and stress. We also review the evidence on the relationship between work stress and substance use. The third section presents our survey data being careful to describe the important proxies and the structure that allows us to explore sorting. The fourth section describes our empirical approach. The fifth section presents our results confirming the link between performance pay and alcohol/drug use. It also explores heterogeneity in those results. The final section provides a summary and ideas for additional research.

2. Motivation and Previous Research

A growing body of empirical work explores the notion that employees tradeoff their health in pursuit of the rewards associated with performance pay. Some of this work comes from case studies by occupational health specialists. Thus, evidence suggests that the transition to piece rates is associated with higher accident rates among Swedish loggers (Sundstroem-Frisk 1984) and that tree cutters in Canada dangerously over-exert themselves when piece rates and a

[2] Indeed, using UK data Green and Heywood (2008) show that as measured by subjective job satisfaction, performance pay workers, on balance, remain more satisfied.

particular forest area combine for easy money (Toupin et al. 2007). Similarly, piece rate workers in India's fertilizer industry face a higher risk of industrial accidents than otherwise equal time rate workers (Saha et al. 2004). In the US, Monaco and Williams (2000) show that truck drivers paid by the mile are more likely to be in an accident or violate safety standards than those paid by the hour. Frick et al. (2013) show that a German steel plant experienced increased sickness absence when it introduced production bonuses.

This emphasis on accidents has carried over to the expanding literature using broad survey data and done largely by economists. The underlying causation argues that performance pay generates increased exertion, the taking of fewer breaks, the taking of greater risks, and working too fast or working to the point of exhaustion. Performance pay increases the reward for these activities (DeVaro and Heywood 2017). The resulting consequence is a greater risk of accident and workplace injury. Bockerman et al. (2012) examine a broad set of high performance work practices in the Finnish Quality of Work survey that includes performance pay and discover no relationship between this set and accidents. Yet, Bender et al. (2012) use the European Working Conditions Survey to show that piece rates are associated with an increased risk of workplace injury after controlling for an extensive set of controls, country fixed effects and error structures. Artz and Heywood (2015) use the 1979 NLSY to show that blue-collar workers in the US experience a higher risk of workplace injury when paid output based pay (piece rates or bonuses). This persists despite worker fixed effects. DeVaro and Heywood (2017) show greater sickness absence and physical ailments among UK workers at firms using performance pay. Their matched employer-employee data allows them to hold constant employer fixed effects but not worker fixed effects. While the elevated absence could be for any sickness, the increased ailments associated with performance pay were concentrated

among repetitive stress injuries and bone/joint ailments. Less direct evidence comes from Freeman and Kleiner (2005) who indicate that piece rates are associated with higher worker compensation costs which largely reflect workplace injuries.

While these studies suggest performance pay may change worker behavior on the job, the determinants of alcohol and drug use may differ substantially from those of industrial accidents.[3] Drug and alcohol use may be thought of as a change in behavior largely off the job that reflects a spillover from the increased pressure and stress at work (Grunberg et al. 1998).[4] Thus, the medical literature focuses on work alienation, work stress and the associated alcohol and drug use. This view often includes stress within the work role as well as stress integrating work and family roles (Frone 1999). Alcohol and drugs are frequently identified as coping mechanisms associated with the stress of negative work as well as home events (Carney et al. 2000). Moreover, Frone (2008) confirms a role for two specific work stressors, work overload and job insecurity. This is telling as it is often thought that performance pay is designed to increase earnings insecurity by putting pay at risk and that workers respond with greater effort and more hours albeit with declining productivity (Gneezy and Rey-Biel 2014, Pencavel 2015)

Alcohol and drug use should then be thought of as a potential response to the stress, time conflict and effort associated with performance pay. While not focusing on alcohol and illicit drug use, economists have certainly examined broader health outcomes associated with performance pay and these help motivate our study. In any early examination, Foster and Rosenzweig (1984) show that agricultural workers paid by the piece expend sufficient extra

[3] Which is not to say the two need be unrelated as Kaestner and Grossman (1998) present evidence on the influence of drug use on workplace accidents and injuries.
[4] Rohleder (2014) reviews the medical literature on the effects of stress arguing that constant chronic psychosocial stress that persists over time can be psychologically and physically damaging.

effort that their physical health is measurably worse. Yet, others have moved beyond just physical health.

Davis (2016) examines self-reported measures of both physical and *emotional* health in a large survey of workers in 109 Vietnamese garment factories. She controls for each factory's success in occupational safety and health compliance and reports that workers paid by the piece report both lower physical and emotional health. Indeed, piece rate payments provided the most consistent and important of all demographic and factory-level variables in determining emotional health. This mimics a slightly earlier but very different longitudinal examination of British workers. Bender and Theodossiou (2014) demonstrate a larger hazard of falling out of good self-reported heath for workers receiving a very broad measure of performance pay (including bonuses, commissions and other more common white collar performance pay). Importantly, for our purposes, they match this with similar results for the hazard of reporting the specific ailment of anxiety. Like stress, this might be thought of as a precursor to alcohol or drug use. Confirming such survey data, Cadsby et al. (2016) use laboratory experiments to demonstrate that performance pay increases stress among risk averse individuals. Allan et al. (2017) provide much more sophisticated experimental evidence showing not only do those earning performance pay experience higher self-reported stress but also demonstrate higher stress as measured objectively by cortisol hormone levels.

In the study most closely related to ours, Dahl and Pierce (2018) take for granted the link between stressful work and coping through substances. They examine the relationship between performance pay and prescription drug use in the Netherlands. They link survey data on performance pay for a set of firms to medical prescription data for their workers. They conclude that the adoption of performance pay is associated with a four to six percent increase

in the usage of one broad class of anti-anxiety drugs and in the use of SSRI anti-depressants. This is observed almost exclusively in men and for those older than fifty. Thus, they argue that performance pay induces stress and anxiety which spills over to harm daily mental health and leads to increased prescriptions for the associated pharmaceuticals.

We bring alternative data to bear. We do not examine drug prescriptions but self-reports of alcohol and drug use. We examine a representative sample of younger workers in the US. None of our workers have reached age fifty over the years we examine. As only half of all US private industry employees participate in employer-sponsored healthcare benefit plans, it should not be assumed that our sample has low cost access to physicians and legal drug prescriptions as in the Netherlands. Moreover, participation in employer health plans is far lower than half among workers who are younger and who earn less (Wile 2017). Thus, the connection between work stress and both alcohol and illicit drugs may be particularly strong in the US and in our sample in particular. While we do not have access to the legal drug prescriptions of our respondents, we will control for the presence of health insurance coverage as a way to account for other avenues of coping. We anticipate that health insurance should be associated with lower use of alcohol and illicit drugs.

3. Data and Variables

We draw our data from the National Longitudinal Survey of Youth 1997 (NLSY). The key advantage of the NLSY is that it contains information on payment methods, self-reported measures of alcohol and drug use and a strong variety of worker controls. An obvious disadvantage is that the NLSY follows a single cohort that may not be fully representative of the population. The NLSY began polling individuals in 1997 when all respondents were in

their teen-age years. Since a variety of mechanisms may impact drug and alcohol use at very young ages, we limit our analysis to NLSY waves consisting of respondents all of whom are at least 18 years of age. Consequently we begin with wave 2002 and end with 2011[5]. After removing all military respondents as well as observations with incomplete information, our marijuana and alcohol samples consist of 62425 observations while our hard drugs sample is 61673 observations.

We use self-reported measures of alcohol and drug use. These are binary responses indicating whether individuals consumed marijuana (pot/weed) or alcohol in the last 30 days, and whether individuals used any drugs like cocaine, crack, heroin, or crystal meth, or any other substance not prescribed by a doctor, in order to get high or achieve an altered state since the date of the last interview (roughly one year in the past)[6]. We recognize the potentially broad set of drugs in this and denote it as hard drugs for convenience. Appendix A1 contains substance use proportions; 4.6% of respondents reported using hard drugs since the last interview while 16.8% and 66.3% used marijuana and alcohol respectively in the last 30 days. While not perfect, the reliability and consistency of self-reported measures of illicit drugs has typically proven very high (O'Malley et al. 1983).

The NLSY contains five forms of compensation other than a simple time rate of pay. These are tips, commissions, bonuses, incentive pay and a very small "other" category. It is not made clear whether these are individual or group oriented nor is it made clear whether bonuses and incentive pay are objectively set (by formula) or determined by the subjective judgement of a supervisor. In the absence of clear guidance as to which of these significantly affects substance

[5] The wave after 2011 (2013) does not include the marijuana and hard drugs use measures. Although the 2015 wave reintroduces these measures, we choose to omit the wave from analysis as it is 4 years removed from the 2011 wave. Moreover, the period since 2011 has seen growing legalization of marijuana usage among US states.
[6] The NLSY does not provide identical usage periods measures for all three substances.

use we combine all five into one measure of performance pay.[7] Roughly 21% of respondents report being paid by at least one of these performance-based payment methods.

The survey's richness allows us to control for demographic variables such as gender, race, age, education, region of residence and marital status. We also control for job characteristics such as usual hours worked per week and the industry and occupation categories using the 2002 Census of Industrial and Occupational Classification Codes. As discussed, we also include a dummy variable indicating the worker is covered by health insurance (see descriptive statistics in Appendix Table A1).

We recognize that unmeasured characteristics may correlate with both substance use and sorting into jobs with performance pay. In response we include proxies for risk attitudes and worker ability. The risk proxy is available only in a single wave but we recognize the broad consistency of risk attitudes over shorter periods of time as supported by Chiappori and Paeilla (2011) and Brunnermeier and Nagel (2008). The 2010 NLSY wave contains the risk preference measure that asks respondents, "are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Rate yourself from 0 to 10, where 0 means 'unwilling to take any risks' and 10 means 'fully prepared to take risks.'" The mean of 5.6 suggests workers are, on average, relatively risk neutral, but preferences are also dispersed as one standard deviation around the mean indicates a range of 3.06 to 8.13.

In the 1999 NLSY wave all respondents completed the Armed Services Vocational Aptitude Battery (ASVAB), a commonly used measure to gauge natural ability or intelligence (Coyle, 2018). We use the worker's percentile ranking in combined mathematical knowledge, arithmetic reasoning and verbal comprehension. The mean ranking in our sample is slightly

[7] Excluding the "other" category makes no material difference to any of our results.

below 50 (48.5) due to omitted military observations and those with incomplete information. In both the case of this ability measure and the earlier risk measure we normalize by fitting a cumulative normal so that the unit of measure is a standard deviation in the underlying variable. This changes no results but aids in the interpretation.

Finally, recognizing that these are single measures that do not vary across waves, we introduce as an explanatory variable the computed average hourly wage. While our results in no way depend on the inclusion of the wage, it provides a measure that varies by wave and is well known to reflect both ability and risk preference. It is obviously endogenous with performance pay but the anticipated bias works against our hypothesis as one would anticipate that its inclusion would bias down the role of performance pay[8]. Again, we see it as a potential proxy but note that its inclusion is not critical.

4. Empirical Approach

We examine the role played by the performance pay indicator in increasingly complete specifications of the determinants of alcohol and drug use. Our estimates can be expressed as variants on the equation:

$$Y_{it}^{*} = \alpha PRP_{it} + \beta' \boldsymbol{X_{it}} + u_t + \varepsilon_{it} \qquad (1)$$

where *i* and *t* index workers and survey waves. In all cases, the likelihood of using alcohol or drugs is an unobserved latent variable Y_{it}^{*} that is proxied by the dichotomous NLSY indicator assumed to be 1 above threshold *k*: thus, Y_{it} = 1 if $Y_{it}^{*} > k$ and $Y_{it} = 0$ otherwise. Logit is chosen to allow an easy comparison to the "conditional" or fixed effect logits that control for

[8] As wages are positively correlated with earnings, their inclusion presumably robs some of performance pay's influence on alcohol and drug use but we will explore this in depth when considering potential income effects.

time-invariant heterogeneity (Long 1997). This fixed effect estimate is preferred as it does not suffer from the incidental parameter issue common in non-linear fixed effect estimates.[9] To facilitate comparison, we present both the average marginal effects and the log-odds for the pooled estimates. All estimates use the sample weights, and we cluster errors by worker to account for repeated observations.

The term $u_t$is a wave fixed effect that may capture variation in substance use associated with overall economic conditions (Carpenter et al. 2017). $\boldsymbol{X}$ is a vector of worker and job characteristics that also collects the constant. PRP indicates whether an individual receives performance related pay, and α is our parameter of interest. We estimate (1) separately for our three types of substance use. Initially, we focus on use, but in extensions consider measures of frequency or intensity of use.

As described, sorting threatens any causal interpretation of α. There are two sorting dimensions that seem of the most concern. First, and perhaps most critical in our setting, risk tolerant individuals sort into performance pay contracts (Cornellissen et al. 2011; Grund and Sliwka 2010; Curme and Stefanec 2007). This follows naturally as the purpose of these contracts is to shift risk to workers. At the same time, there is a well-established link between individual risk preferences and alcohol and drug use (Dave and Saffer 2008, Blondel et al. 2007, Lundborg and Lindgren 2002)[10]. Thus, sorting on risk would generate an upward bias in naïve estimates of the effect of PRP on substance use.

Second, as emphasized in the introduction, more able workers capture a return on their ability by sorting into performance pay (Lazear 2000). While not unambiguous, there may

[9] Although we note that probit estimates of the pooled estimates return very similar results in terms of the size and significance of the key variables.
[10] Dave and Saffer (2008) show evidence that *both* the probability of using alcohol and the amount consumed by users are 6 – 8% higher among risk-tolerant individuals.

also be a correlation between ability and substance use. Thus, Batty et al. (2008) show that those with higher childhood mental ability scores have an increased prevalence of drinking in adulthood. Similarly, White et al. (2012) shows that higher ability scores correlate (after including controls) with a greater likelihood of illicit drug use, especially for women. Again, such sorting on ability would tend to generate upward bias in our estimates.

In response, we first utilize the strengths of the NLSY data that include proxies for both ability (ASVAB) and risk attitudes. These proxies have the potential to mitigate bias arising from sorting. As discussed, we also include wages as a further control. While this inclusion is not critical to our results, it is anticipated that higher wages may also proxy for greater ability and risk tolerance.

We then go beyond this to examine estimates that include worker fixed effects. These hold constant time invariant individual influences that may include both risk preferences and worker ability unmeasured by our proxies. This may be satisfactory as some researchers emphasize the relatively fixed nature of risk preferences. Sahm (2012 p. 1) followed a panel of US respondents over eleven years noting that "while risk tolerance changes modestly with age and macroeconomic conditions, persistent differences across individuals account for over 73% of the systematic variation." Indeed, the typical search for sharp changes in risk preferences involves studying the consequences of dramatic natural disasters and even here a large portion of the population shows persistent risk preferences (Hanaoka et al. 2017). Nonetheless, we recognize that changes in risk preferences might cause workers both to change jobs (and so change performance pay receipt) and to change their use of alcohol and drugs.[11] Controlling for individual fixed effects provides no defense against this potential threat.

[11] Dohmen et al. (2017) demonstrate that individuals become slowly less risk tolerant with age -- they demonstrate that this is a linear process.

As a response to this threat, our data allow us to identify specific matches between workers and employers. We use these to examine the determinants of drug and alcohol use with match fixed effect estimates. This specification excludes workers who change risk preferences and so change employment to an employer whose performance pay policy reflects their new preference. The influence of such sorting is eliminated by focusing on workers who remain with their employer and examining their change in drug and alcohol use as their employer changes performance pay policy. While this substantially narrows the sample of workers, we will show it remains largely representative of the broader sample. It will also confirm estimates on the broader sample and continue to show that sorting by workers does not explain the increased use of drugs and alcohol among workers receiving performance pay.[12]

5. Results

Table 1 reports logit estimates of the relationship between performance pay receipt and marijuana, hard drugs and alcohol use, respectively. They show great consistency across substances. In each case, the likelihood of use decreases with age and marriage. Similarly, the likelihood of reported use is lower for women, Blacks and Hispanics. Education and hours of work are negatively associated with marijuana use but positively associated with alcohol use. Health insurance positively predicts alcohol use (perhaps an income effect) but negatively predicts illicit drug as anticipated.

[12] We recognize a possible more complicated, and we think counter-intuitive, form of sorting. The firms could change their performance pay policy to reflect the risk preferences of their workers. While possible, this obviously implies that the workers initially sorted into their employer in direct opposition to their own risk preferences. Only such counter-intuitive worker sorting would have an employer responding to the risk preferences of their workers with a change in performance pay policy.

The main estimates of interest reveal large, positive and statistically significant, relationships between performance pay and all three types of substance use. The log-odds indicate that holding the other determinants constant, workers on performance pay have a 29 percent higher likelihood of marijuana use, a 35 percent higher likelihood of hard drugs use and a 45 percent higher likelihood of alcohol consumption. These reflect average marginal effects of 0.035 for marijuana, 0.015 for hard drugs and 0.072 for alcohol.

INSERT TABLE 1

As highlighted, sorting on ability and risk threatens interpretation of Table 1. Table 2 adds the three proxies, self-reported risk tolerance, ASVAB and earnings. We note the reduced sample size in Table 2 comes from requiring that each respondent be in the panel in both 1999 (to get the ABSVB) and in 2010 (to get the risk proxy). Thus, as a check we first confirmed that the key performance pay results in Table 1 carry over to the reduced sample – they do. For brevity Table 2 hides the coefficients for most other covariates but we note that adding the proxies eliminates the positive partial correlation of health insurance with alcohol use while retaining the significant negative partial correlations of health insurance with the use of the two illicit substances.

Two additional points are worth noting about the role of health insurance. First, there exist only modest differences in results if employer provided health insurance replaces all forms of health insurance in the estimation. Second, having said that, if one divides the sample by employer provided health insurance, those with insurance have smaller responses to performance pay and significantly so for alcohol use. This hints at the possible substitution of prescribed drugs and substance use. These estimates are available upon request.

As anticipated, the proxies for ability and risk preference each have positive, and statistically significant, influences on substance use. The magnitude of these influences is large for all three substances. A one standard deviation increase in the ability proxy generates average marginal effects of 0.041 for marijuana, 0.018 for hard drugs and 0.058 for alcohol. At the same time a one standard deviation in the risk tolerance proxy generates average marginal effects of 0.023 for marijuana, 0.011 for hard drugs and 0.024 for alcohol. Again, the large and consistent marginal effects are noteworthy and speak to the potential of sorting on ability and risk tolerance. The log wage measure proves a significant positive partial correlate of alcohol use and a negative partial correlate of illicit drugs use.

While the proxies play important roles in the estimates, their inclusion does little to change the relationship between performance pay and substance use. Use of all three substances remains significantly higher among those on performance pay. The new magnitudes from the log-odds indicate a 28 percent higher likelihood of marijuana use, a 27 percent higher likelihood of hard drug use and a 41 percent higher likelihood of alcohol consumption relative to those on time rates. Both these measures and the associated average marginal effects show only the most modest of changes. This provides a first indication of the durability of the association and hints that this relationship may not simply reflect sorting on ability and risk preferences, as important as those seem to be.

INSERT TABLE 2

In additional estimates we altered the measurement and use of the earnings information. The current wage measure includes standard earnings but not those specifically associated with

performance pay. By adding this additional component we can isolate income effect associated with extra earnings associated with performance pay. We recognize, as mentioned earlier, that wage measures are likely collinear with performance pay and we present the estimates with this alternative measure in Appendix Table 2. The critical point is that adding the earnings associated with performance pay does not change the results. The marijuana coefficient is unchanged, the hard drugs coefficient goes very slightly up and that for alcohol goes slightly down. As explicitly controlling for the income associated with performance pay does not change results, it is unlikely that the performance pay influence reflects income effects.[13]

Table 3 seeks to further examine this seeming stability by exploiting the panel structure of the NLSY. The first set of estimates introduce worker fixed effects that hold time invariant characteristics constant, and as result, provide the effect of changes in the performance pay receipt of individuals on their substance use patterns. These estimates are on the smaller sample of workers who change performance pay status. Nonetheless, there remain 5,615 worker transitions into performance pay and a roughly similar 5,450 worker transitions out of performance pay. As the risk preference and ability proxies drop out of the fixed effect estimate, the requirement that workers be in the panel in both 1999 and 2010 is no longer required.

The left panel presents the worker fixed effects estimate and we note that health insurance is now a significantly negative determinant of alcohol use. Also, the only remaining significant role for wages is as a positive determinant of alcohol use. Critically, the positive relationship between performance pay and substance use remains, but is reduced in magnitude. The log-odds indicate a 16 percent higher likelihood of marijuana use, a 21 percent higher likelihood

[13] We have used this alternative full earnings measure in all the estimates in this paper. They are available upon request but are remarkably unchanged throughout.

of hard drug use and a 22 percent higher likelihood of alcohol use relative to those on time rates. All three estimates are highly significant and sizable but clearly the estimates do suggest a role for time invariant characteristics not captured by our ability and risk preference proxies. Nonetheless, the estimates show that changes in performance pay receipt remain associated with changes in substance use.

INSERT TABLE 3

To this point, we have focused on the incidence of consumption. Appendix Table A2 reports analogous results where instead the dependent variable is the frequency of use. Each of the substance use questions asks those who report positive use to indicate approximately how often they have used the substance (within the last year for hard drugs and within the last month for marijuana and alcohol). These counts are estimated as the dependent variable in Poisson specifications with worker fixed effects. This choice of Poisson reflects the absence of the incidental parameter problem (and the associated bias) that is known to exist in, for instance, Tobit (Greene 2004). These confirm a positive link between substance use and the usage (frequency), although the estimate for hard drugs is relatively imprecise. While most of our concern remains with the use itself, it supports our estimates that the extent of use appears to reflect broadly similar patterns.

The change in performance pay receipt from any cause identifies the worker fixed effect estimates just presented for both substance use and the extent of use. Yet, as suggested, it remains possible that salient time-varying unobservables could change both pay receipt and substance use. Thus, a change in risk preference might lead to a new employer having a more compatible performance pay policy and to changes in substance use. We examine this

possibility by limiting the source of identification to an employer's change in performance pay receipt for continuing workers. We identify every match between employer and worker and use these as fixed effects. Thus, the estimate is generated by the variation in performance pay and in substance use within such a match. This excludes the possibility that the worker has changed employer in search of a preferred performance policy. Introducing match fixed effects further limits the changes in performance pay receipt. Yet, there remain 2832 cases in which an employee faced a move into performance pay with their current employer and 2369 in which an employee faced a move out of performance pay with their current employer.

The results in the second panel of Table 3 show the variation in substance use associated with these changes in PRP receipt within employers. These results follow earlier estimates, and if anything, reveal a larger effect of PRP on worker substance use. The log-odds indicate a 29 percent higher likelihood of marijuana use, a 26 percent higher likelihood of hard drug use and a 34 percent higher likelihood of alcohol use. These are remarkably similar to our earliest estimates and point again to the remarkable durability of the results. In sum, the results in Table 3 indicate that the relationship between PRP receipt and marijuana, hard drugs and alcohol use do not reflect either worker sorting on time fixed unobserved worker characteristics, or worker sorting across employers.

6. Heterogeneity and Robustness in the Pattern

In this section we provide three examinations designed to provide a fuller picture of the durability of the relationship between substance use and performance pay. First, we explore the basic patterns by race and gender of the workers. Second, we incorporate controls indicating workers' depressive mood in recognition that performance pay has been shown to

increase prescriptions for SSRI anti-depressants (Dahl and Pierce 2018). Finally, we adjust our PRP measure to account for one type of performance pay (tips) that may identify workers much closer in proximity to substances than workers earning other performance pay types.

The underlying pattern of alcohol and illicit drug use varies by age, race and gender. Chen and Jacobsen (2012) use the National Longitudinal Study of Adolescent Health to conclude that use increases till mid-twenties and then decreases, and that from late adolescence to the early thirties use is higher among men and among whites. All of these differences were apparent in our early cross-sectional results (see Table 1). We now explore whether the role of performance pay differs in systematic ways by race and gender.

We largely view this as an investigation into the generality of our findings. While our theoretical priors are not strong, we note findings in occupational health that minorities in the workplace typically have greater work related stress and that this is often associated with perceived discrimination (Mays et al. 1996, Wadsworth et al. 2007, and Capasso et al. 2016). Indeed, this perceived discrimination has been suggested to influence the general physical health of minorities well beyond simply increasing workplace stress (Johnston and Lordan 2012). Thus, it may be that work stress associated with performance pay plays a smaller role in overall work stress for some and may be less of a determinant of substance use as a consequence.

In Table 4 we summarize estimations that include the proxies for sorting as in Table 2 but which divide the sample into four race and gender groups. The first panel shows the results for marijuana use and confirms significantly higher usage for white men, white women and nonwhite women receiving performance pay. The magnitudes are equal to or larger than those presented for the full sample in Table 2. This happens because the estimation for nonwhite

men shows that performance pay has genuinely no association with marijuana use. The average marginal effect is of the wrong sign and essentially zero. Thus, nonwhite men fail to follow the pattern shown for the other racial and gender groups, a failure that persists in fixed effect estimates available upon request.

INSERT TABLE 4

The middle panel examines hard drug use and reveals a remarkably similar pattern. The average marginal effects of performance pay for the first three groups equal or exceed those presented for the full sample in Table 2.[14] Again, there exists no hint of an influence for performance pay on hard drug use of non-white males.

The final panel examines alcohol use and again shows a similar, if more muted, pattern. All the estimates are positive and significant. The average marginal effects for the two women groups are about .08 and that for white men is .05. The average marginal effect of non-white men is about .03, the smallest of any group.

Thus, the clear pattern across all three substances is that non-white men are far less responsive (and, indeed, unresponsive for two substances) when compared with the remainder of the sample. This heterogeneity is important to recognize as it suggests that firm level policies on performance pay will elicit a different response from non-white men. As suggested, it may be that the stress of performance pay remains small relative to other sources of workplace stress for non-white males. Alternatively, introducing performance pay may bring stress associated with uncertainty and effort but that this is offset to a large extent by reduced stress regarding workplace discrimination. In this view, performance pay if tied to

[14] Statistical significance is likely missing for non-white females despite the magnitude because of the imprecision associated with the small sample size.

easily observable standards, may reduce perceived discrimination.[15] This, in turn, may offset any added workplace stress by improving the chance that race is not a determinant of earnings in the workplace.

While we have placed emphasis on stress, home-work conflict and exhaustion, it is of interest that Dahl and Pierce (2018) found a tight connection between performance pay and SSRI antidepressant prescriptions. We do not have such data but we do have self-reports of moods experienced in the last month. We know the number of times that workers have felt blue, depressed or anxious. These self-reports are available for only five waves (2002, 2004, 2006, 2008 and 2010) and so reduce our sample substantially. These moods, when persistent, also strike us as fundamental personality characteristics not likely to be associated with performance pay. Thus, Curme and Stefanec (2007) confirm that those on performance pay have substantially less "fatalism" and substantially greater "self-esteem." Moreover, Green and Heywood (2008) argue that performance pay, after adjusting for sorting across individuals and jobs, tends to increase job satisfaction. Thus, at minimum it remains an open question what role a depressed mood plays in the relationship we have demonstrated between performance pay and substance use.

To explore the issue we developed a composite index based on three questions in the survey. These asked "how often in the past month have you... "been a very nervous person"..."felt downhearted and blue"..."felt so down in the dumps that nothing could cheer you up"?" To each question the respondent answered: 1 = none of the time, 2 = some of the time, 3 = most of the time, and 4 = all of the time. As a first test we weighted all three questions equally and simply added the scores so that each person in response varied from 4

[15]See Heywood and O'Halloran (2005), Heywood and Parent (2012) and Green et al. (2014) for evidence on the extent to which performance pay reduces observed racial earnings gaps.

to 12. Alternatively, we simply took the individual scores and entered three separate mood variables. We then repeated our series of pooled and fixed-effect estimates.

Table 5 shows the initial results. First, the composite "depressive mood" indicator plays a large and significantly positive influence on substance use of all three types. For example, a one full point increase in the indicator is associated with a 22 percent higher chance of marijuana use. At the same time, we found absolutely no significant simple difference between the depressive mood indicator for those receiving and not receiving performance pay. Thus, it comes as little surprise that Table 5 continues to show strong and robust roles for performance pay. For example, those on performance pay are 31 percent more likely to use marijuana, a figure that is unchanged by the addition of the mood indicator. It is also unchanged by breaking the three indicators into separate variables as shown in the second panel of Table 5. This is true even as each of the separate mood indicators takes a significant coefficient in their own right.

INSERT TABLE 5

The substantial and significant role for performance pay remains in the individual fixed-effect logits. It does, however, follow the earlier pattern of being somewhat attenuated in size. In the match specific fixed effect estimates, the size remains (if not increasing) but the significance is lost. Yet, this is true not only for performance pay but for some of the mood indicators. This suggests a lack of precision due to the smaller sample size associated with using the mood variables which are available in only selected waves.

Our tentative conclusion is that deep-seated depression is not driving the association we identify. Individuals reporting such depression may be more likely to use alcohol and illicit

drugs but they are not more likely to be receiving performance pay. Thus, we continue to suggest that it is exhaustion, stress and the work-family conflict associated with performance pay that drives substance use.

A final robustness check follows from our concern that some jobs involve highly increased proximity to substances. Particularly, we recognize that many who work in bars and restaurants are both paid extensively by tips (a type of performance pay) and have ready access to alcohol often at reduced prices. They also work in an atmosphere that may encourage substance use independent of tips. To check this we employ two separate strategies. First, we simply remove tip payments from the PRP indicator. Second, we omit all food service industry workers from the estimates. In both robustness checks, we find that the relationship between performance pay and substance use remains for all three substances in our preferred worker-employer match fixed effect estimates. Thus, this one form of performance pay does not appear to be driving our results.

7. Conclusions

Performance pay can serve to align the interests of workers and their firms. This can improve profits to the firm and earnings to the worker. Yet, performance pay has also been associated with a long list of unintended negative consequences. These unintended consequences are particularly important when they impact those outside the employment relationship. As substance use generates enormous costs to society that are not fully borne by the worker or the firm, we have examined the influence of performance pay on substance use.

Following the literature, we assume that performance pay creates incentives to exert effort, minimize breaks, take risks and work longer. It also inherently generates earnings uncertainty

that is borne by the worker. We appeal to the medical literature to argue that this stress, exhaustion and uncertainty may lead to the coping behavior of substance use. Our hypothesis that performance pay should be associated with greater substance use receives support in our pooled data from the NLSY. Yet, we recognize that this association may reflect sorting by workers into both performance pay and substance use and not reflect causation. Thus, we first included proxies for the two primary sources of anticipated sorting, ability and risk preferences. This left the association in place. We then estimated worker fixed effect models that also confirm the association. These models hold constant the time invariant worker characteristics that might cause sorting (potentially including ability and risk preferences among others). We recognized that there may still be sorting based on time varying characteristics and so estimate match (employer-employee) fixed effect models. The variation in these models is driven by the employer changing performance pay receipt for on-going employees. This removes a potentially important element of worker sorting. Critically, the large and statically significant influence of performance pay remains.

We undertook a series of robustness checks. First, we divided the sample by race and gender. We confirmed that the influence of performance pay persists for women and for white men. The results are attenuated or even absent for black men. We have speculated that the association between performance pay and workplace stress may differ for black men because the relative strength of stress associated with performance pay is smaller and because performance pay may reduce perceptions of discrimination. Yet, we recognize that these are only speculations. This clearly remains an area for further research: both to confirm the heterogeneity in other data sources and to explain its cause.

Second, we grew concerned by earlier evidence from the Netherlands that isolated a strong relationship between performance pay and SSRI antidepressants. We do not have such data but we have self-reported mood data. Our experiments with this data suggested that self-reported depressive moods were clearly associated with increased substance use. Despite the smaller data set that included the mood data, the role of performance pay was essentially unaltered by including the mood indicators. Indeed, we confirm that the mood indicators were largely uncorrelated with performance pay. Thus, we continue to stress the situation role of exhaustion, stress and work-home conflict as a likely source of coping through substance use.

Finally, we showed that the results are unchanged by removing bar and restaurant workers. These workers often receive large tip incomes (a form of performance pay) and work in environments often uniquely oriented toward consumption of alcohol. It is reassuring that they are not driving the results.

We reiterate in closing that we have not shown that performance pay is harmful to workers, firms or society. Instead, we suggest that any balancing of benefit and harm should likely include the elevated use of alcohol and illicit drugs. We recognize that even this elevation may make for complicated welfare judgements. Thus, Bray (2005) shows that moderate alcohol use does not reduce returns to education and Ullman (2014) argues that absences due to sickness actually declined following the legalization of medical marijuana in several US states. Yet, the overall consequences of substance use have been associated with enormous societal costs and those costs, like those associated with risk of injuries and health deterioration should be kept in mind when evaluating performance pay.

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Table 1: Performance Pay and the Incidence of Drug Use, Pooled Cross-section Logit Estimates

	Marijuana	Hard drugs	Alcohol
Performance pay	0.0346***	0.015***	0.072***
	(6.288)	(4.999)	(11.259)
	{1.287}	{1.351}	{1.449}
Female	-0.057***	-0.010**	-0.0458***
	(-7.283)	(-2.496)	(-5.543)
Black	-0.019**	-0.071***	-0.146***
	(-2.128)	(-10.664)	(-17.582)
Hispanic	-0.047***	-0.019***	-0.056***
	(-4.674)	(-3.562)	(-5.945)
Age	-0.005**	-0.002	0.005**
	(-2.176)	(-1.260)	(2.084)
Married	-0.131***	-0.049***	-0.112***
	(-14.704)	(-9.112)	(-14.408)
Education	-0.006***	-0.001	0.027***
	(-4.090)	(-1.563)	(17.272)
Hours	-4.5×10^{-4}**	-1.2×10^{-4}	9.1×10^{-4}***
	(-2.549)	(-1.184)	(3.968)
Health insurance	-0.043***	-0.015***	0.010*
	(-8.419)	(-5.588)	(1.699)
Occupations (19)	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes
Years / waves (10)	Yes	Yes	Yes
Constant	{1.118}	{0.229**}	{0.239***}
	(0.251)	(-2.109)	(-4.102)
Observations (person- years)	62,425	61,673	62,425
Number of people	8,383	8,359	8,383

Notes: average marginal effects are reported with odds ratios in brackets. t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Survey weights and estimation are used throughout and heteroskedasticity robust standard errors are clustered at the individual level.

Table 2: Performance Pay and the Incidence of Drug Use: Controlling for Ability and Risk Attitudes in Pooled Cross-section Logit Estimates

	Marijuana	Hard drugs	Alcohol
Performance pay	0.033***	0.011***	0.065***
	(5.206)	(3.375)	(8.796)
	{1.274}	{1.265}	{1.413}
Hours	-3.2×10^{-4}	-4.6×10^{-5}	0.001***
	(-1.579)	(-0.412)	(4.280)
Log hourly wages	-0.001	-0.005**	0.039***
	(-0.245)	(-2.082)	(7.705)
ASVAB	0.041***	0.018***	0.058***
	(8.274)	(7.055)	(10.841)
Risk	0.024***	0.011***	0.023***
	(5.543)	(4.685)	(5.308)
Occupations (19)	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes
Years / waves (10)	Yes	Yes	Yes
Constant	{1.128}	{0.233*}	{0.228***}
	(0.231)	(-1.850)	(-3.548)
Observations (person-years)	46927	46475	46927
Number of people	5,870	5,864	5,870

Notes: average marginal effects are reported with odds ratios in brackets. t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Controls for Female, Black, Hispanic, Age, Married, Education and Health insurance included but not reported. Survey weights and estimation are used throughout and heteroskedasticity robust standard errors are clustered at the individual level.

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Table 3: Performance Pay and Drug Use, Worker and Worker in Employer Fixed Effects.

	Worker Fixed Effects			Worker in Employer Fixed Effects		
	Marijuana	Hard drugs	Alcohol	Marijuana	Hard drugs	Alcohol
Performance pay	1.158***	1.207**	1.122***	1.290***	1.258*	1.134**
	(3.123)	(2.573)	(3.049)	(3.260)	(1.810)	(2.071)
Age	0.933	1.037	0.983	0.982	0.953	1.101
	(-1.064)	(0.322)	(-0.334)	(-0.170)	(-0.282)	(1.317)
Married	0.582***	0.519***	0.661***	0.673***	0.614**	0.697***
	(-6.841)	(-4.901)	(-8.064)	(-2.792)	(-2.221)	(-4.549)
Education	0.988	0.976	1.098***	0.990	0.971	1.003
	(-0.639)	(-0.833)	(6.832)	(-0.289)	(-0.667)	(0.137)
Hours	0.998	1.005*	1.005***	1.001	1.012*	1.001
	(-0.992)	(1.901)	(3.707)	(0.182)	(1.797)	(0.586)
Health insurance	0.833***	0.900	0.841***	0.734***	0.999	0.780***
	(-4.047)	(-1.536)	(-4.986)	(-3.919)	(-0.008)	(-4.372)
Log hourly wages	1.015	1.005	1.108***	1.025	0.941	1.058
	(0.464)	(0.100)	(3.957)	(0.425)	(-0.593)	(1.145)
Occupations (19)	Yes	Yes	Yes	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes	Yes	Yes	Yes
Years / waves (10)	Yes	Yes	Yes	Yes	Yes	Yes
Obs. (person-years)	22,442	9,947	38,976	8,140	3,411	16,809
Number of people	2,829	1,247	4,925			
Num. person-emp.				2,207	917	4,304

Notes: odds ratios are reported with t-statistics in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Heteroskedasticity robust standard errors are clustered at the worker level in the first three columns and at the worker – in – employer level in the last three columns.

Table 4: Performance Pay and Substance Use, Heterogeneous Effects

	Marijuana			
	White		Nonwhite	
	Women	Men	Women	Men
Performance pay	0.037***	0.040***	0.032**	-0.007
	(3.715)	(3.545)	(2.304)	(-0.474)
	{1.373}	{1.297}	{1.364}	{0.954}
Marijuana proportion	0.149	0.211	0.112	0.188
Performance pay proportion	0.238	0.217	0.188	0.198
Observations (person-years)	12,633	13,447	11,003	9,824

	Hard drugs			
	White		Nonwhite	
	Women	Men	Women	Men
Performance pay	0.014**	0.015**	0.011	-0.006
	(2.428)	(2.513)	(1.408)	(-0.908)
	{1.337}	{1.288}	{1.531}	{0.842}
Hard drugs proportion	0.053	0.066	0.023	0.038
Performance pay proportion	0.239	0.218	0.188	0.199
Observations (person-years)	12,482	13,321	10,748	9,598

	Alcohol			
	White		Nonwhite	
	Women	Men	Women	Men
Performance pay	0.082***	0.051***	0.080***	0.034**
	(6.339)	(3.998)	(4.678)	(2.013)
	{1.575}	{1.337}	{1.438}	{1.175}
Alcohol proportion	0.724	0.756	0.550	0.625
Performance pay proportion	0.238	0.217	0.188	0.198
Observations (person-years)	12,633	13,447	11,023	9,824

Notes: average marginal effects are reported with odds ratios in brackets. t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Survey weights and estimation are used throughout and heteroskedasticity robust standard errors are clustered at the individual level. Estimations include all Table 2 controls.

Table 5: Performance Pay and Substance Use: Controlling for Mood

	Depression (aggregate)			Depression (individual)		
	Marijuana	Hard drugs	Alcohol	Marijuana	Hard drugs	Alcohol
Performance pay	1.307***	1.255***	1.371***	1.307***	1.259***	1.370***
	(-4.71)	(-2.647)	(-6.494)	(-4.713)	(-2.633)	(-6.501)
Depression	1.229***	1.344***	1.010***			
	(-13.40)	(-13.29)	(-6.911)			
Nervous				1.242***	1.287***	1.134***
				(-5.591)	(-4.302)	(-3.931)
Blue				1.322***	1.438***	1.144***
				(-7.051)**	(-5.567)	(-3.937)
In-the-dumps				1.114***	1.310***	1.016
				(-2.461)	(-4.229)	(-0.429)
Occupations (19)	Yes	Yes	Yes	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes	Yes	Yes	Yes
Years / waves (10)	Yes	Yes	Yes	Yes	Yes	Yes
Obs. (person-years)	22,906	22,741	22,906	22,906	22,741	22,906

Notes: These estimates include all of the covariates in Table 2. t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Survey weights and estimation are used throughout and heteroskedasticity robust standard errors are clustered at the individual level.

Appendix Table A1: Descriptive statistics and variable definitions, NLSY97, 2002/2011

Variable definitions	**Obs.**	**Mean**	**Std. Dev.**
Marijuana = 1 if respondent used marijuana, or grass/pot, in the last 30 days and 0 otherwise	62425	0.168	0.374
Hard drugs = 1 if respondent, since the date of last interview, has used any drugs like cocaine, crack, heroin, or crystal meth, or any other substance not prescribed by a doctor, in order to get high or achieve an altered state and 0 otherwise	61673	0.046	0.210
Alcohol = 1 if respondent had one or more drinks of an alcoholic beverage in the last 30 days and 0 otherwise	62425	0.663	0.473
Marijuana frequency = number of days respondent has used marijuana in the last 30 days	61377	2.119	6.765
Hard drugs frequency = estimated number of times respondent has used Hard drugs since the date of last interview	61595	1.849	22.468
Alcohol frequency = number of days respondent had one or more alcoholic beverages in the last 30 days	61777	4.695	6.489
Performance pay = 1 if respondent received extra compensation from tips, commissions, bonuses, incentive pay, or other	62425	0.211	0.408
Female = 1 if respondent is a female and 0 if otherwise	62425	0.497	0.500
Black = 1 if respondent is black and 0 otherwise	62425	0.252	0.434
Hispanic = 1 if respondent is hispanic and 0 otherwise	62425	0.214	0.410
Age = respondent's age in years	62425	24.336	3.151
Married = 1 if respondent is married and 0 otherwise	62425	0.221	0.415
Education = highest year of education attained	62425	13.159	2.475
Hours = usual weekly hours worked	62425	34.450	13.157
Health insurance = 1 if respondent has any kind of health care coverage	62425	0.674	0.469
Log hourly wages = natural log of base hourly wage rate	61438	2.398	0.671
ASVAB = Armed Services Vocational Aptitude Battery combined percentile ranking of respondents scores in mathematical knowledge, arithmetic reasoning and verbal. Extracted from the 1999 wave of the NLSY97.	50863	46.910	29.188
Risk = respondent's self-selected risk preference scale from 0 to 10 where 0 means "unwilling to take any risks" and 10 means "fully prepared to take risks". Extracted from the 2010 wave of the NLSY.	58058	5.596	2.533

Appendix A2: Performance Pay and the Incidence of Drug Use: Controlling for Ability, Risk Attitudes and log total wages in Pooled Cross-section Logit Estimates

	Marijuana	Hard drugs	Alcohol
Performance pay	0.033***	0.012***	0.049***
	(5.121)	(3.606)	(6.661)
	{1.275}	{1.288}	{1.298}
Hours	-3.2×10^{-4}	-4.6×10^{-5}	0.001***
	(-1.575)	(-0.400)	(4.417)
Log total wage	-8.5×10^{-5}	-0.001	0.045***
	(-0.020)	(-0.513)	(8.548)
ASVAB	0.041***	0.018***	0.058***
	(8.267)	(7.058)	(10.761)
Risk	0.024***	0.011***	0.022***
	(5.541)	(4.685)	(5.223)
Occupations (19)	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes
Years / waves (10)	Yes	Yes	Yes
Constant	{1.117}	{0.233*}	{0.073***}
	(0.200)	(-1.709)	(-5.893)
Observations (person-years)	46927	46475	46927
Number of people	5,870	5,864	5,870

Notes: average marginal effects are reported with odds ratios in brackets. t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Controls for Female, Black, Hispanic, Age, Married, Education and Health insurance included but not reported. Log total wage is the natural log of the hourly wage rate including compensation from performance pay schemes. Survey weights and estimation are used throughout and heteroskedasticity robust standard errors are clustered at the individual level.

Appendix A3: Worker fixed effects Poisson estimations: frequency of use

	Marijuana	**Hard drugs**	**Alcohol**
	(1)	**(2)**	**(3)**
Performance pay	0.083***	0.197*	0.041***
	(3.095)	(1.956)	(3.230)
Age	-0.144***	0.255	-0.028
	(-3.512)	(1.444)	(-1.471)
Married	-0.249***	-0.595***	-0.154***
	(-4.497)	(-3.218)	(-7.470)
Education	-0.001	0.029	0.030***
	(-0.097)	(0.498)	(5.343)
Hours	-0.000	-0.000	0.002***
	(-0.417)	(-0.042)	(3.647)
Health insurance	-0.042	-0.144	-0.040***
	(-1.612)	(-1.278)	(-2.990)
Log hourly wages	0.032*	-0.063	0.017*
	(1.844)	(-0.905)	(1.751)
Occupations (19)	Yes	Yes	Yes
Industries (18)	Yes	Yes	Yes
Regions (4)	Yes	Yes	Yes
Years / waves (9)	Yes	Yes	Yes
Obs. (person-years)	21,676	8,982	54,886

Notes: Heteroskedasticity robust standard errors are clustered at the individual level. Column (2) estimates exclude workers using hard drugs more often than every workday (407 observations). t-statistics are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.