NAVAL POSTGRADUATE SCHOOL
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THESIS

THE ROLE OF SELECTION BIAS IN ESTIMATES OF THE
DETERRENCE EFFECT OF DRUG TESTING: EVIDENCE
FROM THE NATIONAL LOGITUDINAL SURVEY OF
YOUTH

by

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March 1999

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Substance abuse in the military has serious and costly consequences. The aim of this research is to measure quantitatively the deterrence effect of the military's drug testing and "zero tolerance" policies. A second purpose is to statistically measure the degree to which selection bias may explain the deterrence effect associated with the military services' drug testing policy. Additionally, this thesis investigates the propensity of service members to substitute legal drugs or alcohol for illicit drugs as a result of drug testing.

The results indicate the military's drug prevention policies do have a substantial effect on service members' drug use behavior. The evidence also suggests that self-selection of applicants to the military does not significantly reduce the magnitude of the estimated deterrence effect. However, the results also suggest that there may be an unintended consequence of these policies in the form of military members substituting legal drugs such as alcohol for illegal drugs.

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THE ROLE OF SELECTION BIAS IN ESTIMATES OF THE DETERRENCE EFFECT OF DRUG TESTING: EVIDENCE FROM THE NATIONAL LOGITUDINAL SURVEY OF YOUTH

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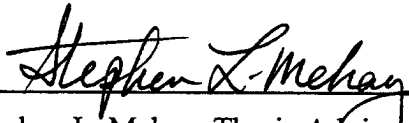## MASTER OF SCIENCE IN MANAGEMENT

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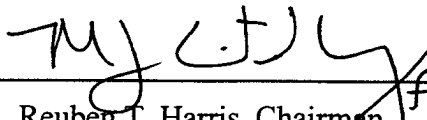Robert Dean Ward

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ABSTRACT

Substance abuse in the military has serious and costly consequences. The aim of this research is to quantitatively measure the deterrence effect of the military's drug testing and "zero tolerance" policies. A second purpose is to statistically measure the degree to which selection bias may explain the deterrence effect associated with the military services' drug testing policy. Additionally, this thesis investigates the propensity of service members to substitute legal drugs or alcohol for illicit drugs as a result of drug testing.

The results indicate the military's drug prevention policies do have a substantial effect on service members' drug use behavior. The evidence also suggests that self-selection of applicants to the military does not significantly reduce the magnitude of the estimated deterrence effect. However, the results also suggest that there may be an unintended consequence of these policies in the form of military members substituting legal drugs such as alcohol for illegal drugs.

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I. INTRODUCTION

A. ENVIRONMENT

Alcohol and other substance abuse has been implicated as a factor in many of this country's most serious and costly social problems, including violence, workplace injuries, child and spousal abuse, sexually transmitted diseases, school failure, automobile accidents, escalating health care costs, and lower worker productivity [Ref. 1]. The Center on Addiction and Substance Abuse at Columbia University estimates that at least one of every five dollars that Medicaid spends on hospital care and one in five Medicaid hospital days are attributable to substance abuse [Ref. 2].

"In 1980 the Court of Military Appeals determined that the taking of bodily fluids yields evidence that is not within the scope of either the Fifth Amendment of the Constitution or Article 31 of the Uniform Code of Military Justice (UCMJ). Additionally, legally supportable scientific techniques for identifying chemical compounds, including marijuana, were developed. In December 1981 DOD authorized the use of the results of compulsory urinalysis in disciplinary and administrative proceedings." [Ref. 3]

Since 1981 the Navy has aggressively pursued a "zero tolerance" drug policy. A number of studies have proven

that this policy has a deterrence effect on illicit drug use, as evidenced in the decline in the proportion of service members who test positive in the Navy [Ref. 4]. However, estimates of the deterrence effect of drug testing have not considered the possibility that self-selection by military applicants may account part, or all, of the observed deterrence effect. Individuals who enter active duty service self-select themselves for the military environment, one, which includes drug testing and other forms of discipline. This self-selection could be based on unobserved characteristics that are also correlated with the propensity to use drugs. As a consequence, estimates of the deterrence effect in prior studies may overstate the deterrence effect associated with the military's drug testing and zero tolerance policies.

The intent of this research is to estimate the size of the deterrence effect using a new data set. Additionally, this thesis will use the new data set to determine the degree of selection bias that may exist in estimates of the deterrence effect of the military services' drug testing policies. The data sets are extracted from the National Longitudinal Surveys of Youth (NLSY) which have been used by prior researchers to analyze illegal drug use.

B.   THE RESEARCH QUESTION

The primary research questions are:

- What is the deterrence effect of the military's drug testing policies?

- Do those who select military service (or are selected by the armed services) have a different underlying propensity for illicit drug use than a comparable representative civilian sample. If so, does this different propensity account for any observed deterrence effects?

- What is the propensity of military service members to substitute legal drugs or alcohol for illicit drugs as a result of drug testing?

The secondary research questions are:

- What does prior research on the subject indicate?

- What is the prevalence rate of illicit drug use for military members?

C. SCOPE

This thesis will evaluate the magnitude of the deterrence effect associated with the military services' drug testing programs. The deterrence effect is estimated by comparing drug prevalence rates of military and civilian samples. This raises the question of whether any observed deterrence effect may be due to selection of military members. Thus, this thesis will examine the degree of self-selection prevalent among the members of the military services as compared to a representative sample from the civilian population and attempt to identify those factors, that influence an individual's propensity for military service. Additionally, this thesis will investigate the propensity of service members to substitute legal drugs or alcohol for illicit drugs as a result of drug testing.

This research, by utilizing the National Longitudinal Survey of Youth, will attempt to confirm or refute prior deterrence effects findings that have been attributed to the military services' drug testing policies using other data sets. Additionally, this thesis will measure the "true" inclination of military personnel to engage in illicit drug use by determining the magnitude by which selection bias and the substitution of legal drugs or alcohol impact the use of illicit drugs.

D. ORGANIZATION OF STUDY

Chapter II of this study provides a review of relevant research, which impacts this study in terms of theory, methodology and models. Chapter III describes the history and current status of the Department of Defenses (DoD) and Navy's Drug prevention programs. Additionally, information regarding the National Longitudinal Survey of Youth (NLSY) and its limitations are provided.

Chapter IV describes the methodology and theory of the study and organization of the research. Variable descriptions are provided as well as hypothesized relationships. The specifications of the logit estimation models are discussed.

In Chapter V, titled "Cross-Sectional Analysis" the principle research questions are examined at two specific points in time, one before (1980) and one after (1984) institution of the military's "zero tolerance" policy. Discussed in detail are estimated logit model results and their implications for the deterrence and other effects at these two specific points in time.

Chapter VI, titled "Panel Analysis" is similar in nature to Chapter V except that those who transition into and out of the armed forces are excluded from the data analysis. The analysis in this chapter focuses the

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research questions on those who remained military members or civilians for both periods (1980 and 1984). In effect we measure the effect of the military's drug testing policy on those who were in the military in both years against a representative sample of civilians who remained civilians in both survey years. Chapter VII summarizes the results and discusses limitations of this thesis. It also presents recommendation for further research in this area.

II. LITERATURE REVIEW

A. THEORY

Numerous studies have been conducted on the ill effects of alcohol and drug abuse. However, the aim of this thesis is to measure the degree of deterrence the military's drug prevention policy has on its population. Another goal is to determine to what extent, if any, substitution and self-selection bias exist in estimates of deterrence.

Since 1980, military personnel and civilians have demonstrated a decrease in the prevalence of use of alcohol, other drugs, and tobacco. The percentage of active duty military that engaged in illicit drug use in the last 30 days declined significantly from 27.6 percent in 1980 to 8.9 percent in 1985. However, military personnel heavy alcohol use increased from 20.8 percent to 22.9 percent during this same period [Ref. 5]. Possibly, the decline in illicit drug use is due to the implementation of the military's urinalysis program in 1981 and the "zero tolerance" policy. However, this conclusion is questionable. A limitation of the 1980 and 1985 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel, which these statistics are drawn from, is that they rely on cross-sectional vice

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longitudinal data. Many of the people who were surveyed in
1980 are probably out of the service in 1985. After the
1981 policy change those who entered military service self-
select for an environment that includes testing for illicit
drugs. Individuals who desire to continue to use drugs may
not want to enter the military. Additionally, those who
are in the military and who are using drugs in 1980 may
decide to leave military service, if they desire to avoid
the consequences. Therefore, the results could be biased
due to self-selection among the applicants who chose to
join the military and among those who chose to leave. The
increase in heavy alcohol is an anomaly that may reflect
substitution away from illegal substances when the initial
crackdown on illicit drug use began in 1981. The following
surveys illustrate previous attempts to quantify selection
and substitution effects, generally among civilian
populations.

B. LITERATURE REVIEW

1. "Demographic Differentials In The Demand For Alcohol And Illicit Drugs"

The majority of public policies that are designed to
reduce substance abuse have been oriented towards
increasing the price of alcohol and illicit drugs.
Policies that increase the cost of alcohol to the public

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have worked by increasing taxes and increasing punitive measures against drunk drivers. Policies that increase costs of illicit drug use to the user are interdiction, destruction of drug crops, and fines and or incarceration for drug offenses. The assumption is that policies aimed at increasing the price of alcohol and drugs to the end user will reduce the demand for these substances. However, the lack of emphasis on demographic differences in response to these policies is rarely considered. Some demographic groups may be unresponsive to these policies. Regardless of changes in costs some demographic group's demand may not change while other demographic groups may be positively impacted by these policies. [Ref. 6]

Shaffer and Chaloupka (1998) use a data set derived from the 1988, 1990 and 1991 National Household Surveys of Drug Abuse and augmented with price data for alcohol and illicit drugs to estimate drug and alcohol use patterns for specific demographic groups. They conducted alcohol and drug price effect tests for each specific demographic group. Additionally, cross price effects were estimated as these effects may enhance or dilute direct effects of price policies. Essentially, if a pair of goods are "substitutes" the increase in price for one will increase the consumption of the other. Conversely, if goods are

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"complements" the increase in price for one will decrease the consumption of both [Ref. 6].

The dependent variables in this study were a continuous measure of alcohol and a binary measure of marijuana. The alcohol variable measured the number of days in the past 30-day period that an individual had consumed alcohol. The drug variable was equal to one if the individual indicated that he had used marijuana in the last year. There were seven demographic variables that defined individuals into one of four mutually exclusive race categories. These race categories were White, Black, Asian or Pacific Islander, and Native American. The White, Male, Nonhispanic group was selected as the comparison group for all others. The purpose of their regressions was to determine the change in usage of alcohol and marijuana as a response to price changes, and to search for evidence of complementary, substitutability or independence of alcohol and drugs [Ref. 6].

The results indicate that racial and ethnic minorities consume less or equal amounts of alcohol and marijuana than non-minorities. The results also show that alcohol and illicit drugs are complements [Ref. 6]. An increase in price of one substance reduces the demand for the other substance. This suggests that within the military context

the consumption of alcohol should fall with an increase in
"cost" of marijuana.

2. **"DO Youths Substitute Alcohol And Marijuana? Some
Economic Evidence"**

In 1984, the federal government enacted the Federal
uniform Drinking Act [Ref. 7]. This legislation required
all states to raise the legal drinking age to 21. However,
measures of alcohol abuse among the youth population
remained high. The assumption was that because of the "War
on Drugs," the nation's youth were substituting alcohol for
illicit drug use [Ref. 7].

This paper addresses the question of substitution
between marijuana and alcohol. Utilizing data from the
Monitoring the Future (MTF) 1982 and 1989 surveys,
Chaloupka and Laixuthai (1997) were able to model an
individual's utility as a function of the level of
intoxication from alcohol and marijuana. Individual
intoxication production functions were developed for
alcohol, marijuana and other drugs. These diminishing
return production functions were then maximized for
different combinations of price structures as a result to
policy enactment in 1984 [Ref. 7].

The results indicate that alcohol consumption is
negatively related to increases in alcohol prices.

Additionally, marijuana use declined as a result of an increase in its price. In states where the costs for marijuana use was lower as a result of decriminalization, the adjoining states had a decrease in alcohol consumption. This suggests that, at least for high school seniors, alcohol and marijuana are substitutes for one another.

3. "Does Increasing The Beer Tax Reduce Marijuana Consumption?"

Using data from the National Longitudinal Survey of Youth, Pacula (1994) was able to establish that alcohol and marijuana are economic complements, not substitutes [Ref. 8]. By analyzing the sign and significance of cross-price effects in demand equations for alcohol and marijuana a complementary relationship was observed. Increases in the price of beer showed a negative and significant effect on the demand for marijuana. Specifically, increases in the tax on beer while reducing consumption of alcohol will also cause a decrease in demand of marijuana. Pacula's study suggests that policies that increase the cost of alcohol have the added benefit of reducing the consumption of marijuana. [Ref. 8]

C.   SUMMARY

In summary, this research does not definitively prove that marijuana and alcohol are complements or substitutes for one another. Shaffer and Chaloupka's (1998) results show that alcohol and illicit drugs are complements and, therefor, the increase in price of one will cause a reduction in demand for the other. Chaloupka and Laixuthai's (1997) research indicates alcohol and marijuana are substitutes and that the increase in price for one will cause an increase in demand for the other. However, Pacula (1994) provides evidence that marijuana and alcohol are complements. This prior research provides useful background information on methodology but provides conflicting predictions of the likely consequences of the military's drug prevention policy on alcohol use.

III. BACKGROUND

A. INTRODUCTION

The use of alcohol and illicit drug use by military personnel is considered to be a poor health practice and interferes with the DoD mission of maintaining a high state of military readiness among the armed forces. The DoD considers any use of illicit drugs to constitute abuse because of negative effects resulting from defiance of laws and regulations. Consequentially, DoD policy aims at preventing and minimizing the effects of alcohol consumption and illicit drug use on military performance and at promoting behaviors that contribute to health and fitness of its members [Ref. 9]. However, "alcohol and drugs are often intricately bound up in military custom and tradition" [Ref. 10]. Social norms within the military have tended to encourage alcohol and tobacco use. Alcohol consumption and being accepted by a predominately male military population have served as a test of suitability for the demanding masculine military role [Ref. 9]. However, the use of substances in the work place has been well documented as to its loss of human capital and resources [Ref. 11]. The crash of a jet on the aircraft carrier USS NIMITZ in 1981 further emphasized the

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military's abuse problem, particularly marijuana usage [Ref. 12].

1. Department of Defense Drug Testing Policy

In 1980, the DoD issued a new comprehensive drug prevention policy directive, DoD Directive 1010.4, [Ref. 13]. This directive established a significant shift from earlier directives that focused on rehabilitation for drug users. The goal of this new policy was to "be free of all the effects of alcohol and drug abuse" [Ref. 12]. The DoD clearly stated that drug abuse is incompatible with the maintenance of high standards of performance, military discipline, and readiness [Ref. 13]. The services, in response to the DoD directive, issued their specific policy guidance.

2. Department of the Navy Drug Testing Policy

In 1980, the navy issued OPNAVINST 5350.4A [Ref. 14]. This instruction shifted the Navy's policy of drug abuse to one of "zero tolerance" which pursued an aggressive drug abuse, detection and deterrence program [Ref. 11]. Since 1981, all services members, officer and enlisted, by instruction, can be separated for their first drug abuse incident [Ref. 15].

B.   THE NATIONAL LONGITUDINAL SURVEY OF YOUTH 1979-1996

The National Longitudinal Survey of Youth (NLSY),
which is currently sponsored by the Bureau of Labor
Statistics (BLS), U.S. Department of Labor, is a panel
survey that has gathered information over time on the labor
market experiences of diverse groups of young men and
women. The NLSY is a nationally representative sample of
civilian and military youth that were first interviewed in
early 1979, and then reinterviewed annually until 1996.
The respondents were aged 14 to 21 in 1979.

The primary purpose of the NLSY survey was to collect
data on the labor market experiences and labor market
attachment of each respondent, and on investments in
education and training undertaken by each respondent.
However, the content of the NLSY survey is much broader due
to interests by several governmental agencies who have
supported the survey over the years. During some years
several agencies provided funding for special sets of
questions. From 1979 through 1984 the Defense Department
provided funding to include a special sub-sample of an
additional 1,280 youth that enlisted in the military. In
1980 the Defense Department and the Labor Department funded
The Armed Services Vocational Aptitude Battery (ASVAB) to
be administered to all respondents in the survey.

Additionally, the National Institute on Alcohol Abuse and Alcoholism and the National Institute on Drug Abuse have provided funding to make possible multiple fielding of expanded sets of alcohol and substance abuse questions. [Ref. 16].

The NLSY has several advantages for the purpose of this research. First, it is a large nationally representative youth survey, with oversampling of particular subpopulations (minorities, the poor and military members). While the NLSY may not generalize to today's young people because this sample was drawn from young people in 1979, these data provide a rich source of information about youth during the peak years of the drug epidemic in the United States. Second, the NLSY is longitudinal, which provides the opportunity to analyze drug use behavior of individuals over time. As a result, NLSY provides a potentially rich source of data for examining many possible variables that may be related to an individual's use of illicit drugs.

Although the survey contains extremely useful survey data that can illuminate the prevalence of drug use within the target populations, the NLSY does have some limitations especially in terms of analyzing drug use. First, the survey depends upon self-reporting of substance use. An

individual may not truthfully and accurately report his actual illicit drug use, for a number of reasons. Thus, drug use and abuse may be generally underreported. Secondly, the sample of military youth (1,280) may not be sufficient to provide a proper representation of some components of the military population. The target sample was that of the enlisted community which omits officers from the sample. For example, the samples drawn from each military branch may not be representative of that particular branch and thus prevent the analysis of the deterrence effects associated with the different service policies as was done in Martinez' thesis [Ref. 17]. Additionally, the over-sampling of the military population was eliminated from the NLSY after 1984. The smaller sample size of military members in more recent precludes applying this analysis to the most recent military drug policy.

Although longitudinal data provides for a way to look at behavior over time, they may not reflect the behavior of current youth. Hence, attempts to generalize the results from this analysis to the current population of youth must be viewed with caution. However, for the purpose of this thesis it is expected that the data will be sufficient to

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provide empirical evidence to gauge the presence and size of the hypothesized deterrence effect.

IV. METHODOLOGY

Borack and Mehay [Ref. 4] hypothesized that the frequency of drug testing would have an effect on the deterrence of illicit drug use. Their empirical results tended to confirm this hypothesis. Martinez [Ref. 17] also was able to quantify the deterrence effect utilizing an alternative data set. However, Borack and Mehay's results were based on limited time series data and Martinez's results were based on a single year of cross sectional data. Moreover, both studies based their results on the DoD Worldwide Health Survey and the National Institute of Drug Abuse's National Health Survey of Drug Abuse. The use of alternative type of data sets, such as the panel data available in the NLSY, would help to verify or reject the existence of a deterrence effect of drug testing. Therefore, one of the goals of this research is to provide replication of previous findings. Additionally, this thesis aims to measure the degree to which selection bias exists in the estimates of deterrence and the degree to which service members substitute one type of substance for another.

A. THEORY

Previous analysis reveals that drug testing and a strict "zero tolerance" policy have been key ingredients to

the success of the Navy's drug deterrence. The presence of the military drug testing program, specifically its punitive nature, is hypothesized to have a causal effect of deterring the use of drugs among military members in comparison to representative civilian samples who are not subject to the same testing or consequences. Differences in drug use between the military and the civilian population shall be measured to determine if a deterrence effect exists that is associated with the military's drug testing policy.

Additionally, it is hypothesized that military members, as a response to the drug testing and zero tolerance policies, may substitute legal drugs or alcohol for illicit drugs. If different substances are substituted, military members, as compared to representative civilians may reveal a higher propensity for legal drugs or alcohol in response to military drug testing. In this thesis, alcohol, as a legal substance, will be used as a proxy for usage of legal drugs due to its popularity and availability. Measuring differences in alcohol use between the military sample and representative civilian samples will measure the substitution effect as a potential unintended external effect of the military's drug testing policy.

Lastly, this thesis will examine the degree to which self-selection among members of the military services affects the measurement of deterrence. Are military personnel different from civilians such that those who select military service would be predisposed toward lower illicit drug usage even in the absence of the drug testing program? The process of selecting military service, or being selected by the military services, may produce members of the armed forces who are inherently predisposed toward lower drug use. The hypothesis is those who enter active duty service self-select themselves for the military environment, one that includes drug testing. Alternatively, the military through its screening process selects candidates who have a lower propensity to use illicit drugs. This self-selection could potentially bias the estimated deterrence effect by attributing observed differences in drug use between the two populations to the military's drug prevention policies, when in fact portion or all of such differences are due to unobservable factors associated with the type of individuals in the two populations. This thesis will use the NLSY data to determine the degree of selection bias in estimates of the deterrence effect of the military services' drug testing policy.

B. ORGANIZATION OF STUDY

The study is organized into two distinct chapters. In Chapter V, titled "Cross-Sectional Analysis," we examine the principal research questions at two specific points in time, one before (1980), and one after (1984) institution of the military's drug prevention policy. The objective of Chapter V will be to measure the effects of the military's drug testing policies on those who are in the military at these two specific points in time by comparing them to otherwise comparable civilians. However, when considering the impact of a policy change on those in the military this cross-sectional analysis has limitations. Those who are in the military in the first year (1980) may have left the military before the second year (1984). Likewise, those who are civilians in the first year may have chosen to enter military service in the intervening years and thus are represented as military personnel in the second year (1984).

In Chapter VI, titled "Panel Analysis," those respondents who transition into or out of military service between 1980 and 1984 are removed from the data sample. Thus, we measure the effect of the military's drug testing policy on those who were in the military in both years

against a representative sample of civilians who remained civilians in both survey years.

Variables for the analysis of the two separate years, 1980 and 1984, were extracted from the NLSY. These two years straddle the military's change in policy, which occurred in 1981. The variables are similar, except for the year in which they were extracted. This offers the opportunity to analyze and compare the deterrence and substitution effect at two specific points on a group who remained in the military and were affected by a significant change in policy. This gives us the ability to examine the behavioral effect on drug deterrence as the result of the policy change. Note, too, that this analysis isolates the deterrence effect to some extent from the selection effect because those who enlisted before the implementation of the drug prevention policies were not influenced by those policies when they entered the military.

This research design provides two distinct data sets for analysis, which should both corroborate and extend prior studies. Generic to both chapters is variable creation and design of models, which is provided in the next section.

C. MODEL SPECIFICATION

In each of the following chapters, the effects of the military's drug testing policy are explored. Each chapter required the specification of multivariate logit models suited to examining each specific effect. The principle difference among the models is the definition of the dependent variable and the sample being analyzed. Dependent variables were developed that are used both in the cross-sectional and panel analysis. The main objective was to examine the determinants of illicit drug usage for the previous 30-days or the previous year. The military is primarily concerned with examining the usage during the previous 30 days. However, illicit drug usage during the previous year is also informative about any long-term deterrence effect of testing on illegal drug use. Three dependent variables were developed (DRUG30, DRUG12 and MARJ) to measure the drug deterrence effect (see Table 4.1 for a definition of these variables). The substitution effect was examined by analyzing alcohol use, measured both as a binary and as a continuous variable, ALCUSED and ALCOHOL, respectively. All models utilize the same explanatory variables, which are defined in the next section.

1. Variable Description

As in Martinez's study [Ref. 17] variables were chosen based on the previous literature and factors hypothesized to affect the propensity for illicit drug use. Prior studies provided the greatest guidance for choosing explanatory variables. Independent variables were chosen on the basis of their value in predicting the likelihood of an individual to use illicit drugs or alcohol. Most of these variables captured demographic characteristics of survey respondents, included race (WHITE, BLACK, OTHER), gender (FEMALE), marital status (SINGLE, WED, SEP), if the respondent has dependent children (KIDS), education level (HSDG, COLL, DADSEDUC), age of respondent (AGE, AGESQ), measure of ability (AFQT), and active military duty status (MIL). Active military members are defined as those who are currently serving on active duty at the time of the survey. The comparison group includes a small number of reservists. It is hypothesized that reservists will behave more closely to civilians as the majority of their professional lives are spent in civilian occupations.

Development of the drug use dependent variables was accomplished by developing binary variables for responses to the discrete substance use questions from the NLSY. In 1984 several drug use questions were available to develop a

comprehensive drug use dependent variable. In 1984 the NLSY asked a respondent about his use of a number of types of drugs. The response to each of these questions was coded binary (0,1). The answer to each of the specific drug questions was summed to obtain composite drug use binary variables for the past year and past month (DRUG12 and DRUG30, respectively). For example, if a respondent indicated that he used cocaine within the last year but not within the last 30-days, it would result in a zero (0) for the discrete 30-day drug use dependent variable (DRUG30) and a one (1) for the one-year discrete drug use dependent variable (DRUG12).

The 1980 survey did not ask questions about numerous different drugs, thus a comparable drug use variable could not be developed. However, a different drug use variable on marijuana use, (MARJ), was available in both the 1980 and 1984 surveys. This binary variable, MARJ, was used to compare drug use behavior in 1980 and 1984.

The substitution effect was analyzed by developing two separate measures of alcohol use. The first, ALCUSED, was coded one (1) if a respondent responded positively to a question referencing the number of times he/she had six or more drinks at one time in the last month; otherwise it was coded zero (0). The second, ALCOHOL, a continuous

variable, was based on the number of days the respondent

drank alcohol in the last month. Original coding indicated

valid skips for both of these variables. In both cases

these valid skips were treated as respondents who had not

used alcohol at the prescribed frequency or within the last

month and were subsequently coded as zero (0). Table 4.1

and 4.2 provide descriptions of the dependent and

independent variables, which are used throughout the

thesis.

Table 4.1: Dependent Variable Definitions

Variable	Definitions
DRUG30	= 1 If respondent used any illicit drugs within the last 30 days, = 0 otherwise. (Based on 1984 NLSY)
DRUG12	= 1 If respondent used any illicit drugs within the last year, = 0 otherwise. (Based on 1984 NLSY)
MARJ	= 1 If respondent used marijuana within the last year, = 0 otherwise. (Based on 1980 and 1984 NLSY)
ALCUSED	= 1 If respondent used alcohol with a frequency of 6 or more drinks at one time in last month, = 0 otherwise. (Based on 1984 NLSY)
ALCOHOL	Number of day's respondent drank alcohol in last month. (Continuous Variable) (based on 1984 NLSY)

Source: Constructed variables from NLSY survey.

Table 4.2: Independent Variable Definition
         (Based on 1980 and 1984 NLSY)

Variable	Definition
MIL	= 1 If respondent is active duty member of the armed forces, = 0 otherwise.
CIV	= 1 If respondent is a civilian. = 0 otherwise,
WHITE	= 1 If respondent is White. = 0 otherwise,
BLACK	= 1 If respondent is Black. = 0 otherwise,
OTHER	= 1 If respondent is not White or Black with regard to race, = 0 otherwise.
MALE	= 1 If respondent is male, = 0 otherwise.
FEMALE	= 1 If respondent is female, = 0 otherwise.
KIDS	= 1 If respondent has dependents that are dependent for at least one-half of their support, = 0 otherwise.
SINGLE	= 1 If respondent has never married, = 0 otherwise.
WED	= 1 If respondent is married or reunited, = 0 otherwise.
SEP	= 1 If respondent is divorced, widowed or separated, = 0 otherwise.
HSDG	= 1 If respondent is a high school graduate, = 0 otherwise.
COLL	= 1 If respondent has completed 1 or more years of college, = 0 otherwise
MOMWK	= 1 If respondent's mother is full time employed, = 0 otherwise
AFQT	Respondents score on Armed Forces Qualification Test. (Continuous Variable)
DADSEDUC	Respondents father level of education in years (Continuous Variable)
AGE	Respondents age in years. (Continuous Variable)
AGESQ	Respondents age in years squared. (Continuous Variable)
M80_M84	= 1 If respondent is a military member in 1980 and 1984, = 0 otherwise.
M80_C84	= 1 If respondent is a military member in 1980 but a civilian in 1984, = 0 otherwise. (Based on 1980 and 1984 NLSY surveys)
C80_M84	= 1 If respondent is a civilian in 1980 but a military member in 1984, = 0 otherwise.
C80_C84	= 1 If respondent is a civilian for 1980 and 1984, = 0 otherwise.

Source: Constructed from the NLSY survey.

2. Hypothesized Relationships

The hypothesized signs were based upon the previous literature. Those who were unable to obtain a high school diploma or equivalent would be more likely to use illicit drugs. The basis for this assumption is that non-high school graduates lack the maturity and responsibility as compared to those who have persevered to attain a high school diploma (HSDG). Additionally, those who have gone to college (COLL) have demonstrated attributes that would indicate that they would be less likely to use illicit drugs. Those respondents who are married (WED), as well as those who have dependents (KIDS), are less likely to use illicit drugs as compared to those who have separated (SEP) and who are single, for the same reasons cited previously.

Race (WHITE, BLACK, and OTHER) is expected to be an indicator of illicit drug usage. Minorities are expected to use or consume less or equal amounts of illicit drugs, as do whites [Ref. 18]. Additionally, FEMALES are less likely to use drugs as MALES. The basis for this assumption is that MALES in comparison are considered to be risk-takers. Thus, MALES are expected to be more likely to use drugs.

AGE is expected to provide explanatory power of drug use. Saffer and Chaloupka (1995) suggest there is a pattern of increasing then decreasing illicit drug use with age. As AGE increases with the sample population of the NLSY it is expected illicit drug use will also increase with this youth group.

Father's level of education (DADSEDUC) and if the mother of the respondent is employed (MOMWK) is expected to provide additional power as a regressor. Level of education as it is related to income provides additional resources available for the purchase of illicit drugs. Additionally, the relationship of a respondents level to the level of education of father (DADSEDUC) is theorized to increase the level resources and usage of illicit drugs of the respondent. The expected results are that with an increase in level of fathers education (DADSEDUC) there will be an increase in illicit drug use by the respondent. Also, similar results are expected if the mother of the respondent works (MOMWK). Finally, military personnel (MIL), due to their exposure to drug testing and the punitive consequences, are less likely to use illicit drugs than a comparable civilian (CIV) counterpart.

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3. Models

A number of models are specified in this analysis. Illicit drug use was modeled for usage within a thirty-day period and one-year period as a function of the previously described characteristics. The focus of this thesis is to estimate the illicit drug usage of a military member as compared to a civilian counterpart. The following drug deterrence models are specified and estimated:

$$(\text{DRUG30/12, MARJ}) = f(\text{MIL, BLACK, OTHER, FEMALE,} \quad [\text{Eq. 4.1}]$$
$$\text{KIDS, WED, SEP, HSDG, COLL,}$$
$$\text{MOMWK, AFQT, DADSEDUC, AGE, AGESQ}$$

The substitution effect was modeled using the dependent variables ALCUSED and ALCOHOL, a binary and continuous variable, respectively. The same explanatory variables as used in Eq. 4.1 are used to predict alcohol use:

$$\text{ALCUSED} = f(\text{MIL, BLACK, OTHER, FEMALE,} \quad [\text{Eq. 4.2}]$$
$$\text{KIDS, WED, SEP, HSDG, COLL,}$$
$$\text{MOMWK, AFQT, DADSEDUC, AGE, AGESQ}$$

$$\text{ALCOHOL} = f(\text{MIL, BLACK, OTHER, FEMALE,} \quad [\text{Eq. 4.3}]$$
$$\text{KIDS, WED, SEP, HSDG, COLL}$$
$$\text{MOMWK, AFQT, DADSEDUC, AGE, AGESQ}$$

D. HYPOTHESIS TESTING PROCEDURE

In Chapter V, identical models are estimated for two different cross sections, 1980 and 1984. In this analysis we measure the effect of the military's drug testing policies in 1984 and compare the effect to 1980 when no policy was in place.

In Chapter VI, as in Chapter V, identical models are estimated for 1980 and 1984. Although, the samples upon which estimates are based are identical, military personnel are restricted to those who are in the military in both years, 1980 and 1984. The comparison group consists of those who are civilians in 1980 who are also civilians in the 1984 sample. This allows us to observe the behavioral effects of the 1981 policy change on this restricted group.

Binomial (or binary) logit estimates were derived using non-linear maximum likelihood techniques. Logits cannot be estimated using ordinary least squares. Instead, we used maximum likelihood, an interative estimation technique that is especially useful for equations that are nonlinear in the coefficients, as is the case here. Maximum likelihood estimation is inherently different from least squares in that it chooses coefficient estimates that maximize the likelihood of the sample data set being observed [Ref. 19]. Since the parameter estimates from the

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logistic procedure are not directly interpretable a

marginal effects are also calculated for each logit

-coefficient. Marginal analysis first estimates the

probability a person would use illicit drugs or alcohol

given they possess a certain attribute, holding all other

variables constant. Marginal effect then allows us to

determine the change in the probability of using illicit

drugs or alcohol when there is a one-unit change in one of

the independent variables. The base case for comparison

for all models throughout this thesis is a white civilian,

male, who is single, has no children or dependents, and

does not possess a high school diploma, no college, average

age, and has obtained an average score on the AFQT. For

example, the marginal effect probability provided for

military (MIL) in each of the models is the probability

that a service member will use illicit drugs or alcohol as

compared to the base case alternative, all other

characteristics held constant.

Additionally, an average civilian and military

individual is constructed for each model. Characteristics

for each sample are identified by the sample mean or median

characteristics. The marginal effect is then computed for

civilians and military personnel for comparison of illicit

drug use or alcohol.

V. CROSS-SECTIONAL ANALYSES

One goal of this chapter is to measure the deterrence effect during 1984. Also an attempt is made to determine whether a substitution effect existed in 1984. Finally, the 1980 sample is used to analyze whether underlying drug use behavior of military personnel was different in a period when military drug prevention policies were less punitive and no urinalysis testing was done.

There were two panels of data in the NLSY that were suited to analyzing drug and alcohol use -- 1980 and 1984. The 1984 survey provided the largest number of military respondents. The over-sampling of the military sample that started in 1979 was ended in 1984. Additionally, in 1984 the inclusion of numerous questions dealing with drug and alcohol use provided for a construction of several drug use variables that could be used in the models. Consequently, the 1984 survey represented the optimum combination of military representation and availability of questions for the first analysis of drug and alcohol use.

The 1980 survey presented the only year prior to the 1981 military policy change that offered any questions on drug use. The only type of drug that was analyzed, however, was marijuana (MARJ). Of particular note, a limited number of alcohol use questions were available

prior to the military's drug policy change of 1981. This limitation prevents measurement of the substitution effect prior to implementation of the military's drug prevention policy change.

A.   ANALYSIS OF 1984 NLSY SURVEY

Again, the 1984 NLSY survey offered the optimum number of questions regarding drug use and a representative number of military personnel for the first analysis. Table 5.1 presents descriptive statistics for the 1984 sample. Mean values for the 1984 civilians and active military members are also provided. It is necessary to emphasize the statistics are not estimates of the population parameters because the probability of selecting each member from the sample is not the same. However, this does not affect the coefficients estimated in the multivariate logit models.

Table 5.1: 1984 Variable Means

Variable	1984 Pooled Mean	1984 Pooled Std Dev	1984 Civilian Mean	1984 Military Mean
DRUG30	0.2143	0.4103	* 0.2216	* 0.1045
DRUG12	0.2595	0.4384	* 0.2672	* 0.1455
ALCUSED	0.3838	0.4863	* 0.3781	* 0.4668
ALCOHOL	5.1634	6.8963	* 5.0348	* 7.0520
MARJ80	0.4686	0.4990	0.4683	0.4942
MARJ84	0.3159	0.4649	* 0.3251	* 0.1795
MIL84	0.0637	0.2443	N.A.	1.0000
WHITE84	0.6928	0.4614	0.6957	0.6212
BLACK84	0.2508	0.4335	0.2478	0.3303
OTHER84	0.0564	0.2307	0.0564	0.0485
MALE84	0.5030	0.5000	0.4842	0.7450
FEMALE84	0.4970	0.5000	0.5158	0.2550
SINGLE84	0.6445	0.4787	0.6582	0.4434
WED84	0.2980	0.4574	0.2853	0.4850
SEP84	0.0574	0.2327	0.0565	0.0715
KIDS84	0.2967	0.4568	0.2898	0.3984
HSDG84	0.7751	0.4175	0.7625	0.9610
COLL84	0.3425	0.4746	0.3515	0.2102
AGE84	22.8097	2.2801	22.7558	23.6021
AGE84SQ	522.148	104.9184	519.6729	558.5228
MOMWK	0.5782	0.4939	0.5789	0.6016
DADSEDUC	11.1514	3.6688	11.1518	11.1178
AFQT	40.9519	28.7572	40.5985	47.5690
M80_M84	0.0335	0.1799	N.A.	0.5431
C80_M84	0.0282	0.1655	N.A.	0.4570
M80_C84	0.0594	0.2365	0.0634	N.A.
C80_C84	0.8789	0.3263	0.9366	N.A.
Sample Size:	12,610		11,300	769

Source: Based on 1984 NLSY survey data.
Note: N.A. = Not Applicable
   * Indicates difference in means is statistically significant at the 1% level

Comparing means for military and civilians in the 1984 survey, illicit drug use in the military is lower than it is among civilians.   In fact, drug use by military personnel is about half what it is for civilians.   Both of the alcohol consumption measures, on the other hand, are higher for the military sample than for the civilian sample.   A simple t-test confirms that the differences in means for the drug and alcohol use variables are

statistically significant. These differences are consistent with the hypothesis that the military drug-testing program may have caused a deterrence and substitution effect.

However, these bivariate statistics may be misleading. The demographic characteristics of the military sample are somewhat different from the civilian sample. The military has a higher representation of blacks as compared to the civilian sector, and it is often argued that blacks believe the military offers a greater economic opportunity than whites. Also, the military sample is more likely to be male, married, and to possess a high school diploma. This. is expected, as the military requires a high school diploma or equivalent for enlistment.

Recall that the NLSY is a panel survey and follows the same individuals over time. For example, 54.3 percent who were in the military in 1984 were still serving in the military in 1980; 45.7 percent of 1984 military personnel were civilians in 1980 but entered active duty during the intervening period. In the 1984 civilian sample, 93.7 percent were still civilians in 1984, while the remaining 6.3 percent were in the military in 1980 but separated from active duty during the intervening period.

Particular note should be taken of the mean values of the illicit drug use variables DRUG12, DRUG30, and MARJ84 in Table 5.1. The illicit drug use rates were all lower for the military sample than the civilian sample. The exception is for the 1980 marijuana use variable (MARJ80), which is higher for active duty personnel. This demonstrates that those in the military in 1984, regardless if they were civilians or military earlier in 1980 had a lower propensity to use drugs than their civilian counterparts. The 1984 military sample's reported marijuana use in 1980 was slightly higher than the civilian sample. Table 5.2, which is extracted from Table 5.1, is provided for further clarification.

Table 5.2: Illicit Drug Use Rates for 1984 Survey
           Population

	DRUG30	DRUG12	MARJ84	MARJ80
CIVILIAN	22.2%	26.7%	32.5%	46.8%
MILITARY	10.5	14.6	18.0	49.4
Difference	-11.7 *	-12.1 *	-14.5 *	+2.6

Source: Based on 1980 and 1984 NLSY surveys
* Indicates difference in means is statistically significant at the 1%
  level

Table 5.2 suggests that the military's drug testing program had a deterrence effect on those in the military in 1984. Also, it demonstrates that military personnel in 1980 were just as likely to use marijuana as were

civilians. These difference-in-differences provides
preliminary evidence that there is no selection bias among
those who entered military service in 1980.

In Table 5.1 the marijuana use rate (MARJ84) for the
military sample includes people who were civilians in 1980
as well as people who were in the military in 1980.
Additionally, the MARJ84 mean for the civilian sample
includes individuals who were in the military service in
1980 but left during the intervening years. Table 5.3
provides a closer analysis of marijuana use in 1984 for
these sub-samples.

Table 5.3: Marijuana Use Rates in 1984 Military and
Civilian by Year

| | | MIL84 | |
		Yes	No
MIL80	Yes	13.3 (391)	40.6 (694)
	No	23.4 (329)	32.0 (10,260)

Source: Based on 1980 and 1984 NLSY surveys
Note: Cell size in parenthesis

Table 5.3 breaks down marijuana use in 1984, as
derived from Table 5.1, into four groups. Those reporting
marijuana use in 1984 who were military members for both
years had a 13.3 percent rate as compared to a use rate of

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32.0 percent for individuals who were civilians for both

years. This demonstrates that military members in 1984

showed a substantially lower propensity to use marijuana

than a comparable civilian sample. Also, those who were in

the military in 1980 but left the military service in the

intervening years show a 40.6 use rate which is far higher

than those who stayed in the military for this entire

period (13.3 percent) and even higher than for "continuous"

civilians (32.0 percent).

This would indicate that the introduction of the

military's drug prevention program in the intervening years

may have induced service members with a propensity for drug

use to leave the military. Additionally, civilians in 1980

who entered the military prior to 1984 demonstrated a lower

reported marijuana use rate than civilians who remained

civilians for both years (23.4 percent versus 32.0). This

would suggest that the military's drug prevention policy

might have deterred those who would otherwise have applied

for military service from doing so. However, the use rate

for "continuous" civilians (32.0 percent) is higher than

for "continuous" military members (13 .3 percent).

In Table 5.1 marijuana use (MARJ80) for the military

sample includes military members who eventually left the

services and later became civilians. Additionally, the

civilian sample in 1980 includes individuals who entered
the armed forces between 1980 and 1984. Table 5.4 provides
a closer analysis of marijuana use in 1980 for these sub-
samples. Table 5.4 shows that differences in drug use in
1980 are very small between the various groups. Moreover,
for each cell drug use is higher in 1980 than in 1984.

Table 5.4: Marijuana Use Rates in 1980 for Military and
Civilians by Year

		MIL84	
		Yes	No
MIL80	Yes	48.5% (391)	61.9% (1,085)
	No	50.5 (1,414)	45.9 (11,674)

Source: Based on 1980 and 1984 NLSY surveys
Note: Cell size in parenthesis

Table 5.4 breaks down marijuana use in 1980 as
provided in Table 5.1 into four groups. The proportion of
those reporting using marijuana in 1980 who are
"continuous" military members is 48.5 percentage points as
compared to 45.9 percentage points for individuals who are
"continuous" civilians. This demonstrates military members
in 1980 actually show a higher propensity to use marijuana
than a comparable civilian sample. This evidence counters
the hypothesis that those who enter military service select

out of the military environment, which includes drug testing. Additionally, military members who left service in the intervening years reported a 61.9 percent use rate in 1980 as compared to a 48.5 percent rate for those who remained in service. This suggests the change in the military's drug testing program (and possibly because of it) may have induced some drug users to leave the military. Individuals who were civilians in 1980 who entered military service in the intervening years and are represented as military in 1984 demonstrated a higher proportion of marijuana use in 1980 (50.5) than those who remained civilians for both years (61.9). This would indicate that the introduction of the military's drug prevention program in the intervening years may have had the effect of inducing military personnel members who used marijuana to leave the armed forces. However, this sample demonstrated a much lower propensity to use marijuana than those who left military service did.

1. Deterrence Effect

One goal of this thesis was to attempt to verify Martinez's [Ref. 17] findings of a deterrence effect by using a different data file. The deterrence effect is measured for past 30-day and past one-year drug use,

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respectively. The previously mentioned variables were extracted from the NLSY survey for 1984.

Tables 5.5 and 5.6 detail the estimated coefficients and associated marginal effects from maximum likelihood estimates of Eq. 4.1 and Eq. 4.2, respectively. The parameter estimates are interpreted as the change in the log-odds of illicit drug use given a one-unit change in the independent variable, holding all other explanatory variables constant. The calculated marginal effects provide the change in the probability of an individual using illicit drugs or alcohol when there is a one-unit change in one of the independent variables.

Table 5.5: Logit Estimates of Determinants of 30-Day Drug Use for the 1984 Survey year. (Dependent variable: DRUG30)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
MIL84	-1.1246	0.1513	0.0001	-0.1733
BLACK84	0.1109	0.0714	0.1204	0.0234
OTHER84	0.3317	0.1203	0.0058	0.0730
FEMALE84	-0.6242	0.0543	0.0001	-0.1110
KIDS84	0.0096	0.0705	0.8915	0.0020
WED84	-0.6487	0.0752	0.0001	-0.1143
SEP84	0.1442	0.1146	0.2085	0.0306
HSDG84	-0.3534	0.0736	0.0001	-0.0672
COLL84	-0.6391	0.0691	0.0001	-0.1129
MOMWK	0.1806	0.0539	0.0008	0.0386
AFQT	0.0053	0.0013	0.0001	0.0011
DADSEDUC	0.0507	0.0083	0.0001	0.0106
AGE84	0.7058	0.2499	0.0047	0.1629
AGE84SQ	-0.0146	0.0054	0.0072	-0.2168
Constant	-9.7198	2.8708	0.0007	-0.0000

Notes:
Sample size: 9,342   Log liklihood: 512.9 (p= 0.0001)
Concordance ratio: 65.9%

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Table 5.6: Logit Estimates of Determinants of 12-Month Drug
Use for the 1984 Survey year.
(Dependent variable DRUG12)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
MIL84	-0.8862	0.1288	0.0001	-0.1697
BLACK84	-0.0714	0.0677	0.2917	-0.0162
OTHER84	0.2729	0.1135	0.0162	0.0646
FEMALE84	-0.4877	0.0502	0.0001	-0.1022
KIDS84	0.0088	0.0655	0.8929	0.0020
WED84	-0.6674	0.0691	0.0001	-0.1345
SEP84	0.1634	0.1072	0.1274	0.0382
HSDG84	-0.3592	0.0698	0.0001	-0.0772
COLL84	-0.6040	0.0640	0.0001	-0.1235
MOMWK	0.1951	0.0501	0.0001	0.0458
AFQT	0.0062	0.0012	0.0001	0.0014
DADSEDUC	0.0510	0.0077	0.0001	0.0117
AGE84	0.6289	0.2320	0.0067	0.1529
AGE84SQ	-0.0129	0.0050	0.0102	-0.2400
Constant	-8.6263	2.6654	0.0012	0.0000

Notes:
Sample size: 9,342   Log Likelihood: 510.8 (p = 0.0001)
Concordance ratio: 64.9%

The results reveal that military (MIL) members,
females (FEMALE), and married persons (WED) have a
significantly lower rate of illicit drug use both in the
short-term and long-term. In addition, respondents who
were separated (SEP), or lacked a high school diploma
(NOHSDG) showed higher illicit drug use in both the short-
term and the long-term.

The most pertinent coefficient in the 1984 analysis is
the coefficient of the military (MIL84) variable. As
stated earlier, the hypothesis is that military personnel
who work in a drug-testing environment will reduce their
demand for illicit drugs. The tables indicate that
military personnel are 17.3 and 17.0 percentage points less

likely to use illicit drugs in the short-term and long-term, respectively, than otherwise comparable civilian youth.

In the 1984 sample, the average military individual is 23.6-year-old white male, who has no children, is most likely to have been married, has a high school diploma but no college to his credit, scored on average a 48 on the AFQT and grew up with a working mother (see Table 5.1). The average civilian individual, for the 1984 sample, is a 22.8-year-old, white single female, with no children and who also has a high school diploma and no college education to her credit who scored a 41 on the AFQT and also grew up with a working mother. (See Table 5.1). In comparing these 'notional' average individuals, the average military individual is 3.3 and 3.0 percentage points less likely to use drugs in the short-term and long-term, respectively, as compared to the average civilian in the 1984 survey. These statistics show that the military's drug prevention policies may have a sizable deterrence effect on the average military individual in comparison to the average civilian in 1984.

2. Substitution Effect

The substitution effect is measured by analyzing differences in alcohol consumption between military and

civilian populations where consumption is measured in two alternative ways: using a binary variable (ALCUSED), and a continuous variable (ALCOHOL). The specification is based on Eq.s 4.2 and 4.3, respectively. Again, the substitution of alcohol for military members is hypothesized to be a potential externality of the military's drug testing policy.

Table 5.7 details the coefficient estimates and marginal effects from the ALUCSED model as specified above in Eq. 4.2. The first model in Table 5.7 is similar to the previous models in Tables 5.5 and 5.6, other than the drug use dependent variable is replaced with the alcohol consumption variable, ALCUSED. ALCUSED is a binary variable and represents a respondent who has consumed alcohol within the last month with a frequency of 6 or more drinks in a single sitting (i.e., "binge" drinking).

The majority of explanatory variables in Table 5.7 are highly significant. With regards to the substitution effect, particular note should be taken of the positive and significant coefficient of the MIL84 variable, which indicates military members are more likely to engage in "binge" drinking than civilians are. The coefficient is significant at the 10 percent level. However, its magnitude is small; the probability of abusing alcohol is

about 6 percentage points higher for service members than for civilians. This suggests that the military's drug testing policy may have the unintended effect of inducing military personnel to substitute alcohol for drugs.

The coefficient estimates for minorities are significant and negative. Blacks are 21.0 percentage points less likely to abuse alcohol than whites. The educational coefficient estimates for those who have obtained one or more years of college education (COLL) is highly significant and negative. This is consistent with the hypothesis that individuals who have persevered and stayed in school are less likely to use drugs and alcohol. However, the HSDG variable is statistically insignificant. Individuals who are married or who have children have a lower likelihood of using alcohol. This is also consistent with the notion that individuals who are married or who have dependents have family obligations and are more likely to act maturely and responsibly. The age coefficient is positive and significant which is consistent with this age group. The ability variable (AFQT) is positive and significant. It is theorized that individuals who posses a higher aptitude also posses a greater ability to conceal their abuse. The coefficients for MOMWK and DADSEDUC are both positive and significant. This is consistent with our

hypothesis that individuals who come from family

backgrounds with greater resources also themselves obtain

higher levels of income which may be used for substance

abuse.

Table 5.7:   Logit Estimates of Determinants of Alcohol Use
             in 1984.
             (Dependent variable ALCUSED = Six or more
             drinks per sitting per month)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effects
MIL84	0.2456	0.0970	0.0113	0.0571
BLACK84	-0.8538	0.0650	0.0001	-0.2103
OTHER84	-0.3904	0.1103	0.0004	-0.0961
FEMALE84	-1.1225	0.0469	0.0001	-0.2721
KIDS84	-0.1047	0.0607	0.0848	-0.0253
WED84	-0.5978	0.0627	0.0001	-0.1478
SEP84	0.0823	0.1047	0.4316	0.0196
HSDG84	-0.0898	0.0668	0.1785	-0.0217
COLL84	-0.4390	0.0589	0.0001	-0.1083
MOMWK	0.1077	0.0466	0.0209	0.0255
AFQT	-0.0008	0.0011	0.4728	-0.0002
DADSEDUC	0.0378	0.0071	0.0001	0.0090
AGE84	0.3904	0.2122	0.0659	0.0888
AGE84SQ	-0.0082	0.0046	0.0762	-0.2249
Constant	-4.3743	2.4371	0.0727	0.0000

Notes:
Sample size: 9,350   Log likelihood: 1,167.3 (p = 0.0001)
Concordance ratio: 70.2%

As a second analysis of the substitution effect we use

a continuous measure of alcohol consumption, (ALCOHOL),

which represents the number of days a respondent drank

alcohol in the last month. Recall from Table 5.1 the

average number of days of consumption for the civilian

sample and military samples are 5.03 and 7.05 days,

respectively. Table 5.8 details the coefficient estimates

from the ALCOHOL model as specified in Eq. 4.3. The model is estimated using ordinary least squares techniques.

The majority of explanatory variables are highly significant. With regards to the substitution effect particular note should be taken of the positive and highly significant coefficient of MIL84. Active duty members are estimated to drink 1.47 more days in a month as compared to an otherwise comparable civilian. This represents about a 20 percent difference between the two groups. When comparing the 'notional' average military with the 'notional' average civilian, the average military individual is 35.2 percent less likely to abuse alcohol as compared to the average civilian. This again suggests that the military's drug testing policy may have the unintended effect of causing military personnel to substitute untested substances (alcohol) for tested substances (illicit drugs).

The negative and highly significant alcohol coefficients for minorities (BLACK and OTHER) are interesting in conjunction with drug use finding in Tables 5.5 and 5.6. These results indicate that minority groups are less likely to use alcohol and drugs. Additionally, females (FEMALE) and those who are married (MARRIED) are less likely to engage in drug use and consumption of alcohol. Other intriguing results are the education

variables. Recall in Tables 5.5 and 5.6 those who had
completed a high school education (HSDG) or completed one
or more years of college (COLL) showed a lower propensity
to use drugs. However, in Tables 5.7 and 5.8 these same
variables show a higher consumption of alcohol. It is
theorized that these individuals fear the punitive
consequences of using illegal substances and choose alcohol
over drugs and that the environment among our higher
educational institutions may promote consumption of
alcohol.

Table 5.8: Ordinary Least Squares Estimates of Determinants
           of Alcohol Use in 1984.
           (Dependent variable ALCOHOL = Number of days
           drank alcohol in last month)

Variable	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
MIL84	1.4685	0.2929	5.013	0.0001
BLACK84	-1.1132	0.1841	-6.046	0.0001
OTHER84	-1.3200	0.3213	-4.109	0.0001
FEMALE84	-3.5179	0.1385	-25.396	0.0001
KIDS84	-0.4227	0.1752	-2.413	0.0159
WED84	-1.9172	0.1806	-10.616	0.0001
SEP84	-0.1150	0.3156	-0.364	0.7155
HSDG84	-0.7685	0.1995	-3.852	0.0001
COLL84	-0.9061	0.1714	-5.287	0.0001
MOMWK	0.4713	0.1376	3.425	0.0006
AFQT	0.0212	0.0033	6.344	0.0001
DADSEDUC	0.1617	0.0209	7.754	0.0001
AGE84	2.4462	0.6787	3.605	0.0003
AGE84SQ	-0.0484	0.0147	-3.283	0.0010
Constant	-24.5423	7.7940	-3.149	0.0016

Notes:
Sample size: 12,686   Mean of Dependent Variable: 5.35
R^2 = 0.1306   F value = 100.1
Adj. R^2 = 0.1293   Prob>F = 0.0001

B.   ANALYSES AND COMPARISON OF 1980 AND 1984 NLSY SURVEYS

In the second portion of the cross-sectional analysis the 1980 survey is analyzed and compared to the 1984 survey. The 1980 survey provided a limited number of questions regarding a respondent's use of illicit drugs. Also, the 1980 survey lacked a suitable alcohol use question for substitution analysis with military respondents. However, a respondent's past-year marijuana use is asked during both 1980 and 1984. Thus, marijuana, due to its popularity and availability, is used as a proxy for all illicit drug use and is developed into a dependent variable for both the 1980 and 1984 samples (MARJ80 and MARJ84).

Tables 5.9 provides descriptive statistics for cross-sectional 1980 variables both for the pooled data and for civilian and military sub-samples. Comparing means for those who were in the military in the 1980 survey against those who are civilians shows a higher representation of whites, males, married people, and high school degree holders in the military. However, the military member is less likely to have attended college.

In Table 5.9, the marijuana use rate (MARJ80) for the military sample represents those who became civilians in 1984 as well as those who were "continuous" military.

Additionally, the 1980 marijuana use rate (MARJ80) for the civilian sample includes individuals whom later entered military service (before 1984).

Table 5.9:   Variable Means for 1980 NLSY Sample,

Variable	1980 Pooled Mean	1980 Pooled Std Dev	1980 Civilian Mean	1980 Military Mean
MARJ80	0.4686	0.4990	* 0.4589	* 0.5657
MARJ84	0.3159	0.4649	0.3175	0.3078
MIL80	0.0935	0.2911	N.A.	1.0000
WHITE80	0.6928	0.4614	0.6883	0.7436
BLACK80	0.2508	0.4335	0.2559	0.2094
OTHER80	0.0564	0.2307	0.0558	0.0470
MALE80	0.5030	0.5000	0.4855	0.6430
FEMALE80	0.4970	0.5000	0.5145	0.3570
SINGLE80	0.8791	0.3260	0.8953	0.7216
WED80	0.1059	0.3078	0.0906	0.2546
SEP80	0.0150	0.1215	0.0141	0.0238
KIDS80	0.1004	0.3005	0.0933	0.1684
HSDG80	0.3969	0.4892	0.3437	0.9119
COLL80	0.1596	0.3662	0.1654	0.1031
AGE80	18.8270	2.3002	18.597	21.0529
AGE80SQ	356.2673	85.0101	347.6476	439.8520
MOMWK	0.5782	0.4939	0.5794	0.6179
DADSEDUC	11.1514	3.6688	11.1151	11.6764
AFQT	40.9519	28.7572	39.8611	53.2822
M80_M84	0.0335	0.1799	N.A.	0.3604
M80_C84	0.0594	0.2365	N.A.	0.6396
C80_M84	0.0282	0.1655	0.0311	N.A.
C80_C84	0.8789	0.3263	0.9689	N.A.
Sample Size:	12,610		11,006	1,135

Source: Based on 1980 and 1984 NLSY surveys
Note: * Indicates the difference in means is statistically significant at the 1% level
        N.A. = Not Applicable

Particular note should be taken of the mean values of the marijuana variables (MARJ80, MARJ84) in Table 5.9. Past-year marijuana use among military in 1980 was higher than that of the civilian sample. Those who were military in 1980, regardless if they remained in the military or left military service before 1984, demonstrate a

substantial decrease in reported marijuana use from 56.6

percent to 30.8 percent in 1980 and 1984, respectively. In

comparison, those who were civilians in 1980, regardless if

they remained a civilian or entered military service before

1984, show lower past-year marijuana use, but less than the

decrease for military personnel. These statistics are

derived from Table 5.9 and presented in Table 5.10 to

clarify marijuana use differences for these groups.

Table 5.10: Marijuana Use Rates of Military and Civilians
             in 1980 Survey

	Civilian	Military
MARJ80	* 45.9%	* 56.6%
MARJ84	31.8	30.8
Difference	-14.1	25.8

Source: Based on 1980 NLSY survey
* Indicates the difference in means is statistically
  significant at the 1% level

Table 5.10 demonstrates that those who were military

in 1980 had a higher propensity for marijuana use than

their civilian counterparts. By 1984 marijuana for both of

the 1980 survey samples had reduced to comparable

percentages. Also, in 1984 the difference in mean

marijuana use is not statistically significantly. This

demonstrates that those in the military in 1984, regardless

if they were civilians or military in 1980 were just as

likely to use marijuana as their civilian counterparts.

Thus, this provides evidence that there is no self-selection effect among those who entered the military in 1980.

Among those in the 1980 military sample, 36.0 percent continued to serve in the military in 1984, and 64.0 percent became civilians by 1984. In the 1980 civilian sample 96.9 percent remained civilians in 1984, while the remaining 3.1 percent entered active duty during the intervening period.

1. Deterrence Effect

The deterrence effect is measured again using Eq. 4.1 for the 1980 and 1984 samples but with marijuana use as the dependent variable. Tables 5.11 and 5.12 detail the parameter estimates and marginal effects of marijuana use in 1980 and 1984. Note that the civilian comparison group is somewhat younger in 1980, but the variables for age control for the differences.

Table 5.11: Logit Estimates of Determinants of Marijuana
Use in 1980
(Dependent Variable: MARJ80)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
MIL80	0.1051	0.0840	0.2107	0.0257
BLACK80	-0.3920	0.0575	0.0001	-0.0907
OTHER80	-0.0742	0.1021	0.4672	-0.0179
FEMALE80	-0.2200	0.0437	0.0001	-0.0521
KIDS80	0.1258	0.0819	0.1245	0.0308
WED80	-0.4455	0.0822	0.0001	-0.1023
SEP80	-0.2698	0.1872	0.1495	-0.0635
HSDG80	-0.0964	0.0709	0.1742	-0.0231
COLL80	-0.2559	0.0744	0.0006	-0.0603
MOMWK	0.2061	0.0440	0.0001	0.0507
AFQT	-0.0014	0.0010	0.1467	-0.0098
DADSEDUC	0.0388	0.0066	0.0001	0.0351
AGE80	0.6498	0.1164	0.0001	0.1610
AGE80SQ	-0.0136	0.0032	0.0001	-0.2218
Constant	-7.6236	1.0823	0.0001	0.0000

Notes:
Sample size: 9,161   Log likelihood = 338.4 (p = 0.0001)
Concordance ratio: 60.5%

Table 5.11 shows that military members (MIL80) are
more likely to use marijuana in 1980 than civilians are.
The difference in the probability is 2.6 percentage points.
However, the coefficient of MIL80 is statistically
insignificant. Thus, we cannot reject the hypothesis that
there is no difference in the marijuana use rate.

The coefficient estimates for BLACK80 is highly
significant and negative which is consistent with the
literature and hypothesis. Blacks are about 9 percentage
points less likely to have used marijuana within the last.
The coefficient estimates for respondents who are females,
or are married are highly significant and negative.

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Table 5.12: Logit Estimates of Determinants of Marijuana Use in 1984
(Dependent Variable: MARJ84)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
MIL84	-0.9197	0.1183	0.0001	-0.2022
BLACK84	0.0434	0.0633	0.4931	0.0107
OTHER84	0.0460	0.1118	0.6808	0.0114
FEMALE84	-0.5780	0.0475	0.0001	-0.1344
KIDS84	0.0654	0.0621	0.2923	0.0162
WED84	-0.7624	0.0655	0.0001	-0.1723
SEP84	0.0243	0.1044	0.8158	0.0060
HSDG84	-0.3638	0.0670	0.0001	-0.0870
COLL84	-0.4821	0.0601	0.0001	-0.1136
MOMWK	0.1644	0.0474	0.0005	0.0409
AFQT	0.0063	0.0012	0.0001	0.0456
DADSEDUC	0.0506	0.0073	0.0001	0.0464
AGE84	0.5446	0.2176	0.0123	0.1353
AGE84SQ	-0.0114	0.0047	0.0155	-0.2621
Constant	-7.1663	2.4988	0.0041	-0.0000

Notes:
Sample size: 9,355   Log likelihood: 625.9 (p = 0.0001)
Concordance ratio: 65.5%

Table 5.12 shows that in 1984 there exists a significant deterrence effect. Military personnel in 1984 had a drug use probability that was 20 percentage points below that of civilians. This deterrence effect, however, may be understated given the previous findings. This evidence seems to eliminate the role of selection bias in explaining the observed deterrence effect in 1984. Those who entered service in 1980 were similar to civilians in regard to drug use. However, in 1984 it appears clear that the military's drug testing program has a deterrence effect.

One of the major goals of this thesis was to corroborate or refute the findings of previous research by

Martinez, which established the existence of a deterrence effect. Table 5.2 indicated that the deterrence effect (Past-year drug use) for military is 12 percent points lower than for the civilian sample. Table 5.12 shows that marijuana use was 20 points lower for the military. While these results cannot be directly compared to Martinez's research due to the difference in sample populations and the sample survey instruments, the existence of the deterrence effect appears to be clearly supported.

As previously discussed, the military samples, which are examined in 1980 and 1984, change. This limitation is overcome in the next section by removing those who transition into or out of military service. This panel analysis will provide the opportunity to replicate the findings of the cross-sectional analysis but using a cohort of military personnel who are observed in both 1980 and 1984.

VI. PANEL ANALYSIS

The focus of this chapter is similar to the cross-sectional analysis. The goal is to analyze the deterrence effect, the substitution effect, and the scope of selection bias in the deterrence estimates. However, the targeted sample is different. The samples are restricted to those who remained in the military or civilian sample in both 1980 and 1984, that is, to "continuous" civilians and "continuous" military. Respondents who either entered or left the armed forces between 1980 and 1984 are excluded from the panel analysis. This approach will provide a clearer indication of the effects of drug testing policy change on those who were in the armed forces prior to and after the new drug policies were introduced in 1981. In this case we know there are no selection effects associated with the military's drug policies, as these policies did not exist when these individuals entered the military.

A.   ANALYSIS OF THE 1984 NLSY SURVEY

Again, the 1984 NLSY survey offered the optimum number of questions regarding drug use and a representative number of military personnel for this analysis. Table 6.1 presents the descriptive statistics for the 1984 sample. The restricted sample size for this analysis is 11,593 as compared to the cross-sectional models in Chapter V, which

used a sample of 12,610. Variable means are also provided

separately for 1984 civilians and active military members.

Table 6.1: 1984 Variable Means for Continuous Civilians
            and Continuous Military

Variable	1984 Pooled Mean	1984 Pooled Std Dev	1984 Civilian Mean	1984 Military Mean
DRUG30	0.2113	0.4083	* 0.2164	* 0.0856
DRUG12	0.2558	0.4363	* 0.2614	* 0.1181
ALCUSED	0.3762	0.4844	* 0.3742	* 0.4227
ALCOHOL	4.9821	6.7675	* 4.9326	* 6.1727
MARJ80	0.4586	0.4983	0.4586	0.4853
MARJ84	0.3126	0.4636	* 0.3198	* 0.1386
WHITE84	0.6918	0.4618	0.6901	0.6812
BLACK84	0.2510	0.4336	0.2527	0.2729
OTHER84	0.0572	0.2322	0.0572	0.0459
MALE84	0.4829	0.4997	0.4735	0.6347
FEMALE84	0.5171	0.4997	0.5265	0.3653
SINGLE84	0.6582	0.4743	0.6751	0.2523
WED84	0.2873	0.4525	0.2722	0.6523
SEP84	0.0544	0.2268	0.0527	0.0955
KIDS84	0.2908	0.4542	0.2817	0.5114
HSDG84	0.7590	0.4277	0.7498	0.9818
COLL84	0.3493	0.4768	0.3544	0.2265
AGE84	22.7017	2.2777	22.6138	24.8205
AGE84SQ	517.1610	104.6849	513.0817	615.4909
MOMWK	0.5733	0.4946	0.5749	0.5845
DADSEDUC	11.1245	3.7114	11.1085	11.4274
AFQT	40.0969	28.9396	39.6836	52.1854
M80_M84	0.0367	0.1881	N.A.	1.0000
C80_C84	0.9633	0.1881	1.0000	N.A.
Sample Size:	11,593		10,606	440

Source: Based on 1984 NLSY survey.
Note: N.A. = Not Applicable
         * Indicates difference in means is statiscally significant at
           the 1% level

The 1984 sample statistics contained in Table 6.1 are

for those who were "continuous" military or "continuous"

civilians during the 1980-1984 period. The percentages

reporting to have used drugs, as indicated by the dependent

drug variables, DRUG30, DRUG12 and MARJ84 are considerably

lower for the military than the civilian sample. The

substantial difference in illicit drug use by the military

sample is evidence of the deterrence effect of the

military's drug prevention policy.   However, the alcohol

consumption variables ALCUSED and ALCOHOL indicate that

consumption among military personnel is higher than among

the civilian population, which provides evidence of the

substitution effect. The remaining demographic

characteristics are similar to those shown in Table 5.1.

1.   Deterrence Effect For Continuous Military Personnel

The deterrence effect is measured again using Eq. 4.1

but applied to this restricted sample. The deterrence

effect is measured in 1984 for "continuous" military as

compared to a "continuous" civilian. Those respondents who

transition to or from military service are removed from the

sample. Tables 6.2, 6.3, and 6.4 provide the parameter

estimates and marginal effects for the three drug use

variables, DRUG30, DRUG12, and MARJ84, respectively.

Table 6.2: Logit Estimates of Determinants of Drug Use in 1984
(Dependent variable: DRUG30)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
M80_M84	-1.2703	0.2349	0.0001	-0.1897
BLACK84	0.1071	0.0749	0.1525	0.0227
OTHER84	0.2616	0.1276	0.0403	0.0571
FEMALE84	-0.5900	0.0567	0.0001	-0.1067
KIDS84	-0.0016	0.0756	0.9835	-0.0003
WED84	-0.6729	0.0813	0.0001	-0.1190
SEP84	0.1501	0.1239	0.2256	0.0321
HSDG84	-0.4066	0.0757	0.0001	-0.0770
COLL84	-0.6637	0.0740	0.0001	-0.1177
MOMWK	0.1722	0.0565	0.0023	0.0370
AFQT	0.0058	0.0014	0.0001	0.0364
DADSEDUC	0.0509	0.0087	0.0001	0.0107
AGE84	0.7145	0.2561	0.0053	0.1659
AGE84SQ	-0.0149	0.0056	0.0075	-0.2039
Constant	-9.7596	2.9374	0.0009	-0.0000

Notes:
Sample size: 8522   Log likelihood: 464.4 (p = 0.0001)
Concordance ratio: 65.9%

Table 6.3: Logit Estimates of Determinants of Drug Use in 1984
(Dependent variable: DRUG12)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
M80_M84	-1.0733	0.1963	0.0001	-0.2082
BLACK84	-0.0768	0.0711	0.2800	-0.0180
OTHER84	0.1945	0.1202	0.1057	0.0469
FEMALE84	-0.4649	0.0524	0.0001	-0.1026
KIDS84	0.0141	0.0702	0.8404	0.0034
WED84	-0.7049	0.0747	0.0001	-0.1484
SEP84	0.1530	0.1159	0.1868	0.0368
HSDG84	-0.4045	0.0717	0.0001	-0.0902
COLL84	-0.6221	0.0684	0.0001	-0.1332
MOMWK	0.1848	0.0526	0.0004	0.0445
AFQT	0.0067	0.0013	0.0001	0.0467
DADSEDUC	0.0524	0.0081	0.0001	0.0125
AGE84	0.4556	0.2361	0.0536	0.1117
AGE84SQ	-0.0092	0.0051	0.0731	-0.1791
Constant	-6.6283	2.7069	0.0143	0.0000

Notes:
Sample Size: 8,522   Log likelihood: 473.1 (p = 0.0001)
Concordance Ratio: 65.0%

Table 6.4: Logit Estimates of Determinants of Marijuana
Use in 1984
(Dependent variable: MARJ84)

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
M80_M84	-1.0853	0.1788	0.0001	-0.2372
BLACK84	0.0346	0.0663	0.6014	0.0086
OTHER84	-0.0089	0.1178	0.9395	-0.0022
FEMALE84	-0.5413	0.0494	0.0001	-0.1288
KIDS84	0.0689	0.0662	0.2975	0.0172
WED84	-0.7635	0.0702	0.0001	-0.1762
SEP84	0.0147	0.1129	0.8961	0.0037
HSDG84	-0.3869	0.0688	0.0001	-0.0936
COLL84	-0.4918	0.0640	0.0001	-0.1177
MOMWK	0.1798	0.0497	0.0003	0.0449
AFQT	0.0066	0.0012	0.0001	0.0479
DADSEDUC	0.0505	0.0076	0.0001	0.0126
AGE84	0.3757	0.2222	0.0909	0.0936
AGE84SQ	-0.0078	0.0048	0.1054	-0.1738
INTERCPT	-5.2294	2.5466	0.0400	-0.0000

Notes:
Sample size: 8,531   Log likelihood: 558.2 (p = 0.0001)
Concordance ratio: 65.3%

The results of Tables 6.2, 6.3 and 6.4 reconfirm

previous results contained in Tables 5.5 and 5.6 in the

cross-sectional analysis. In the above tables all

estimates for the parameters of the "continuous" military

service variable (M80_M84) are negative and statistically

significant in all three drug models (DRUG30, DRUG12, and

MARJ84). This again provides clear evidence of the

deterrence effect associated with the military's drug

prevention policy. The marginal effects for M80_M84

indicate "continuous" military respondents demonstrated a

lower propensity to use drugs in 1984 as compared to

"continuous" civilians. They were 19 percentage points

less likely to use drugs on a short-term basis and 21

65

percentage points less likely on a long-term basis. Additionally, the marijuana use variable, MARJ84, indicates continuous military personnel were 24 percentage points less likely to have used marijuana in the last year as compared to continuous civilians.

In the 1984 sample, the average continuous military individual is a married white male who has children and possesses a high school diploma but has not completed any college. The average continuous civilian individual, for the 1984 sample, is a white single female, with no children and who also has a high school diploma and no college education to her credit. (See Table 6.1). In comparing these "notional" individuals, the results are similar to those in the cross-sectional analysis in Chapter V. The average continuous military individual has a 13.4 and 16.9 percentage point lower drug use rate for the short-term and long-term use, and a 19.7 point lower rate for marijuana use as compared to the average continuous civilian in 1984. These statistics again show that the military's drug prevention policies may have a deterrence effect of illicit drug use on the average military individual in comparison to the average civilian in 1984.

2. Substitution Effect for Continuous Military Personnel

The substitution effect is measured by analyzing differences in alcohol consumption between military and civilian populations using both a binary variable (ALCUSED) and a continuous variable (ALCOHOL). (See Eq. 4.2 and Eq. 4.3 apply, respectively). The substitution of alcohol is hypothesized to be a potential consequence of the military's drug testing policy. Tables 6.5 and 6.6 provide parameter estimates for the alcohol use models. The sample consists of continuous military as compared to continuous civilians.

The results in Tables 6.5 and 6.6 show that continuous military personnel consumed more alcohol as compared to continuous civilians. In 1984 continuous military personnel were 6.1 percent more likely to "binge drink" (consume 6 or more drinks in one sitting) (see Table 6.5) than continuous civilians. Also, these continuous military personnel consumed alcohol on 1 additional day in a given month than a comparable continuous civilian. This shows that there may have been a substitution effect associated with the military's drug testing program.

Table 6.5: Logit Estimates of Determinants of Alcohol
Consumption in 1984 for Continuous Military as
Compared to Continuous Civilians
Dependent variable: ALCUSED

Variable	Parameter Estimate	Standard Error	Pr > Chi-Square	Marginal Effect
M80_M84	0.2593	0.1325	0.0503	0.0609
BLACK84	-0.8535	0.0683	0.0001	-0.2100
OTHER84	-0.3977	0.1155	0.0006	-0.0984
FEMALE84	-1.1207	0.0488	0.0001	-0.2708
KIDS84	-0.0716	0.0648	0.2694	-0.0174
WED84	-0.6138	0.0674	0.0001	-0.1521
SEP84	0.0619	0.1128	0.5835	0.0149
HSDG84	-0.0928	0.0686	0.1761	-0.0226
COLL84	-0.4273	0.0627	0.0001	-0.1058
MOMWK	0.1024	0.0488	0.0361	0.0245
AFQT	-0.0002	0.0012	0.8610	-0.0015
DADSEDUC	0.0353	0.0075	0.0001	0.0085
AGE84	0.4487	0.2205	0.0419	0.1025
AGE84SQ	-0.0095	0.0048	0.0485	-0.2230
Constant	-5.0362	2.5283	0.0464	-0.0000

Notes:
Sample size: 8,526   Log Likelihood: 1,044.8 (p = 0.0001)

Table 6.6: Ordinary Least Squares of Estimates of the
Determinants of Alcohol Consumption in 1984 for
Continuous Military as Compared to Continuous
Civilians
Dependent variable: ALCOHOL

Variable	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
M80_M84	0.9051	0.3882	2.332	0.0197
BLACK84	-1.1722	0.1890	-6.203	0.0001
OTHER84	-1.2170	0.3282	-3.708	0.0002
FEMALE84	-3.4222	0.1418	-24.142	0.0001
KIDS84	-0.4245	0.1822	-2.330	0.0198
WED84	-1.9521	0.1886	-10.353	0.0001
SEP84	-0.0669	0.3330	-0.201	0.8409
HSDG84	-0.8258	0.2006	-4.118	0.0001
COLL84	-0.8349	0.1785	-4.676	0.0001
MOMWK	0.4823	0.1411	3.417	0.0006
AFQT	0.0242	0.0034	7.041	0.0001
DADSEDUC	0.1439	0.0214	6.732	0.0001
AGE84	1.9462	0.6853	2.840	0.0045
AGE84SQ	-0.0374	0.0149	-2.505	0.0123
Constant	-18.8841	7.8588	-2.403	0.0163

Notes:
Sample Size: 11,663   Mean of Dependent Variable: 5.17
R^2 = 0.1303   F value = 91.0
Adj. R^2 = 0.1289   Prob.>F = 0.0001

B. ANANYSIS OF THE 1980 NLSY SURVEY

In this section, the effects of the military's drug policies are measured in 1980 for continuous military as compared to continuous civilians. This analysis seeks to determine whether individuals who were military members in both 1980 and 1984 were more or less likely to use drugs in 1980 before the drug policy was implemented. If selection was a determinate factor for explaining the measured deterrence effect in 1984, continuous military personnel should also have revealed a lower propensity to use marijuana in 1980. The military and civilian marijuana use for this 1980 sample is provided in Table 6.8 below. Sample sizes for the populations are provided for in parenthesis.

Table 6.7: 1980 Variable Means for Continuous Military and Continuous Civilians

Variable	1980 Pooled Mean	1980 Pooled Std Dev	1980 Civilian Mean	1980 Military Mean
MARJ80	0.4586	0.4983	0.4575	0.4846
MARJ84	0.3126	0.4636	* 0.3202	* 0.1330
WHITE80	0.6918	0.4618	0.6928	0.6842
BLACK80	0.2510	0.4336	0.2512	0.2654
OTHER80	0.0572	0.2322	0.0560	0.0503
MALE80	0.4829	0.4997	0.4730	0.6329
FEMALE80	0.5171	0.4997	0.5270	0.3671
SINGLE80	0.8849	0.3192	0.8930	0.6871
WED80	0.1002	0.3003	0.0925	0.2857
SEP80	0.0149	0.1213	0.0144	0.0272
KIDS80	0.0993	0.2991	0.0951	0.2018
HSDG80	0.3715	0.4832	0.3484	0.9297
COLL80	0.1657	0.3718	0.1678	0.1156
AGE80	18.7117	2.2896	18.6158	21.0340
AGE80SQ	351.9555	84.3340	348.3541	439.1474
MOMWK	0.5733	0.4946	0.5780	0.5845
DADSEDUC	11.1245	3.7114	11.1276	11.5173
AFQT	40.0969	28.9396	39.7985	51.1814
M80_M84	0.0367	0.1881	N.A.	1.0000
C80_C84	0.9633	0.1881	1.0000	N.A.
Sample Size:	11,593		10,677	441

Source: Based on 1980 NLSY survey
* Indicates the difference in means are statistically
significant at the 1% level

The descriptive statistics in Table 6.7 pertain to the 1980 characteristics of continuous active duty personnel and continuous civilians. The percentage reporting past-year marijuana use (MARJ80) for the military is comparable to the civilian percentage, 48 versus 46 percentage points. The difference in MARJ80 means for the civilian and military sample is not statistically significant. Thus, they are equal. This indicates that military personnel were just as likely to use drugs in 1980, as were civilians. However, in 1984 marijuana use among military personnel had dropped dramatically to only 13 percent

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whereas civilian use dropped to 31 percent. Table 6.8

derived from Table 6.7, clarifies marijuana use differences

for these groups.

Table 6.8: Marijuana Use Rates for Civilians and Military
in 1980 and 1984

	Civilian	Military
MARJ80	45.8% (391)	48.5% (694)
MARJ84	* 32.0 (329)	* 13.3 (10,260)
Difference:	-13.8	-35.2

Source: Based on 1980 and 1984 NLSY
Note: Cell sizes in parenthesis
           * Indicates difference in means is statistically
             significant at the 1% level

Table 6.8 illustrates differences in drug use between

1980 to 1984 for this 1980 survey. The military

demonstrated a 35.2 percentage point reduction in reported

marijuana use as compared to only an 13.8 percentage point

reduction for civilians. This demonstrates the military

drug policies had a positive effect on its members.

Marijuana use for military and civilians in 1980 is

comparable which suggests military members had same

predisposition to use illicit drugs as did civilians.

The above statistics are indicated in the shaded area

in the table. The shaded area represents those

respondents, 391, who are continuous military as compared

to continuous civilians, 10,260. Again those who

transition from service, as represented by the unshaded

areas, were omitted from the analysis.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The primary goal of this study was to determine whether the military's drug testing policy tends to deter service personnel from using drugs. A second goal was to determine whether those who select the military (or are selected by the armed services) have a different underlying propensity for illicit drug use than otherwise comparable civilians. If so, does this different propensity account for any observed deterrence effect? A final goal was to determine whether the presence of the military's drug testing program, and the punitive nature of the "zero tolerance" policy, cause military members to substitute legal substances such as alcohol, for illicit drugs?

The results of this analysis indicate that the presence of the military's drug testing program has a sizable negative impact on the prevalence of drug use inside the military. Specifically, in comparing civilian and military in 1980 and 1984 the military showed a decline in illicit drug use of 35.2 percent while civilian usage had only decreased only 13.8 percent over the same period (see Table 6.8). This provides evidence that the military's drug prevention program has been successful in reducing the usage rate among its members in the military

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during this period. The phrase "zero tolerance" and its implied meaning are truly understood in the ranks of the military. However, this does not mean "zero incidence," a term which implies no usage.

The military's drug testing policies may have had the unintended consequence of inducing its members to consume more alcohol, at least in the early years of the program. This substitution effect indicates that alcohol, as a legal drug, is a substitute for illicit drugs at least in this environment. It appears that the military's drug prevention program is not all-inclusive, that alcohol consumption within the military is higher than the civilian's usage. However, as this may imply negative connotations, the consumption of alcohol by military personnel may not have the same negative outcomes on performance as drug consumption. In fact, low levels of consumption may provide an avenue for relief from a stressful environment. Consequentially, alcohol consumption all else equal may be the lesser of evils.

B. LIMITATIONS

The drawback of the analysis is that the data are from the early 1980s. Although these data are representative of that period of the all-volunteer era, the nature of the

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military has changed considerably in the past decade and a half. Thus, we may not be able to generalize these results to the current military environment. For example, tolerance of alcohol abuse is far lower in the military today than it was in the early 1980's. Thus, an analysis of more current data may provide more relevant information for policy makers, especially in terms of the substitution effect.

Additionally, an analysis that utilizes more sophisticated statistical procedures, may improve the accuracy of these estimates. One could, for example, use the weights provided in the NLSY to correct for the over-sampling of specific demographic groups.

One additional limitation discovered during the analysis was the absence of price information for drugs and alcohol. Military exchanges make available alcohol at reduced costs to members of the military as compared to the civilian community. This reduced cost may stimulate the demand for alcohol among military personnel and thus generate spurious estimates of the substitution effect. Higher consumption of alcohol among uniformed personnel may be causally linked to price differences rather than represent a policy-induced substitution effect.

While the deterrence effect indicated a substantial decrease in usage of illicit drugs within the military, the number of explanatory variables in the multivariate model was limited. Additional explanatory variables, including price, cross prices, and regional location, could improve on estimates of deterrence and substitution.

C.   RECOMMENDATIONS

It is clear that the military has benefited from its drug prevention policies in comparison to the civilian sector. However, the civilian sector is where the vast majority of cutting-edge research is being conducted. There are key differences in the military and civilian sectors that must be taken into account when attempting to generalize results from sector one to the other, but these discrepancies by no means invalidate this research. The trend in the civilian sector seems to be toward increased education efforts, whereas education has been a low priority in the military. In part this is because of legal limitations on using urinalysis tests on civilian employees. Also, few civilian jobs, except those in key industries where safety is a primary concern, even test employees for drug use.

Another issue is whether the costs of the military's current zero drug tolerance policy exceeds the costs. The

zero tolerance policy essentially mandates the discharge of employees who test positive on a urinalysis test. Some of these discharged service members are costly to replace when one factors the full costs of recruiting and training them. A comprehensive cost-benefit or cost-effectiveness analysis of alternative deterrence policies needs to be conducted.

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