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Sex Differences in the Effects of Alcohol on Labour Market Indicators

by

Nicole Dawn MacPherson

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ABSTRACT

In addition to the costs of motor vehicle accidents, deteriorated health, and criminal justice expenses, alcoholism has been cited as the cause of significant costs in the form of lost productivity and wages. This thesis attempts to empirically estimate the effects of heavy alcohol use on full-time labour market participation and on earnings. Since alcohol affects men and women differently, the sex differences in the effects of heavy alcohol use on labour market indicators is the focus of this thesis. The econometric methods used explore the endogenous relationships between heavy alcohol use, full-time labour market participation, and earnings, using data from the Canadian General Social Survey. The results indicate that heavy alcohol use positively impacts the propensity to work full-time for both males and females. Males who drink heavily are found to earn 9 percent less than those who do not. This number is over twice as large for women – females who drink heavily earn 20 percent less than those who do not.

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To my parents

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CHAPTER ONE: Introduction

1. Alcohol and the Labour Market

The costs of excessive alcohol use to society are extensive. Alcohol abuse has been pointed to as the cause of consequential expenses to society in the form of motor vehicle accidents, deteriorated health, and criminal justice costs, as well as the emotional and mental costs to the friends and families of the alcohol abuser (Shahandeh, 1985, Manning, et. al. 1983, Minister of Health and Welfare, 1984). In addition to these, excessive alcohol use has been cited as the cause of lost productivity and wages, a cost that is of particular interest to economists.

The effects of alcohol use on labour market productivity have been debated in recent economic literature. Alcoholism is considered to be a major social problem that negatively impacts earnings and labour market participation (Mullahy and Sindelar, 1991, 1993, 1996). It has been found, however, that moderate, and sometimes even heavy, alcohol consumption leads to higher wages relative to abstainers (Berger and Leigh, 1988; French and Zarkin, 1995; Zarkin et. al., 1998). This thesis will examine the relationships between heavy alcohol use and labour market participation, and between heavy alcohol use and earnings. It will focus on the sex differences in these relationships.

Recent medical literature has shown that moderate alcohol consumption is beneficial to health, specifically, it is associated with reduced risk of coronary heart disease. Alcohol can increase HDL cholesterol levels, which aids in the removal of cholesterol from arterial walls. In addition, alcohol reduces

atherosclerosis, a condition in which the arteries narrow and harden (Elnicki, 1998). To achieve these benefits, it has been recommended that women and men consume one and two drinks per day, respectively (ARF, 1997). Given that moderate alcohol consumption is beneficial to health, it should also lead to higher earnings, since health and productivity are positively correlated.

Although moderate alcohol use is thought to have certain health benefits, exceeding the recommended number of drinks per day can have serious medical implications. Both men and women consuming three or more drinks daily risk deterioration of the brain, pancreas, and liver (Elnicki, 1998). In addition, excessive alcohol consumption can lead to unstable behaviour, paranoia, and increased accidents and injuries (i.e., drunk driving) (Mullahy and Sindelar, 1996). Individuals who suffer from health problems as a result of excessive drinking could have difficulties in the workplace, or even problems becoming employed.

There is thought to be a causal relationship between alcohol use and earnings, and between alcohol use and labour market participation. Sickness, hangover, body tremors, antisocial behaviour, late arrivals, extended lunch breaks, and early departures are some work characteristics of alcoholics that contribute to lowered earnings potential (Shahandeh, 1985). Alcoholics may not have the stamina to complete schooling, post-secondary or otherwise, and therefore may have lower human capital characteristics which decrease earnings potential.

It has been shown that alcohol use affects earnings, but it is reasonable to also expect that earnings affect alcohol consumption. If the income elasticity of consumption is non-zero, then changes in earnings would affect alcohol usage. When examining the effects of alcohol on earnings, it is important to realize the possibility, and indeed, the probability, of a simultaneous relationship between them.

Excessive alcohol use may also affect labour market participation. Alcoholism is considered to be a disease, and as such, it can affect the decision to enter the labour market and/or the ability to maintain employment. It is thought that lowered reliability and productivity associated with alcoholism may increase unemployment within that group (Mullahy and Sindelar, 1996). Again, it has been hypothesized that there is a causal relationship between labour market participation and alcohol use, but the exact nature of the relationship is ambiguous. Stress and depression resulting from unemployment could exacerbate alcohol use. However, lack of income due to unemployment could reduce alcohol consumption (Mullahy and Sindelar, 1996).

1.1 Heavy Drinking

Alcoholism is considered to negatively affect productivity, whereas moderate consumption is thought to have positive effects on it. This thesis attempts to estimate the relationships between heavy drinking and labour market participation, and between heavy drinking and earnings. Heavy drinking is defined differently than alcoholism or alcohol abuse and dependence.

Individuals are defined as alcoholics if they have experienced chronic physical and mental difficulties related to alcohol consumption, such as blackouts, withdrawal symptoms, and the desire to stop drinking but the inability to do so (Mullahy and Sindelar, 1993). Heavy drinking is defined in this thesis only by drinking habits, not by the symptoms or effects associated with those habits. Males who drink heavily are those who drank at least once per week in the past year, and who consumed at least eight drinks on at least one occasion in the past week. The definition of a female heavy drinker is altered due to the sex differences in the ability to metabolize alcohol (Mullahy and Sindelar, 1996). Women who are considered to be heavy drinkers also drank at least once per week in the past year. However, to be classified as a heavy drinker, a female would have consumed at least four drinks, as opposed to eight, on at least one occasion in the past week. These definitions take into account both frequency and intensity of alcohol use (Hamilton and Hamilton, 1997). Alcoholics are, by definition, heavy drinkers, but heavy drinkers are not necessarily alcoholics.

The fact that heavy drinkers may or may not have the characteristics of alcoholism changes the way in which their habits affect labour market indicators. If an individual is a heavy drinker, but does not yet suffer from bodily damage due to alcohol, then that individual's earnings or decision to participate in the labour market may not be negatively impacted.

There is a social aspect to alcohol consumption. Drinks after work, drinks on the golf course, drinks with clients – these situations are not uncommon in the professional world, and may aid in promoting an individual's career. In addition

to the social aspect, high-income individuals may shoulder high levels of professional responsibility. This implies that these individuals may be under a great deal of pressure, and may drink heavily to relieve this stress. These factors imply that individuals who drink heavily may have higher earnings those who do not.

On the other hand, negative psychological aspects associated with low paying, "dead-end" jobs may result in increased alcohol consumption. That is, monotony, lack of mental stimulation, anxiety about job security, poor morale, and bad labour-management relations are some factors that encourage heavy drinking (Shahandeh, 1985). Therefore, individuals who drink heavily may be engaged in low income jobs. The relationship between heavy alcohol use and earnings is uncertain.

How heavy drinking affects participation in the labour market is also unclear. It is possible that alcohol negatively affects participation if an individual suffers from physical or mental problems due to alcohol use. However, not all individuals who drink heavily have these problems, leaving the relationship between heavy consumption and participation unknown.

Relationships between alcohol use and labour market indicators can also be a result of unobservable heterogeneity. Individuals who drink heavily may also have certain unobservable or unquantifiable characteristics that lead to particular labour market outcomes. In this case, drinking heavily does not cause certain labour market outcomes, rather, unobservable characteristics that cause individuals to drink heavily also induce particular labour market results.

1.2 Sex Differences

When examining the relationship between alcohol and labour market indicators, it is important to account for differences between males and females. Women are less likely than men to drink heavily, and are more likely to be abstainers. In the 1985 General Social Survey (GSS), almost 10 percent of prime age males are classified as heavy drinkers, as compared with 6 percent of prime age females, even when accounting for the sex differences in the definition of heavy drinker. Of women aged 25-59, 43 percent abstain from alcohol use, whereas 22 percent of men in the same age group were abstainers.

The differences in alcohol use between sexes is partially due to the medical consequences of drinking during pregnancy or while nursing. Pregnant women who drink put the unborn children at risk of developing fetal alcohol syndrome, a debilitating disease that can result in severe learning disabilities, emotional and mental problems, and physical deformities. Women who are nursing also put their children at risk of developmental problems. In addition, alcohol physically affects women differently from men. Women metabolize alcohol faster than do men, and suffer from greater liver damage from consuming the same amount of alcohol (Mullahy and Sindelar, 1996).

Another reason for differences in alcohol use between sexes is the influence of religious beliefs. According to the GSS, over 50 percent of women describe themselves as religious, while only 38 percent of men do so. Since many religions frown on the consumption of alcohol, this may help explain why fewer men than women abstain from alcohol consumption.

Since drinking habits differ between sexes, and because alcohol has different physical effects on men and women, it is important to examine the effects of alcohol use on the labour market separately for each sex. If alcohol physically affects men and women differently, it is not unreasonable to hypothesize that it will also affect their labour market indicators in a different manner.

1.3 Outline of the Thesis

This thesis is structured in the following way. Chapter Two outlines previous empirical literature dealing with the question of alcohol's effects on the labour market. It will examine papers dealing with both alcoholism and moderate drinking and their effects on earnings, as well as alcoholism's effects on employment. The data used for this study is discussed in detail in Chapter Three. Chapter Four outlines the econometric methodology used to estimate the pertinent relationships. In addition, this chapter provides some intuition behind the methodology used, and discusses limitations of the empirical model. The results from the empirical work are discussed in the fifth chapter.

CHAPTER TWO: Literature Review

2. Introduction

A growing body of literature has examined the effect of alcohol use and alcoholism on labour market indicators. Most widely studied are the effects of alcoholism on wages and participation in the labour force. The effects of moderate alcohol use have received some attention, but results and policy implications from this literature have been inconclusive. This chapter will examine the literature on the effects of alcohol use and abuse on both wages and participation in the labour market. The first section will outline Berger and Leigh's (1988) seminal paper on wages and drinking. The next section will look at alcoholism and its effects on both earnings and on labour market participation. Moderate alcohol use is examined in the following section. Hamilton and Hamilton's (1997) paper, estimating the relationships between light, moderate, and heavy drinking and earnings is the focus of the fourth section. The final section concludes with a discussion about possible problems with the existing literature.

2.1 Berger and Leigh (1988)

The empirical literature on alcohol and the labour market begins with a seminal paper authored by Berger and Leigh (1988). This paper examines the differences in wages between drinkers and abstainers. The sample consists of males and females, aged 18 and over, taken from the United States 1972-73 Quality of Employment Survey. Because individuals choose drinking categories,

a correction must be made to account for the self-selection bias. Failure to do so would cause the sample to be non-random, and would lead to unreliable estimates. In order to correct for the self-selection bias, the authors estimate the propensity to drink using probit analysis. The propensity to drink, known as a latent variable, dictates the drinking category an individual will choose. A latent variable is an unobservable one that drives observable ones. That is, an individual will be a drinker only if the propensity to drink is greater than zero. The propensity to drink is not observed, but drinking is. The authors assume that the propensity to drink is a function of exogenous variables, some of which are components of the individual's human capital equation. The estimates of the propensity to drink are then used to correct for the bias arising from the following equations:

$$\ln W_{ND} = X_{ND} b_{ND} + e_{ND}$$
$$\ln W_{D} = X_{D} b_{D} + e_{D},$$

where W is the wage, X is a vector of human capital variables, D and ND indicate drinker and non-drinker, respectively, and the e's are correlated with the error term from the propensity to drink equation. When the selection bias is corrected for, consistent estimates of the b's are found.

Berger and Leigh find that, even after controlling for observable characteristics and selectivity bias, drinkers earn higher wages than non-drinkers. Male drinkers earn 45 percent higher wages than men who abstain, and wages of female drinkers are 34 percent higher than those of their non-drinking counterparts. The authors offer three possible explanations for their results. First, the results could reflect the health benefits (and hence, productivity

increases) of moderate drinking. Secondly, the authors hypothesize that those who drink could be earning higher wages currently at the expense of future earnings. That is, drinkers could have flatter age-earnings profiles, with young drinkers working instead of pursuing higher education. Finally, the authors concede that those with health problems related to heavy drinking may have dropped out of the labour force, since the sample only accounts for those currently working.

2.2 Mullahy and Sindelar (1991, 1993, 1996)

Mullahy and Sindelar (1991) examine the labour market effects of alcoholism, focusing on sex differences. Specifically, they test the hypothesis that alcoholism will negatively affect both labour force participation and earnings. Mullahy and Sindelar define an alcoholic as an individual who has at any time met the criteria for alcohol dependence or alcohol abuse. The symptoms associated with these are consistent with the American Psychiatric Association's Diagnostic Statistical Manual. Diagnosis of abuse or dependence relies on a number of symptoms including blackouts, withdrawal symptoms, desire to stop drinking but inability to do so, and family and work problems cause by drinking.

Mullahy and Sindelar look at the differences in mean values of various characteristics between alcoholics and non-alcoholics, for both males and females. They observe that non-alcoholics are more educated, are more likely to be employed, and have higher incomes than alcoholics. They also observe that women are affected by alcoholism in a different way than are men. Specifically,

the income gap between alcoholic and non-alcoholic women is larger than that for men.

The observation is made by the authors that alcoholics tend to work less and earn less when working than non-alcoholics. They test the hypothesis that this is due to alcoholism itself, rather than to other unobserved characteristics. Mullahy and Sindelar estimate models of the probability of working, household income, and personal income. Each model is estimated with and without human capital characteristics. That is, work probability, household income, and personal income are each regressed against a vector of demographic variables and a dummy variable indicating alcohol abuse or dependence. In the second set of regressions, education, family structure, transfer income, and various disorder measures are included in each model. In this way, the authors separate the total effect of alcoholism from its indirect effects.

In the first case, alcoholism is found to have statistically significant, negative effects on work probability and household income for both males and females. Alcoholism has a negative, statistically significant effect on personal income for males only. When human capital characteristics are added to the models, alcoholism has a statistically significant, negative effect only on labour market participation. Household and personal incomes are not affected by alcoholism with the addition of these variables. Mullahy and Sindelar state that these results reflect a strong relationship between alcoholism and human capital characteristics. As well, the results imply that alcoholism affects labour force participation more strongly than it does income.

Building on their earlier work, Mullahy and Sindelar (1993) investigate the effects of early symptoms of alcoholism on labour market indicators. As before, one explanatory variable is a dummy indicating that the respondent had at any time displayed the symptoms of alcohol abuse or dependence.

Mullahy and Sindelar restrict their study to males aged 22-64, using data from the 1980-81 wave of the Epidemiological Catchment Area survey. They estimate a linear model

$$y = z\alpha + \varepsilon ,$$

where y is the log of earnings, and z is a vector of exogenous variables, including health components of human capital (alcoholism, mental health, physical health), non-health human capital measures (education, experience), and demographic variables. ε is a stochastic error term, assumed to have the property $E(\varepsilon|z)=0$.

Since individuals self-select into the labour market, the authors use a probit equation to estimate full-time labour force participation, l_t. The participation variable is generated by a linear latent variable model with a homoskedastic normal error term, that is, $l_t = 1(z_t\beta + \eta_t > 0)$, where 1(.) indicates labour market participation. Mullahy and Sindelar use Heckman's (1978) two-step procedure which utilizes the result

$$E(y_t \mid l_t = 1, z_t) = z_t\alpha + \gamma\lambda_t ,$$

where λ_t is the inverse Mill's ratio under the assumption of normality of the error term, and γ is an unknown scalar parameter that reflects $\text{cov}(\varepsilon, \eta)$. Self-selection into the labour market truncates the sample data, and the inverse Mill's ratio is used to normalize the data and correct for this truncation.

Mullahy and Sindelar note that alcoholism has both direct and indirect effects on earnings. It is important to realize that alcohol abuse can affect human capital characteristics, and can therefore indirectly affect earnings. They also note that alcoholism is not likely to be exogenous to the earnings model. That is, labour market outcomes and alcoholism could be simultaneously determined. Alcohol use may affect labour force participation and earnings, but earnings and participation may affect alcohol use. If alcohol is a normal good, its income effect will be positive. Thus, higher earnings will positively affect consumption of alcohol. There may also be a social aspect in labour market participation, causing the consumption of alcohol and working to be simultaneously determined. Although the authors mention the probability of endogeneity, and the possibility of biased estimates, they treat alcoholism as an exogenous characteristic of individuals.

Mullahy and Sindelar's age-earnings profiles of the two drinking cohorts suggest that alcoholics have flatter age-earnings profiles than non-alcoholics. This could be due to the fact that alcoholics may drop out of school earlier, and hence earn more initially than their non-alcoholic counterparts. Because of this supposed lack of education, alcoholics may pursue "dead-end" jobs with little opportunity to substantially increase earnings. The authors examine the effects of alcoholism on all workers aged 22-64, as well as on "prime-age" workers, age 30-59. Presumably, examining prime-age workers should control for the disparity between young alcoholics and non-alcoholics, due to their education decisions.

The results are that alcoholism has a statistically significant negative impact on wages for all workers, and on participation and earnings for prime-age workers. Mullahy and Sindelar find that the full effect of alcoholism on income is that alcoholics earn almost 37 percent less than non-alcoholics. When controlling for human capital characteristics, the authors find that earnings of alcoholics are 18 percent less than those of non-alcoholics. In other words, half of the effect of alcoholism on earnings is due to the effect on human capital characteristics.

Mullahy and Sindelar (1996) examine the effects of problem drinking on employment and unemployment. They define problem drinking as heavy drinking as well as the diagnosis of an alcohol-related disorder, alcohol abuse and/or dependence.

The authors state that physical and mental health problems associated with problem drinking could have a direct effect on labour market productivity and reliability. In addition, less labour market experience and education, as well as a greater probability of divorce, are possible indirect effects of problem drinking on participation in the labour market. The purpose of the paper is to estimate these effects. However, there is likely a causal relationship between participation in the labour market and problem drinking. Namely, the stresses of unemployment alone could increase alcohol consumption. Conversely, the lack of income caused by unemployment could lead to decreased alcohol consumption.

Decisions regarding both the labour market and the consumption of alcohol are driven by prices, wages, observable exogenous factors, and unobservable characteristics. It follows that

$$D = D(A, L, X, \theta),$$

where D indicates problem drinking, A and L reflect alcohol consumption and labour supply, respectively, X represents observed exogenous factors, and θ is a vector of unobservable characteristics. To account for simultaneity, participation in the labour market (employment) can be modeled as follows

$$L = L(D, X, \theta).$$

The above is the model that Mullahy and Sindelar estimate, using data for both males and females, aged 25-59. They use a generalized method of moments (GMM) model, developed by Hansen (1982), and extended by Heckman and MaCurdy (1985), known as the HM/GMM method. The HM/GMM estimator is found by formulating an equation describing the probability of each labour market outcome conditional on both observables (X) and unobservables (θ). This method is an instrumental variable estimation approach, and is used to correct for correlations between unobservable characteristics and problem drinking measures. The instruments used by Mullahy and Sindelar are all variables in the X vector, excluding the problem drinking measure, but including variables reflecting a history of living with alcoholic relatives in one's youth. As well, state taxes on beer and cigarettes and a measure of per capita state-level alcohol sales are also used as instruments.

Mullahy and Sindelar find that heavy drinking and alcohol abuse have negative effects on employment, and positive effects on unemployment. When

unobserved heterogeneity is controlled for, the magnitude of the estimates increases. However, the estimates are not generally statistically significant, and the standard errors are large, leaving room for uncertainty.

2.3 French and Zarkin (1995) and Zarkin, *et.al.* (1998)

To examine the effects of moderate alcohol use on wages and earnings, French and Zarkin (1995) collect data from a sample of randomly selected employees at four worksites. Two worksites were manufacturing firms, one was a financial firm, and the last a small municipality. For reasons of confidentiality, the names and locations of the worksites cannot be revealed. The empirical model follows that of Mullahy and Sindelar (1993), and the log of wages is specified to be the only endogenous variable, with alcohol use treated as exogenous to the model.

French and Zarkin look at the direct effect of alcohol use, as well as the full effect. The direct effect equation is specified to be

$$W = \beta_0 + \beta_1 D + \beta_2 H + \beta_3 S + \beta_4 A + \beta_5 A^2 + \beta_6 A^3 + \beta_7 FD + \beta_8 ND + v$$

and the full effect equation is

$$W = \gamma_0 + \gamma_1 D + \gamma_2 S + \gamma_3 A + \gamma_4 A^2 + \gamma_5 A^3 + \gamma_6 FD + \gamma_7 ND + e$$

where *W* is the log of wages, *D* is a vector of demographic variables, *H* is a vector of human capital variables, *S* is a vector of worksite-specific indicator variables, *A* is a variable for alcohol use measuring the total number of drinks the respondent consumed in the past year, *FD* is a an indicator for former drinkers (those who have drank alcohol in their lifetime, but not in the past year), *ND*

indicates individuals who have never drank alcohol in their lifetime, and *v* and *e* are random error terms. The direct effect equation controls for human capital variables. This shows only alcohol's effect on wages, but not on human capital characteristics. The full effect equation allows alcohol to affect education, job tenure, and health status, as well as other human capital variables.

The authors estimate the above equations using ordinary least squares (OLS), and find that there is a negative, non-linear relationship between wages and alcohol use. Expressing concern about the effect of outliers on the results, French and Zarkin also estimate the equations using bounded influence estimation. In doing so, significant anomalies in the data will not skew the results. The results from this estimation method are comparable to the ones found in the previous model.

Because of the non-linear relationship between wages and alcohol use, French and Zarkin examine the possibility of an optimal number of drinks. Using the bounded model, they find that wages peak for individuals consuming 617 drinks per year (averaging 1.69 per day) for the full effect, and 876 drinks per year (2.40 drinks per day) for the direct effect. These results are consistent with medical findings.

Zarkin, *et. al.* (1998) build on the previous work of French and Zarkin (1995), to examine the effects of alcohol use on wages for prime-age men and women. They measured alcohol use by multiplying the average number of drinks an individual consumes per sitting by the number of times that individual drank in the past 30 days. The authors then separated men and women into eight

drinking cohorts – one category for abstention, two for light drinkers, three for moderate drinkers, and two for heavy drinkers. The cut-off points for each cohort differed between sexes. The reason for this is that, as previously mentioned, alcohol has different physical effects on females than it does on males.

Zarkin, *et. al.*, estimated the following model:

$$W = \beta_0 + \beta_1 DEM + \beta_2 ALC + \varepsilon ,$$

where *w* is the log of hourly wages, *DEM* is a vector of demographic variables, and *ALC* is a vector of alcohol use variables.

The results from this model indicate that, for men, drinking between 1 and 5 drinks in 30 days increases wages by 6.8 percent. Consuming 6 to 16, and 17 to 31 drinks in 30 days will increase wages by 9.3 and 7.6 percent, respectively. For women, consumption of 3 to 8 drinks will increase wages by 8.6 percent. No other statistically significant results were found.

2.4 Hamilton and Hamilton (1997)

Hamilton and Hamilton (1997) examine the relationship between alcohol consumption and earnings for males, aged 25-59, from the General Social Survey. They divide the observations into three drinking cohorts: abstainers, moderate drinkers, and heavy drinkers. The hypothesis that they are testing is that moderate drinkers will earn more than abstainers, because of the medical benefits associated with it. The authors also expect a drop off in wages with heavy drinking. They use a polychotomous choice model, thus allowing alcohol use to affect the return to human capital characteristics. To control for

endogeneity, the authors use the price of alcohol, religious affiliation, and religious attendance as instruments (exogenous characteristics). Hamilton and Hamilton hypothesize that wages are a function of human capital variables and sociodemographic characteristics. Namely,

$$\ln W_{ij} = X_j \beta_j + u_{ij}$$

for i=1...N individuals, and j=1,2,3 drinking status. The error term is assumed to be normally distributed.

Because individuals choose their own drinking status, each wage equation contains non-random, truncated samples. Hamilton and Hamilton correct for this bias by using a variation of the standard Heckman selection correction technique developed by Lee (1983). By doing so, estimates from the model give information on an individual's expected wages as if he were randomly assigned to drinking status. That is, the estimated β's will be unbiased.

Hamilton and Hamilton use a Blinder-Oaxaca decomposition to analyze the mean wage differentials between individuals of drinking types j and k in the following way:

$$W_j - W_k = (X_j - X_k)(0.5\beta_j + 0.5\beta_k) + (\beta_j - \beta_k)(0.5X_j + 0.5X_k) + (u_j - u_k),$$

where $(X_j - X_k)(0.5\beta_j + 0.5\beta_k)$ reflects the part of the wage gap ascribed to differences in characteristics between abstainers, moderate drinkers, and heavy drinkers. That is, the fact that heavy drinkers tend to have less education and are younger on average than the other two categories is reflected in this term. The term $(\beta_j - \beta_k)(0.5X_j + 0.5 X_k)$ reflects a pure wage differential, measuring the difference between the productivity of drinking status k and that of status j, given

the same observed characteristics. The final term in the equation is simply the mean difference between residuals resultant from sample selection bias.

These decompositions indicate that abstainers earn 10 percent less than moderate drinkers. Heavy drinkers earn 5.6 percent less than those who drink moderately. For abstainers, the differential due to lower mean characteristics is –4.1 percent, and the pure wage differential is –2.6 percent. The authors state that the pure wage differential indicates that moderate drinking is responsible for increases in productivity and wages.

When examining the wage gap between heavy drinkers and moderate drinkers, it is interesting to note that the differential resultant from lower mean characteristics is –1.5 percent. The pure wage differential is –75.8 percent. However, this dramatic negative effect is negated by the mean difference in residuals attributable to sample selection (71.7 percent). In other words, Hamilton and Hamilton find that although heavy drinking has a substantial negative effect on productivity, it is concealed in the wage gap by the positive sample selection into heavy drinking.

2.5 Discussion

The seminal paper by Berger and Leigh (1988) is an important one that attempts to explain the relationship between alcohol use and wages. However, when interpreting the results found by Berger and Leigh, the implicit assumption made by the authors that the income elasticity of alcohol is zero must be kept in mind. That is, increases in income do not affect the consumption of alcohol. If

alcohol is a normal good, this assumption is probably not realistic. This is a limitation to the Berger and Leigh model, that is, estimation not accounting for a causal relationship between wages and alcohol will yield biased results.

The results found by French and Zarkin (1995) must be interpreted with several qualifications. Similar to Berger and Leigh (1988), alcohol is assumed to be exogenous to the model. As the authors note, the failure to account for possible endogeneity leads to biased results. Second, and more importantly, the data for this study is not random. Only those who are employed are examined. Thus, as French and Zarkin observe, the positive relationship between moderate alcohol use and wages is conditional on working. The selection bias rising from this could distort the results.

Another possible problem lies in French and Zarkin's definition of alcohol use. The authors measure use by the number of alcoholic drinks consumed in one year. However, this number does not reflect binge drinking, which indicates serious drinking problems. An individual consuming 365 drinks in a year may be drinking one drink a day, or may be drinking fourteen drinks in one sitting every two weeks. By concluding that the optimal number of drinks is between 617 and 876 drinks per year, French and Zarkin do not accurately reflect the importance of moderate, as opposed to binge, drinking.

Similar specification issues arise in their later work. The sample used in Zarkin, et. al., (1998) consists only of those individuals who were currently employed, and no correction for this truncation was made. Failure to correct for this implies that the sample was non-random, and hence estimates will be biased

and inconsistent. As well, the authors note that they used two-stage least squares (2SLS) to account for possible endogeneity, but did not report these results because of implausibly large wage differentials. That is, Zarkin, et. al., did not account for a causal relationship between wages and alcohol use because of strange results. Instead of examining the possibility of errors in estimation or misspecification, the authors simply used OLS and admitted biased estimates.

Even with possible econometric problems, the results from French and Zarkin (1995) and Zarkin, et. al. (1998), are consistent with those found by Hamilton and Hamilton (1997). That is, moderate alcohol use has a positive effect on earnings. In fact, Hamilton and Hamilton find that moderate alcohol users earn more than both heavy users and abstainers.

Mullahy and Sindelar (1991 and 1993) also find that alcoholics earn less than non-alcoholics. They also find that problem drinkers are less likely to be employed, and more likely to be unemployed, taking into account the causal relationship between participation in the labour market and alcohol abuse.

This thesis will attempt to add to the literature by estimating the sex differences in alcohol's effects on the labour market, using econometric methods which will estimate the relationships between alcohol use, labour market participation, and earnings.

CHAPTER THREE: Data and Descriptive Statistics

3. Introduction

The data used in this study was compiled from the 1985 General Social Survey (GSS). Statistics Canada contacted and surveyed a random sample of Canadians by telephone during the period September 25 to October 18, 1985. Both males and females aged 25-59 are used in this study to examine the sex differences of alcohol on labour market indicators. The majority of individuals have completed their schooling by age 25, and have retired by age 60. Therefore, this age cohort is the appropriate one to use when examining labour market indicators. Including students and retirees in the sample will distort the results, as these individuals tend to choose not to be employed regardless of drinking habits and human capital characteristics.

The sample included 2040 prime age males and 2647 prime age females. A complete listing of the variables and summary statistics can be found in Tables 3.1 and 3.2. There are significant sex differences in employment, earnings, and drinking habits, as well as in occupation. This chapter will examine these differences in detail.

3.1 Sex Differences in the Data

Prime age males are employed full-time more than females. Eighty-three percent of men sampled aged 25-59 are employed full-time, compared with forty-six percent of prime-aged women. Of those employed, there are significant sex differences in incomes and occupations. The mean income from full-time

employment for males is $24,704.05, whereas the average female earns $10,397.87 (1985 dollars). The median income from employment for males is $27,000, and the median income for females is $18,000 (unreported).

Managerial positions and the production sector tend to be male-dominated, while females are employed in greater numbers in the administrative sector. Fifteen percent of males in the sample are in management positions, compared with seven percent of females. The production sector employs 42 percent of the males in the sample, and 33 percent of the women. Females are represented almost four times as much as males in administrative positions – 22 percent compared with six percent. There are no such differences in the professional and service sectors. Sixteen percent of both men and women in the sample are classified as professionals – individuals in the sciences, medicine, nursing, academia, architecture, engineering, education, and religion. The service and sales industry employs fifteen percent of males and females. The remainder of individuals in the sample have employment in agriculture, forestry, and/or fishing.

Tables 3.3 and 3.4 list earnings broken down by occupation and sex for individuals who were employed full-time in 1985. Females in the sample consistently earn less than males, regardless of occupation. Women in management and professional positions earn just over $22,000 and $23,000 on average, respectively, whereas the mean income of their male counterparts is around $33,000. On average, males in the sample earn over $23,000 in service and $25,000 in agriculture. Females in service and agriculture earn $12,269.73

and $7884.21, respectively. In the female dominated administrative sector, women earn less than two thirds of what males earn - $16,000 compared with over $25,000. These numbers are similar to the earnings in the production sector.

Educational attainments are similar between the sexes. Eight percent of males and seven percent females in the sample did not graduate from high school. A high school diploma was the highest level of academic achievement for 51 percent of males and 54 percent of females. Approximately 23 percent of males and 22 percent of females had either a diploma from a community college or technical institution, or some college education. More males than females in the sample had a degree from a recognized college – 11 percent of females compared with almost 18 percent of males had earned at least a bachelor's degree.

More males than females in the sample are classified as heavy drinkers, even when accounting for the difference in the definition between the sexes. Almost 10 percent of males in the sample consumed alcohol at least once a week for the past twelve months, and had at least eight drinks at one sitting in the past week. The definition of a female heavy drinker is the same as the male's in terms of frequency, but differs with respect to intensity – at least four drinks in one sitting in the past week, rather than eight. Six percent of females in the sample fit this definition.

Past consumption of alcohol is thought to impact present consumption, implying that the length of time that an individual has been a drinker should affect

current drinking habits. Almost 38 percent of prime age males began drinking prior to age 18, compared with 19 percent of females, which may partially explain the difference in the amount of heavy drinkers between the sexes.

The percentage of males with high blood pressure, heart disease, respiratory illness, and/or diabetes is similar to that of females. However, more females in the sample suffer from arthritis than do males. Almost 20 percent of females are diagnosed with arthritis, compared with 15 percent of males. These health indicators are thought to affect earnings and labour market participation, especially if these illnesses are particularly debilitating.

Tables 3.5 to 3.12 look at the income and educational differences between heavy drinkers and others. Those females classified as heavy drinkers are more likely to be employed, and earn more than those who are not. Women who drink heavily earn just over $15,000 on average, while the mean income of those who do not is $10,000. The full-time employment rate for heavy drinking males is higher than that of men who do not drink heavily. However, the income differential between these groups is negligible.

A greater number of heavy drinkers (both male and female) are high school dropouts. Thirteen percent of males and ten percent of females are both heavy drinkers and high school dropouts. Of those individuals in the sample who do not drink heavily, seven percent of both males and females did not complete high school. A high school diploma is the maximum educational achievement by 50 percent of males and 55 percent of females who are not heavy drinkers. Of

those who are classified as heavy drinkers, 56 percent of males and 52 percent of females have high school diplomas.

Approximately 23 percent of males have a diploma from a technical/ community college or some college education, regardless of drinking habits. Of female heavy drinkers, 27 percent have achieved this educational level, compared with 21 percent of non-heavy drinkers. Eleven percent of females, both heavy drinkers and not, have a college degree. The difference between male drinking cohorts for this educational cohort is substantial. Less than half as many heavy drinkers than not had earned at least a bachelor's degree – 8 percent compared with 19 percent.

There are some important demographic differences between drinking groups. For both sexes, a greater number of individuals who are not heavy drinkers are married than those who do drink heavily. Almost 56 percent and 55 percent of male and female heavy drinkers are married, respectively. This is compared with 74 percent of males and 69 percent of females who do not drink heavily. In addition to this, heavy drinkers tend to be younger, and are inclined to smoke more than the other group. Individuals who do not drink heavily tend to be classified as being religious more than heavy drinkers.

This chapter has discussed the data and descriptive statistics used in this thesis. It has compared the educational achievements, earnings, and drinking habits between men and women. It has also examined mean differences in schooling and income between drinking cohorts. The following chapter will outline the econometric model and methodology employed to examine the

relationships between labour force participation, earnings, and heavy alcohol use. It will also give insight as to the reasoning behind the particular model used.

Table 3.1: Summary statistics, prime age males
2040 Observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.832	0.373	0	1
perinc	24704.05	13922.38	0	50000
drink	0.099	0.298	0	1
age25-29	0.237	0.426	0	1
age30-34	0.216	0.411	0	1
age35-39	0.180	0.384	0	1
age40-44	0.116	0.320	0	1
age45-49	0.090	0.286	0	1
age50-54	0.086	0.281	0	1
age55-59	0.075	0.264	0	1
hpress	0.141	0.348	0	1
heart	0.041	0.199	0	1
diab	0.016	0.124	0	1
resp	0.086	0.281	0	1
arth	0.153	0.360	0	1
hsdrop	0.076	0.266	0	1
hsgrad	0.510	0.500	0	1
collinc	0.234	0.424	0	1
cgrad	0.179	0.384	0	1
nofaith	0.147	0.354	0	1
religus	0.344	0.475	0	1
relcath	0.195	0.396	0	1
married	0.719	0.450	0	1
numkids	1.567	1.539	0	1
forborn	0.153	0.360	0	1
yngdrnk	0.379	0.485	0	1
smoker	0.367	0.482	0	1
Nfld.	0.060	0.237	0	1
PEI	0.009	0.094	0	1
NS	0.071	0.256	0	1
NB	0.053	0.225	0	1
Que.	0.176	0.381	0	1
Ont.	0.259	0.438	0	1
Man.	0.074	0.261	0	1
Sask.	0.057	0.232	0	1
AB	0.134	0.341	0	1
BC	0.107	0.310	0	1
govt	758.96	1796.30	0	10000
interest	436.89	1543.49	0	10000
manager	0.146	0.354	0	1
prof	0.160	0.367	0	1
admin	0.060	0.237	0	1
service	0.146	0.353	0	1
aggie	0.071	0.255	0	1
product	0.417	0.493	0	1

Table 3.2: Summary statistics, prime age females
2647 observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.456	0.498	0	1
perinc	10397.87	11575.19	0	50000
drink	0.061	0.240	0	1
age25-29	0.214	0.410	0	1
age30-34	0.203	0.402	0	1
age35-39	0.161	0.368	0	1
age40-44	0.102	0.303	0	1
age45-49	0.077	0.267	0	1
age50-54	0.091	0.287	0	1
age55-59	0.092	0.289	0	1
hpress	0.138	0.345	0	1
heart	0.043	0.203	0	1
diab	0.159	0.125	0	1
resp	0.092	0.288	0	1
arth	0.200	0.400	0	1
hsdrop	0.073	0.261	0	1
hsgrad	0.544	0.498	0	1
collinc	0.215	0.411	0	1
cgrad	0.107	0.310	0	1
nofaith	0.085	0.279	0	1
religus	0.437	0.496	0	1
relcath	0.238	0.426	0	1
married	0.684	0.465	0	1
numkids	1.851	1.684	0	1
forborn	0.131	0.338	0	1
yngdrnk	0.191	0.393	0	1
smoker	0.301	0.459	0	1
Nfld.	0.060	0.238	0	1
PEI	0.008	0.087	0	1
NS	0.068	0.252	0	1
NB	0.056	0.229	0	1
Que.	0.184	0.387	0	1
Ont.	0.233	0.423	0	1
Man.	0.062	0.241	0	1
Sask.	0.056	0.230	0	1
AB	0.116	0.321	0	1
BC	0.097	0.297	0	1
govt	866.53	1815.36	0	10000
interest	229.10	1130.11	0	10000
manager	0.075	0.263	0	1
prof	0.162	0.369	0	1
admin	0.219	0.413	0	1
service	0.146	0.353	0	1
aggie	0.007	0.084	0	1
product	0.331	0.471	0	1

Table 3.3: Male income by occupation

OCCUPATION	# OBS	MEAN	STD. DEV.	MIN.	MAX.
employed	1699	27461.9	12239.56	300	50000
manager	276	33441.8	11933.72	1000	50000
professional	295	32286.78	11932.18	300	50000
admin	102	25147.16	8564.92	1330	50000
service	264	23529	12019.24	1800	50000
agriculture	132	25781.06	15840.87	1400	50000
production	630	24957.88	10502.82	2000	50000

Table 3.4: Female income by occupation

OCCUPATION	# OBS	MEAN	STD. DEV.	MIN.	MAX.
employed	1209	18820.21	10040.01	200	50000
manager	151	22484.95	9637.84	1200	50000
professional	285	23592.59	9763.60	450	50000
admin	375	15979.89	6310.70	1300	35000
service	194	12269.73	9285.60	200	50000
agriculture	81	9300.00	9794.56	300	28000
production	96	16351.27	8973.09	1500	50000

Table 3.5: Summary statistics, prime age males, non-heavy drinkers 1839 observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.830	0.375	0	1
perinc	24704.22	14057.43	0	50000
age25-29	0.218	0.413	0	1
age30-34	0.213	0.409	0	1
age35-39	0.184	0.387	0	1
age40-44	0.120	0.325	0	1
age45-49	0.092	0.290	0	1
age50-54	0.094	0.292	0	1
age55-59	0.080	0.271	0	1
hpress	0.1403	0.347	0	1
heart	0.430	0.203	0	1
diab	0.017	0.129	0	1
resp	0.088	0.284	0	1
arth	0.157	0.364	0	1
hsdrop	0.071	0.256	0	1
hsgrad	0.505	0.500	0	1
collinc	0.235	0.424	0	1
cgrad	0.190	0.392	0	1
nofaith	0.137	0.344	0	1
religus	0.366	0.482	0	1
relcath	0.204	0.403	0	1
married	0.737	0.440	0	1
numkids	1.624	1.541	0	1
forborn	0.162	0.368	0	1
yngdrnk	0.352	0.478	0	1
smoker	0.349	0.477	0	1
Nfld.	0.063	0.242	0	1
PEI	0.009	0.093	0	1
NS	0.068	0.252	0	1
NB	0.053	0.224	0	1
Que.	0.179	0.383	0	1
Ont.	0.252	0.434	0	1
Man.	0.073	0.261	0	1
Sask.	0.058	0.234	0	1
AB	0.135	0.342	0	1
BC	0.110	0.313	0	1
govt	764.95	1822.24	0	10000
interest	461.71	1596.53	0	10000
manager	0.152	0.359	0	1
prof	0.165	0.372	0	1
admin	0.059	0.235	0	1
service	0.147	0.354	0	1
aggie	0.071	0.257	0	1
product	0.406	0.491	0	1

Table 3.6: Summary statistics, prime age males, heavy drinkers
201 observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.856	0.352	0	1
perinc	24702.50	12652.08	0	50000
age25-29	0.418	0.494	0	1
age30-34	0.244	0.430	0	1
age35-39	0.149	0.357	0	1
age40-44	0.075	0.263	0	1
age45-49	0.065	0.247	0	1
age50-54	0.015	0.122	0	1
age55-59	0.035	0.184	0	1
hpress	0.149	0.357	0	1
heart	0.025	0.156	0	1
diab	0.005	0.071	0	1
resp	0.070	0.255	0	1
arth	0.124	0.331	0	1
hsdrop	0.129	0.336	0	1
hsgrad	0.557	0.498	0	1
collinc	0.229	0.421	0	1
cgrad	0.085	0.279	0	1
nofaith	0.234	0.424	0	1
religus	0.144	0.352	0	1
relcath	0.109	0.313	0	1
married	0.557	0.498	0	1
numkids	1.045	1.419	0	1
forborn	0.075	0.263	0	1
yngdrnk	0.632	0.484	0	1
smoker	0.537	0.500	0	1
Nfld.	0.035	0.184	0	1
PEI	0.010	0.100	0	1
NS	0.095	0.293	0	1
NB	0.060	0.238	0	1
Que.	0.154	0.362	0	1
Ont.	0.322	0.469	0	1
Man.	0.075	0.263	0	1
Sask.	0.045	0.207	0	1
AB	0.124	0.331	0	1
BC	0.080	0.271	0	1
govt	704.21	1541.73	0	10000
interest	209.82	897.95	0	10000
manager	0.100	0.300	0	1
prof	0.114	0.319	0	1
admin	0.070	0.255	0	1
service	0.139	0.347	0	1
aggie	0.060	0.238	0	1
product	0.517	0.501	0	1

Table 3.7: Summary statistics, prime age females, non-heavy drinkers 2485 observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.444	0.498	0	1
perinc	10092.82	4085.30	0	50000
age25-29	0.208	0.406	0	1
age30-34	0.201	0.401	0	1
age35-39	0.161	0.368	0	1
age40-44	0.100	0.300	0	1
age45-49	0.078	0.268	0	1
age50-54	0.092	0.289	0	1
age55-59	0.096	0.294	0	1
hpress	0.139	0.346	0	1
heart	0.044	0.205	0	1
diab	0.017	0.129	0	1
resp	0.089	0.285	0	1
arth	0.200	0.400	0	1
hsdrop	0.072	0.258	0	1
hsgrad	0.546	0.498	0	1
collinc	0.212	0.409	0	1
cgrad	0.107	0.309	0	1
nofaith	0.082	0.275	0	1
religus	0.446	0.497	0	1
relcath	0.240	0.427	0	1
married	0.693	0.462	0	1
numkids	1.881	1.689	0	1
forborn	0.134	0.341	0	1
yngdrnk	0.183	0.386	0	1
smoker	0.289	0.453	0	1
Nfld.	0.063	0.243	0	1
PEI	0.007	0.082	0	1
NS	0.068	0.252	0	1
NB	0.056	0.230	0	1
Que.	0.185	0.388	0	1
Ont.	0.227	0.429	0	1
Man.	0.061	0.239	0	1
Sask.	0.056	0.231	0	1
AB	0.116	0.321	0	1
BC	0.097	0.295	0	1
govt	865.02	1789.48	0	10000
interest	225.32	1117.50	0	10000
manager	0.073	0.260	0	1
prof	0.164	0.371	0	1
admin	0.212	0.409	0	1
service	0.145	0.352	0	1
aggie	0.007	0.085	0	1
product	0.335	0.492	0	1

Table 3.8: Summary statistics, prime age females, heavy drinkers
162 observations

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
employed	0.648	0.479	0	1
perinc	15077.04	11049.83	0	50000
age25-29	0.302	0.461	0	1
age30-34	0.228	0.421	0	1
age35-39	0.160	0.368	0	1
age40-44	0.130	0.337	0	1
age45-49	0.068	0.252	0	1
age50-54	0.074	0.263	0	1
age55-59	0.037	0.189	0	1
hpress	0.117	0.323	0	1
heart	0.031	0.173	0	1
diab	0	0	0	0
resp	0.136	0.344	0	1
arth	0.198	0.399	0	1
hsdrop	0.099	0.299	0	1
hsgrad	0.519	0.501	0	1
collinc	0.272	0.446	0	1
cgrad	0.111	0.315	0	1
nofaith	0.130	0.337	0	1
religus	0.290	0.455	0	1
relcath	0.210	0.408	0	1
married	0.539	0.499	0	1
numkids	1.395	1.530	0	1
forborn	0.086	0.282	0	1
yngdrnk	0.315	0.466	0	1
smoker	0.488	0.501	0	1
Nfld.	0.019	0.135	0	1
PEI	0.019	0.135	0	1
NS	0.068	0.252	0	1
NB	0.049	0.217	0	1
Que.	0.160	0.368	0	1
Ont.	0.327	0.471	0	1
Man.	0.080	0.273	0	1
Sask.	0.049	0.217	0	1
AB	0.117	0.323	0	1
BC	0.111	0.315	0	1
govt	889.69	2180.56	0	10000
interest	287.11	1311.10	0	10000
manager	0.105	0.307	0	1
prof	0.136	0.345	0	1
admin	0.315	0.466	0	1
service	0.173	0.379	0	1
aggie	0.006	0.079	0	1
product	0.265	0.443	0	1

Table 3.9: Income and education, males, non-heavy drinkers

VARIABLE	# OBS	MEAN	STD. DEV.	MIN.	MAX.
income	1839	24704.22	14057.43	0	50000
hsdrop	1839	0.071	0.256	0	1
hsgrad	1839	0.505	0.500	0	1
collinc	1839	0.235	0.424	0	1
cgrad	1839	0.190	0.392	0	1

Table 3.10: Income and education, males, heavy drinkers

VARIABLE	# OBS	MEAN	STD. DEV.	MIN.	MAX.
income	201	24702.50	12652.08	0	50000
hsdrop	201	0.129	0.336	0	1
hsgrad	201	0.557	0.498	0	1
collinc	201	0.229	0.421	0	1
cgrad	201	0.085	0.279	0	1

Table 3.11: Income and education, females, non-heavy drinkers

VARIABLE	# OBS	MEAN	STD. DEV.	MIN.	MAX.
income	2485	10092.82	11545.06	0	50000
hsdrop	2485	0.072	0.258	0	1
hsgrad	2485	0.546	0.498	0	1
collinc	2485	0.212	0.409	0	1
cgrad	2485	0.107	0.309	0	1

Table 3.12: Income and education, females, heavy drinkers

VARIABLE	# OBS	MEAN	STD. DEV.	MIN.	MAX.
income	162	15077.04	11049.83	0	50000
hsdrop	162	0.099	0.299	0	1
hsgrad	162	0.519	0.501	0	1
collinc	162	0.272	0.446	0	1
cgrad	162	0.111	0.315	0	1

CHAPTER FOUR: Econometric Methodology

4. Introduction

The methodology employed in this thesis accounts for simultaneous relationships between ful-time labour market participation, earnings and heavy alcohol use. The estimated coefficients from this methodology are consistent, although their standard errors are incorrect.

Section 1 of this chapter will outline the econometric model used to estimate the relationships between heavy alcohol use and the labour market. The second section will discuss the exact estimation methods used, and will give a brief digression on the shortcomings of standard econometric techniques for this particular issue. Specification tests for the appropriateness of the assumption of simultaneity are the focus of the third section. The fourth section concludes with a discussion of the limitations of this model.

4.1 The Econometric Model

Full-time participation in the labour market is observed, but the propensity to be employed is not. Following Maddala (1983), the propensity to be employed is modeled as a continuous variable, generated by a number of observable factors including alcohol use. Individuals who drink heavily may have difficulties maintaining employment or becoming employed due to their condition. However, there may be some unobservable characteristics that cause individuals who drink heavily to also be employed. Therefore, there is no clear expectation as to the sign of ζ. The model is

$$(1) P_i^* = W_i\alpha + \varsigma A_i^* + v_i$$

$$(2) P_i = 1 \quad if \quad P_i^* > 0$$
$$P_i = 0 \quad otherwise,$$

where P_i^* is a latent participation index, P_i is the observed discrete indicator for labour market participation, W_i is a vector of human capital and socioeconomic characteristics thought to affect participation, A^*_i is a latent index for heavy drinking, and v_i is a stochastic error term. If the propensity to participate is sufficiently high, that is, greater than zero, individual *i* will be employed full-time. The binary indicator for participation equals one if the individual is engaged in full-time employment, zero otherwise. Included in the vector of human capital and socioeconomic characteristics are variables indicating age, health problems, education, marital status, country of birth, smoking habits, interest income, government transfers, and the number of children the individual has.

This study examines males and females aged 25-59. Individuals are grouped into seven age cohorts. An indicator variable is assigned to each group. Age affects the employment decision differently for females than it does for males. Participation is steady for males, but females tend to exit the labour market for childbearing and child rearing activities.

The health problems in the participation equation include high blood pressure, heart disease, respiratory illness, diabetes, and arthritis. These are binary variables which are set equal to one if the individual suffers from these problems, zero otherwise. Also included is a dummy variable indicating whether the individual is a smoker.

There are three education indicators in the participation equation: high school graduate, some college or a community/technical college diploma, and college graduate, with a minimum of a Bachelor's degree. The excluded category is high school dropout, meaning that the other indicator variables are interpreted relative to this group. Failure to eliminate one of these indicators leads to perfect collinearity, as the indicator variables will be linear combinations of one another.

Non-labour income is defined as investment income and government transfers. These variables are added into the participation equation, and are expected to have a negative impact on employment. They indicate, respectively, the dollar amount the individual received in interest and dividend payment and from government funds in 1984.

The indicator variable for heavy drinking, A_i, is also generated by a latent process. Drinking decisions are motivated by a vector of exogenous variables, denoted Z_i. In addition, alcohol use may be affected by employment status. The stress of being unemployed may cause an individual to drink more. On the other hand, unemployment may hinder the ability to drink because of a lack of income. That is, the sign of ω could be either positive or negative. Symbolically,

$$(3) A_i^* = Z_i\gamma + \varpi P_i^* + \upsilon_i$$

$$(4) A_i = 1 \quad if \quad A_i^* > 0$$
$$A_i = 0 \quad otherwise,$$

where υ_i is a stochastic error term.

The drinking equation (3) includes all exogenous variables in the participation equation except non-labour income and the number of children, as they are assumed to not affect the drinking decision. Also included in the exogenous vector are religious status, age of first drink, and regional variables which proxy price, as well as reflect other regional variation.

The binary indicator for the dependent variable is set equal to one if the individual is defined to be a heavy drinker, zero otherwise. This definition is different between sexes, as mentioned previously. The decision to use a minimum of eight drinks a day at least once a week for males as indicative of heavy drinking follows Knupfer (1984), who finds that such individuals have the highest risk of social disapproval or personal concern over their drinking habits (Hamilton and Hamilton, 1997). The lower amount of drinks for females reflects alcohol's different effects on women – namely, women are unable to metabolize alcohol at the same rate as men, and suffer from greater health problems from consumption of the same amount (Mullahy and Sindelar, 1996).

Following Hamilton and Hamilton (1997), religious status is used to explain drinking decisions. Dummy variables are used to indicate no religion as well as regular attendance of religious services. Involvement in the Catholic faith is also added in the regression equation. A number of religions (i.e., Protestant, Islamic) frown upon the use and excessive use of alcohol, and hence, regular attendance at services and strong religious beliefs can affect drinking status. It is thought that Catholicism would affect the drinking decision differently. The Catholic religion does not have strict views on alcohol use.

The age at which an individual begins drinking presumably affects alcohol decisions. Alcohol is considered to be an addictive substance, meaning that past consumption affects current consumption. The longer an individual has been drinking, the more tolerant the body is to the effects of alcohol. Therefore, it is important to examine the effects of the age at which one began drinking on current alcohol consumption. A variable indicating whether the individual began drinking prior to age 18 is added to the vector of exogenous variables. This is used to capture the effects of drinking history (Hamilton and Hamilton, 1997).

Earnings are modeled as a function of exogenous human capital and socioeconomic characteristics, denoted X_i, and alcohol use. Heavy drinking is thought to affect productivity, and therefore earnings. Since earnings are only observed if individual *i* participates in the labour market, they are thought to be determined by the following latent process

$$(4) E_i^* = X_i\beta + \delta A_i^* + \varepsilon_i$$

$$(5) E_i = E_i^* \quad if \quad P_i = 1$$
$$E_i = 0 \quad otherwise,$$

where E_i^* are latent earnings, and ε_i is a stochastic error term.

The vector of exogenous variables in the earnings equation includes the same indicators for age, marital status, health problems, smoking habits, country of birth, and education that are in the drinking and participation equations. Age is a proxy for experience, and should affect earnings as such. Married individuals are expected to have different earnings from those who are unmarried. Married men are assumed to be responsible for the financial provision for the family, and

so are expected to earn more than unmarried men. As well, married women have a higher reservation wage than unmarried women because they have the option of being provided for. This should be reflected in the earnings equation. Education is expected to have positive impacts on earnings, as outlined in standard labour market literature (Becker, 1960).

Excluded from the earnings equation are the number of children, age of first drink, non-labour income, religious status, and the price of alcohol. These variables are assumed to not affect earnings.

Also included in the earnings equation are indicator variables for five occupational cohorts. Managers are defined to be government officials and individuals in management and government administrative positions. Individuals in sciences, academia, architecture, engineering, medicine (including nursing), and religious and teaching positions are included in the professional, paraprofessional, and technical cohort. A dummy variable is included to indicate those in clerical and administrative support occupations. Individuals in sales and in the service industry make up another group. A fourth group is comprised of those in agriculture, forestry, fishing, and related occupations. The final group is made up of individuals in production, construction, operating, maintenance, and material handling occupations.

4.2 Estimation Methods

The drinking and participation equations are characterized by qualitative, dichotomous dependent variables. That is, individual *i* is either a heavy drinker

or not, and is either employed or not. This lack of continuity means that ordinary least squares (OLS) estimation is inappropriate. Parameter estimates rising from the linear regression model will be biased and inconsistent (Pindyck and Rubinfeld, 1991).

When a dependent variable is dichotomous, its expected value can be interpreted as the probability of the event occurring (i.e., the probability that the dependent variable will equal 1). If the linear regression model is used to estimate equations with dichotomous dependent variables, then the probability of the event occurring can be outside the [0,1] interval. This is due to the nature of the linear model. The probability can be restricted to be in the [0, 1] interval, but doing so will yield biased estimates.

An appropriate alternative to OLS estimation is maximum likelihood probit. The probit model utilizes the standard normal cumulative probability density function, which transforms the linear model so that the conditional probabilities lie in the [0,1] interval. The drinking equation in another form is

$$(6) A_i^* = Z_i\gamma + \upsilon_i,$$

where labour market participation is included in the Z_i vector. The probit model utilizes the following to examine the probability that an individual will be a heavy drinker

$$(7) Pr(A_i^* > 0) = Pr(\upsilon_i < Z_i\gamma) = \Phi(Z_i\gamma),$$

where $\Phi(.)$ is the standard normal cumulative density function. That is, the probability that an individual's propensity to drink will be greater than zero, and therefore that individual will be a heavy drinker, depends upon his/her human

capital and sociodemographic characteristics, Z_i, as well as on the unknown parameters, γ. The likelihood that individual *i* will be a heavy drinker is given by $\Phi(Zi\gamma)$. The likelihood function for the entire sample is calculated by multiplying together the likelihoods of all individuals in the sample. This function can be maximized to yield consistent parameter estimates.

If there is simultaneity between heavy alcohol use, labour market participation, and earnings, it must be taken into account. For example, estimating equations (1) and (3) without accounting for a possible endogenous relationship between heavy alcohol use and labour market participation will yield inconsistent results. Simultaneity implies that the error terms in the equations are correlated. When the random error term v_i changes, P_i^* also changes. When this occurs, A_i^* is affected, therefore, A_i^* is correlated with v_i. Similarly, P_i^* is correlated with υ_i. This correlation implies that estimates will be inconsistent unless the simultaneity is accounted for. This simultaneous system, as well as that determining the relationship between earnings and heavy alcohol use, can be estimated by the two-stage method for binary dependent variables, as illustrated by Maddala (1983, pp. 246-47).

To estimate this simultaneous system, an instrumental variable approach is used. An appropriate instrument is one that is highly correlated with the variable in question, but not with the error term.

All variables in W_i and Z_i are used as instruments for P_i^* and A_i^*. This vector of variables is denoted Y_i. It is thought that the socioeconomic and human capital elements in Y_i are highly correlated with both participation and alcohol

use, but not with the error terms. The first step in estimating this system is to estimate

$$(8) P_i^* = \Pi_1 Y_i + \eta_1$$
$$(9) A_i^* = \Pi_2 Y_i + \eta_2,$$

The above must be solved using the probit maximum likelihood method, as both dependent variables are dichotomous. The parameter estimates rising from (8) and (9) give the following predicted values

$$(10) \hat{P}_i^* = \hat{\Pi}_1 Y_i$$
$$(11) \hat{A}_i^* = \hat{\Pi}_2 Y_i,$$

The second step in this procedure is to substitute the predicted values into the original system,

$$(12) P_i^* = W_i \alpha + \zeta \hat{A}_i^* + v_i$$
$$(13) A_i^* = Z_i \gamma + \omega \hat{P}_i^* + \upsilon_i,$$

That is, the propensity to become employed and the propensity to drink are estimated using sociodemographic and human capital characteristics as instruments. The reason for this estimation is that the propensity to become employed and the propensity to drink are not observed, as noted before. These estimated values are then substituted into equations (12) and (13).

Equations (12) and (13) are then estimated by maximum likelihood probit, which will give rise to consistent and unbiased estimates of α, ζ, γ, and ω. Because the estimated values of the propensities to drink and to be employed are used, rather than the true values, the standard errors of the parameter estimates will be incorrect (Maddala, 1983). There is no formal proof in the literature, but it is thought that the extra variation included in the equation due to

the addition of these generated regressors implies that the standard errors may be biased downward. If this is the case, null hypotheses will tend to be rejected when they actually should not be rejected.

When examining the earnings equation, it is important to note that earnings are only observed if the individual is employed. This implies that the sample taken for the earnings equation is truncated and therefore non-random, as it only includes employed individuals. This type of truncation is known as incidental truncation (Greene, 1993). That is, a sample of employed individuals is not a random sample.

To correct for this, the inverse Mill's ratio can be calculated using the predicted probabilities from equation (12). The inverse Mill's ratio, denoted λ, is defined as

$$(14)\ \lambda(W_i\alpha) = \phi(W_i\alpha)/(1 - \Phi(W_i\alpha)),$$

where $\phi(W_i\alpha)$ is the standard normal probability density function, and $\Phi(W_i\alpha)$ is the standard normal cumulative density function calculated using the predicted values from equation (12). The inverse Mill's ratio depends on the propensity to be employed - that is, if earnings are observed, then it must be inferred that the propensity to be employed is greater than zero. The inverse Mill's ratio is added as a regressor in the earnings equation. This inclusion will correct the selection bias arising from the elimination of unemployed individuals from the sample (Heckman, 1978).

The equation to be estimated is now

$$(15) E_i^* = X_i\beta b + \delta\hat{A}_i^* + \theta\lambda(\alpha) + \varepsilon_i,$$

where the predicted value for the drinking index is substituted for A_i^*. This equation can be estimated by OLS, and the coefficients will be unbiased and consistent (Maddala, 1983). Note that excluding the inverse Mill's ratio from the regression results in the specification error of an omitted variable (Greene, 1993). Omitting a relevant variable (i.e., the inverse Mill's ratio) will yield biased and inconsistent estimates of all parameters.

4.3 Specification Tests

It is important to determine whether endogenous relationships exist between heavy alcohol use and earnings, and heavy alcohol use and participation. A Hausman Test is used for this purpose. The idea behind the Hausman Test is that the ordinary least squares (or probit) estimator will be biased if there is simultaneity. If not, it will be unbiased and consistent. Using an instrumental variable approach in estimation will account for endogeneity. That is, the instrumental variables (IV) estimator will be consistent in the presence of simultaneity between two variables. The Hausman Test examines whether there is a significant difference between the OLS and the IV estimator. If there is no statistically significant difference, then the null hypothesis of no simultaneity cannot be rejected. To determine whether simultaneity exists, the artificial regression approach is used, as outlined by Davidson and MacKinnon (1993).

The first step in the Hausman Test is to regress the indicator for heavy alcohol use, A_i, on Y_i, using maximum likelihood probit, as the dependent variable is dichotomous. Symbolically,

$$(16) A_i = 1(\varphi Y_i + \kappa_i > 0),$$

where κ_i is a random error term. This will yield an estimated value for A_i

The second step in the Hausman Test is to regress earnings on the appropriate vector of exogenous variables, the indicator for heavy drinking, and the estimated value for heavy drinking. That is,

$$(17) \quad E_i = X_i\beta + \rho A_i + \chi\hat{A}_i + \eta$$

Under the null hypothesis of exogeneity, χ will not be significantly different from zero. The second step is repeated using participation in the labour market as the dependent variable, and the appropriate exogenous vector in lieu of X_i on the right hand side.

The results from the Hausman test are listed in Table 4.1. The Hausman test rejected the null hypothesis of no simultaneity between alcohol use and earnings for both males and females. It also rejected the null hypothesis of exogeneity between alcohol use and labour market participation for females and for males at the ten percent level.

4.4 Discussion

The methodology used in this thesis accounts for endogenous relationships between heavy alcohol use, earnings, and labour market participation. The estimation methods used follow those outlined by Maddala (1983, pp. 246-47), which yields consistent estimates.

The next section will discuss the results from estimation. It will look at the effects of heavy alcohol use on earnings and labour market participation, as well as the effects of employment on drinking. This section will also look at alcohol's impact on human capital characteristics.

Table 4.1: Results from Hausman test

estimated values of χ

REGRESSION	COEFFICIENT	STD. ERROR	T / Z	P >|T| / |Z|
male participation	0.1677302	0.0930259	1.803	0.071
female participation	0.5096152	0.099717	5.111	0.000
male earnings	0.0706795	0.0344774	2.050	0.041
female earnings	0.2869044	0.0691077	4.152	0.000

CHAPTER FIVE: Results

5. Introduction

The econometric results are listed in Tables 5.1-5.16. This chapter will discuss and interpret these results. The first section will look at the employment decision, focusing on sex differences. The decision to be a heavy drinker will be examined in the second section, again looking at how employment and human capital characteristics affect males' and females' decisions differently. The third section will discuss the results from the earnings equation, and will look at the interaction between alcohol and human capital, and earnings. Section Four will examine different human capital effects, and will discuss the direct and indirect effects of alcohol on earnings. The final section concludes.

5.1 Labour Market Participation

The decision to become employed full-time is less of an issue for men than it is for women. In the sample, 83 percent of prime age males, as compared with 46 percent of prime age females, are engaged in full time employment. These percentages are lower than would be expected, because of the classification of self-employed individuals as being unemployed.

There are two categories that the unemployed can be classified into. The first is that of involuntary unemployment. Included in this category are those who are in-between jobs, those who have health problems impeding their employment, as well as those who are simply unable to find work. The second category is that of voluntary unemployment, which includes students and

retirees. In addition to this, individuals can choose to be unemployed because of childcare and familial responsibilities. This latter case is generally only applied to females. The vast difference in the employment rates between sexes implies that childbearing and child rearing activities are responsible for a large percentage of female unemployment. In a two-parent household, it is typically the female who is faced with the choice to either stay at home and raise the children or reenter the labour market, after childbirth. Males generally do not pause their careers when they have children, rather, they are often held responsible for financial provision for the family.

The male employment decision is therefore straightforward. The traditionally male role of provider implies that men are financially responsible for their families and themselves. Therefore, prime age males (those who are not students or retirees) will choose to be employed when possible. The female employment decision is more complex. It is influenced by the number of children she has and by her spouse's income, in addition to the factors that affect the male employment decision.

The results from the labour market participation equation are listed in Tables 5.1 and 5.2. Heavy drinking has a positive, statistically significant impact on the likelihood of full-time labour force participation for both sexes. There are two possible explanations for this result. The first is that drinking heavily can actually increase the likelihood of employment through direct or indirect effects. In other words, heavy drinking can make individuals more employable. It is possible that individuals who are heavy drinkers need the income to support this

habit, and so choose to work full-time. This would suggest that heavy drinking drives employment. Another explanation is that there are some unobservable characteristics that cause individuals to both be employed full-time and to drink heavily. That is, individuals who are heavy drinkers have some unobservable and unquantifiable characteristics that also make them employed. For example, such individuals may drink heavily on social occasions, and it may be such social behaviour that also causes them to be employed.

Married women are far less likely to be employed full-time than unmarried women. This result is indicative of the fact that married women can choose to be supported financially by their husbands, but single women must support themselves. Unsurprisingly, males that are married are more likely to be in the labour force than unmarried males, because of the traditional responsibility of providing for the family. The number of children a woman has negatively affects the likelihood that she will be working, but family size does not affect the male employment decision. This result supports the fact that women, rather than men, are usually faced with the choice to stay at home with child rearing responsibilities.

When examining the effects of age on labour force participation, it must be kept in mind that the excluded category is that of 25-29. Therefore, all results are relative to this age group. Males aged 30-39 are more likely to be employed full-time than those aged 25-29. Age does not have a statistically significant effect on the likelihood of female full-time employment.

Higher education significantly improves the likelihood that a female will work full-time. At the ten percent significance level, females who completed some college education, as well as those who earned a diploma from a technical/community college or a bachelor's degree, were much more likely to be employed than those who dropped out of high school. Education does not affect the male full-time participation decision, again, it is possible that the role of provider impels men to work regardless of educational achievements. Such achievements, however, may drive women to find work in order to utilize their education. The higher relative returns to labour market participation may be an incentive to find employment, rather than to be a homemaker.

Health measures affect the employment decision differently for men and for women. Arthritis has a significant negative impact working full-time for males, but not for females. High blood pressure, heart disease, diabetes, and respiratory illness do not have any effect on labour market participation for either sex.

Ethnicity and smoking have effects on the female full-time employment decision, but not the male one. Females born in a country outside of Canada are more likely to be employed than those who are not. Regular smoking has a negative effect on the propensity to be employed. It is uncertain whether these two factors cause changes in employment, or if there is some unobservable heterogeneity. That is, females who are born outside of Canada may choose to be employed for reasons related to their ethnicity. Similarly, there may be some

factors, correlated with smoking, that cause women who are smokers also to be unemployed.

Receiving government transfers has a significant, negative impact on employment for both males and females. This is not surprising, as the receipt of government monies is an alternative to employment. Welfare and government assistance programs decrease the likelihood of being employed full-time because they provide income, making labour force participation less necessary.

The majority of the economic literature dealing with alcohol and the labour market holds drinking exogenous to the model. To examine the effects of exogenous alcohol use on labour market outcomes, the original methodology was abandoned, and the indicator for heavy drinking used in the participation and earnings equation, rather than the estimated propensity to drink. The effects of human capital and sociodemographic elements on labour market participation are similar when heavy alcohol use is held exogenous. In this case, drinking has a significant and positive effect on female full-time employment, as before. However, when heavy alcohol use is held exogenous to the participation decision, it has a positive, but insignificant effect on male employment.

The true effect of heavy alcohol use on employment is positive. However, for males, there is negative sample selection into drinking. That is, males who have above average (conditional on observable characteristics) tendencies to drink heavily also have above average tendencies to be unemployed. This is shown by the insignificant effect resulting from the case when heavy alcohol use is held exogenous to the model.

5.2 Drinking Decisions

The results for the drinking equation are listed in Tables 5.3 and 5.4. Fewer factors affect the propensity to drink for females than for males. Youth drinking, religious status, ethnicity, marital status, and smoking affect the female propensity to drink. The male drinking decision is affected by age and education, in addition to the elements that affect the female decision. As well, the regional variable used as a proxy for price is statistically significant for a few provinces.

The results indicate that full-time labour market participation has a significant, positive effect on the likelihood of heavy drinking for females only. A possible interpretation of this result is that the stress of being employed increases the likelihood of a woman being a heavy drinker. Another explanation is that there are some characteristics shared by women who are employed and who are heavy drinkers. That is, rather than heavy drinking being caused by employment, there are some elements that cause a female to both be employed full-time and be a heavy drinker. Full-time labour market participation has no significant effect on the male propensity to drink. One conceivable explanation for the difference in the effect of participation on heavy alcohol use between sexes is that extended absences from the workplace due to childbearing and child rearing responsibilities could add to the stress of employment when a woman chooses to return to or begin work.

The likelihood of an individual being a heavy drinker is increased if that individual began drinking prior to age 18 for both males and females. This supports the hypothesis that alcohol is an addictive substance, and that past

consumption positively affects current consumption. The body builds up tolerance to alcohol consumption over time, and so the longer an individual drinks, the more likely s/he is to be a heavy drinker. This result could also be due to preferences – individuals with greater preferences for alcohol will tend to drink both earlier and more. Drinking prior to age 18 increases the likelihood of a male being a heavy drinker more than it does for a female. This could be due to the fact that many women give up drinking during pregnancy, and so they fail to build up the same tolerance to alcohol as their male counterparts. Regular smoking also contributes to the likelihood of heavy drinking for both sexes. Cigarettes and alcohol are thought to be complements, and so regular consumption of cigarettes tends to imply regular alcohol consumption.

Marital status has a significant, negative impact on the likelihood of heavy drinking for both males and females. Marriage decreases the likelihood of heavy drinking, possibly because of companionship and family values. Individuals with family may be reluctant to drink heavily in order to set an example for the children. As well, married individuals may prefer to spend free time with their spouse and children, rather than drinking.

Since many religions do not approve of or allow alcohol use among members, it is not surprising to find that individuals who consider themselves religious are far less likely to be heavy drinkers than those who do not (Hamilton and Hamilton, 1997). Religious beliefs have a much greater impact on male alcohol use than on female alcohol use. As well, the results imply that Catholicism has a positive impact on the propensity to drink for females, although

it has no significant effect for males. The effect of Catholicism on the propensity to drink almost negates the negative effect of religious beliefs.

Education affects the male, but not the female, decision to be a heavy drinker. Males with a diploma from a community/technical college, as well as those with some college education or a bachelor's degree, were less likely to be heavy drinkers than those who did not complete high school. This implies that the pursuit of higher education has a negative impact on the propensity to drink for males only. It is possible that high school dropouts are employed in blue-collar jobs that may be monotonous or involve a lack of mental stimulation. As well, individuals in such employments may experience anxiety about job security, poor morale, and bad labour-management relations. These aspects may encourage heavy drinking (Shanendeh, 1985).

In addition to this interpretation, it is possible that the education variables are reflecting the income effect of alcohol consumption. Since income is not included in this regression, variables that are highly correlated with it could pick up its effect on alcohol use. Education and income are highly correlated, and the effects of education on alcohol use could also encompass the effects of income on alcohol use.

Aging also negatively affects the likelihood of heavy drinking for males, but does not impact females. Males between the ages of 35 and 59 are less likely than those aged 25-29 to be heavy drinkers, with males aged 50-54 being the least likely. It is possible that young males are more likely to be heavy drinkers

than older ones due to the relative lack of responsibilities and obligations that come with age.

Ethnicity plays a role in the likelihood of both males and females being heavy drinkers. Individuals born outside of Canada are less likely to drink heavily than those who are Canadian-born. The impact of ethnicity on the propensity to drink is much greater for males than for females.

The provincial variable used as a proxy for price indicates that there is some regional variation in drinking. Males living in Nova Scotia, New Brunswick, and Ontario, and females living in Prince Edward Island are more likely to be heavy drinkers than those in British Columbia. This regional variation could be a result of different alcohol taxes among the provinces, as well as other factors that vary across regions.

When labour market participation is held exogenous, the results are not significantly different than when the causal relationship is accounted for. Employment has a statistically significant, positive effect on heavy alcohol use for females only.

5.3 Earnings Equation

From the descriptive statistics of the survey, it is known that male earnings are higher than female earnings regardless of occupation. This section will attempt to explain the variation in earnings for both females and males, and will contrast the effects of different factors on income between the sexes. The

elements that have a statistically significant effect on earnings are alcohol use, age, education, ethnicity, marital status, and occupation.

The variables in the earnings equations are indicators, meaning the estimated coefficients must undergo a transformation in order to be interpreted as the percentage effect on earnings. Following Halvorsen and Palmquist (1980), the percentage effect of an indicator on the dependent variable is

$$100*(\exp(\beta)-1)$$

where β is the estimated coefficient associated with the indicator variable.

The results from the earnings equation are listed in Tables 5.5 and 5.6. Heavy drinking has a statistically significant, negative impact on earnings for both males and females. Males and females who drink heavily earn 9 and 20 percent less than those who do not, respectively. This negative impact is comparable to those results found in the economic literature, excepting in Berger and Leigh (1988). This could reflect the health and social problems associated with heavy drinking. Individuals who are employed and who are heavy drinkers may have deteriorated physical and/or mental states that negatively affect productivity, and therefore, earnings potential. Poor health resulting from heavy drinking could affect job performance, and could lead to a lack of promotions and raises. The methodology used held some health problems constant, but did not account for specifically alcohol-related disorders, such as liver disease. Mental distress caused by drinking heavily could negatively affect work ethics and standards, and would decrease earnings potential. Another interpretation of these results is that individuals who drink heavily also make less because of selection into lower

paying jobs. Heavy drinkers may not have the stamina or interest to pursue high-paying jobs with a great deal of responsibility and stress due to their deteriorated conditions. The estimates from the earnings equation reflect the direct effect of heavy alcohol use on earnings. The effects of alcohol use on human capital will be discussed in the next section.

It is important to note that the impact of heavy drinking on earnings is much larger for females than it is for males. The impact for women is over twice as large as that for men. This is consistent with Mullahy and Sindelar (1991), who found that the negative effect of alcoholism on earnings for women was twice that of men.

The majority of the economic literature on earnings and alcohol use holds drinking exogenous to income. In this model, when heavy alcohol use is exogenous, it does not have a statistically significant effect on earnings. Therefore, failure to account for endogeneity has a critical effect on the results. Although the results from the earnings equation used in this thesis are consistent with the economic literature, the econometric methodology differs from most studies by accounting for endogeneity of heavy drinking. The implication of the difference in results between the two models is that there is positive sample selection into drinking. When the relationship between drinking and earnings is endogenous, it is seen that individuals who drink heavily earn less. Estimating this relationship holding alcohol use exogenous to the model yields the result that there is no difference in earnings between heavy drinkers and others. This implies that individuals who drink more also tend to earn more, hence, there is

positive sample selection into drinking. Therefore, the endogenous relationship between earnings and alcohol use should be accounted for, otherwise incorrect conclusions could be drawn.

In this model, education has a positive effect on male earnings only. As expected, males with a college degree earn more than high school dropouts. The earnings differential between college graduates and high school dropouts is 20 percent. This result supports standard human capital theories, which state that increases in education should increase productivity, and therefore earnings. However, education has a negative impact on earnings for women. This result will be discussed in the next section.

Marital status has a negative impact on male earnings (significant at the ten percent level), but positively affects female earnings. Married women earn 16 percent more than their unmarried counterparts, whereas married men earn over 16 percent less than those who are unmarried. One reason for this is that women who are married have a higher reservation wage than those who are not. Married women can choose to be supported by their husbands, and so are not necessarily forced by financial reasons to enter the workforce. Unmarried women, on the other hand, do not have this option, and so they have a lower reservation wage. The wage differential between married and unmarried men may be due to mobility issues. Married men tend to be less mobile and willing to relocate than unmarried men. A high degree of mobility indicates that the individual will have higher earnings. It should be noted that this outcome is an anomaly in comparison to the usual labour market results that married men earn

more than their unmarried counterparts. Holding alcohol exogenous does not alter this result. However, exclusion of the inverse Mill's ratio from the earnings equation yields the standard result that married men earn more than those who are unmarried. Because the inverse Mill's ratio is calculated from the participation equation, it is possible that the classification of self-employed individuals as being unemployed is the reason for this anomalous result.

When examining the effects of occupation on earnings, it must be kept in mind that the excluded category consists of those in the production sector, and so the results must be compared to this group. Not surprisingly, those in managerial and professional positions have higher earnings than those in this sector. Female managers and professionals both earn 19 percent more than women in production. Male managers earn 21 percent more than those in the production sector, whereas males in professional positions earn almost 13 percent more. The earnings differential between women in the service industry and the production sector is over twice as large as that for men. In the service industry, women earn 38 percent less, and males earn 14 percent less, than those in the production sector. The most striking difference is that of the agricultural sector. Men working in agriculture earn 11 percent less than those in production. For women, this differential is 69 percent. This could be a result of few women in the agricultural sector, and those in this area earn very little. As mentioned in Chapter 3, women in agriculture earn an average of approximately eight thousand dollars annually. There is no statistically significant difference in earnings between the production sector and those in administrative and

secretarial positions, for either males or females. Therefore, in every sector except administration and management, the earnings differentials are much larger for women than for men. This result implies that occupation has a greater impact on earnings for females than for males, that is, there are larger earnings gaps between occupations for women.

Age affects earnings differently for females than for males. Females between the ages of 30 and 39 earn more than those aged 25-29. Women aged 30-34 earn 19 percent more, and those in the 35-39 age bracket earn 14 percent more, than the latter category. Men in the 30-34 age group earn 9 percent less than those aged 25-29. The only other age group that has a statistically significant effect on male earnings is 45-49. Men in this age bracket earn 22 percent more than those in their late twenties. This result is an anomaly, given that age is a proxy for work experience. As age (and therefore experience) increases, income should also increase. This could be a result of imprecise estimates – as noted earlier, the econometric methodology introduces incorrect standard errors. The coefficients for the male equation have the expected pattern, but large standard errors. Earnings are notably higher for females over age 50. When comparing to those aged 25-29, women aged 50-54 and 55-59 had 51 and 26 percent higher earnings, respectively.

Female earnings are greater when they are in their thirties and over 50. Female earnings during their forties are not significantly different from those during their late twenties. This could be due to the high number of women reentering the workforce following childbearing and child rearing activities.

Extensive time off from the labour market for such activities could lead to lowered earnings simply because of a lack of experience. Continued labour force participation leads to promotions and increased productivity, as indicated by the augmented earnings experienced by women in their fifties.

Individuals born in a country other than Canada earn less than native Canadians, regardless of sex. Foreign-born men and women earn 11 and 13 percent less than those born in Canada. This could indicate a lack of education transferability – that is, individuals practicing particular occupations in their home countries do not always continue these careers when they immigrate to Canada because of differences in educational standards. In addition, lack of knowledge about the language and culture could inhibit the attainment of well-paying jobs.

5.4 Human Capital Effects

The effects of education on earnings are dispersed in the occupational variables. Individuals with particular academic achievements pursue certain occupations. Therefore, the impact of human capital on earnings is often reflected in the effects of occupational differences on earnings. To estimate this effect, the occupational variables were omitted from the earnings equation. The estimated coefficients for the educational variables show the total effect of education on earnings. The results from this regression are found in Tables 5.13 and 5.14.

For males, the difference in earnings between high school graduates and dropouts is not significantly different from zero, as before. However, receipt of a

diploma from a community/technical college, or some college education, has a positive effect on earnings,[1] whereas previously this achievement had no significant impact. Individuals with this level of education earn 10 percent more than high school dropouts. Males with a college degree have 33 percent higher earnings than high school dropouts. When measured with the occupational variables, this differential is 20 percent. This supports the hypothesis that the returns to education are reflected in the different occupations. That is, males with post-secondary education receive earnings benefits due to both their academic achievements and to their subsequent careers.

When the occupational variables are omitted from the female earnings equation, the returns to high school graduation become more negative, and the returns to a technical/community college diploma become less negative. The returns to the receipt of a college degree with occupational variables added are significantly negative. When these variables are omitted, the returns are not statistically different from zero. Such a result is unexpected and anomalous, considering human capital theories. Omitting the inverse Mill's ratio from the female earnings equation yields positive returns to education. As in the case of male marital status, it is possible that classing self-employed individuals as unemployed could cause the anomalous results.

To estimate the full effect of heavy alcohol use on earnings, all variables other than the inverse Mill's ratio and the drinking variable are omitted from the earnings regression. The full effect of alcohol use includes both direct and indirect effects. That is, heavy alcohol use may affect earnings due to its effect

[1] Significant at the ten percent level.

on human capital characteristics, as well as having a direct impact. To see how alcohol use affects the return to these characteristics, the earnings equation is estimated with various human capital elements, following Mullahy and Sindelar (1993). The results from this are listed in Tables 5.15 and 5.16.

For males, the omission of all variables other than the drinking variable and the inverse Mill's ratio shows that the full effect of heavy alcohol use on earnings is negative and significant. The magnitude of this effect is slightly larger than when the human capital and sociodemographic variables are included in the regression. That is, the full effect of heavy drinking on male earnings is almost 12 percent, whereas the direct effect is 9 percent. This indicates that heavy alcohol use has a small negative impact on male earnings through its effects on human capital characteristics, as well as having a significant direct effect.

When all the human capital and sociodemographic variables are omitted from the female earnings equation, the effect of heavy alcohol use on earnings does not change. However, it is interesting to note the outcome when only the education variables are omitted, namely, the effect of heavy alcohol use on earnings is larger and more negative. Drinking has a negative impact on female education. That is, women who drink heavily tend to be less educated. Heavy alcohol use has a negative direct effect on earnings, as well as an indirect effect, through its impact on education.

Examining Tables 5.15 and 5.16, it is interesting to note that as more human capital elements are added to the equation, the effect of alcohol on earnings becomes increasingly larger until the addition of educational variables.

The Mill's ratio also follows this pattern, indicating that human capital characteristics affect employment more than they affect earnings, as the Mill's ratio is calculated from the participation equation. This is in contrast to the results found by Mullahy and Sindelar (1993). A possible explanation for this is that this model accounts for endogeneity between alcohol use and earnings, and Mullahy and Sindelar's does not.

5.5 Conclusion

Labour market participation has a statistically significant, positive impact on the propensity to drink for females only. It is possible that the stresses of being employed cause women to drink more. However, it is also plausible that there is no causal relationship between the two, and it is simply that there are some unobservable reasons that women who are employed tend to drink more.

Heavy alcohol use was found to have positive and significant effects on labour market participation for both males and females. It is possible that individuals who are heavy drinkers need the income to support their habit, and so become employed. An alternative explanation for this result is that there are some unobservable characteristics that cause heavy drinkers to also be employed.

Although heavy alcohol use was found to have a positive impact on employment, it negatively affects earnings for both sexes. The health problems associated with drinking heavily could decrease productivity, which would be reflected in lowered income and earnings potential. The impact is larger for

women than for men, possibly reflecting greater health costs of drinking for females. Females who drink heavily earn 20 percent less than those who do not, where male heavy drinkers earn 9 percent less than non-heavy drinkers. The negative impact of heavy alcohol use on earnings can be attributed both to its direct effect on earnings capacity and to its effect on human capital characteristics. Drinking heavily has a negative impact on education for both sexes, and on other human capital characteristics for males.

An important result of this paper is that accounting for an endogenous relationship between alcohol use and earnings yields different results from the model that does not. Holding alcohol exogenous in the earnings equation gives the result that heavy drinking does not have an effect on earnings. The difference in results indicates the importance of accounting for a causal relationship between alcohol and earnings.

Table 5.1: Male labour market participation equation estimates

Number of obs = 2040
Chi-squared = 205.14
Pseudo R-squared = 0.1562

Log Likelihood = -837.63108

VARIABLE	COEF	STD. ERROR	Z	P> |Z|
drink	0.183	0.091	2.006	0.045
age30-34	0.252	0.108	0.342	0.019
age35-39	0.313	0.121	0.600	0.009
age40-44	0.249	0.139	1.799	0.072
age45-49	-0.007	0.144	-0.046	0.963
age50-54	0.197	0.187	1.054	0.292
age55-59	-0.040	0.168	-0.239	0.811
hpress	-0.046	0.101	-0.460	0.645
heart	-0.104	0.173	-0.600	0.548
diab	-0.238	0.263	-0.905	0.366
resp	-0.093	0.120	-0.775	0.438
arth	-0.327	0.096	-3.394	0.001
hsgrad	-0.035	0.142	-0.247	0.805
collinc	0.050	0.155	0.324	0.746
cgrad	0.034	0.172	0.201	0.841
married	0.393	0.088	4.447	0.000
forborn	0.099	0.105	0.937	0.349
smoker	-0.068	0.081	-0.839	0.401
interest	0.000	0.000	0.527	0.598
govt	-0.0001	0.000	-8.667	0.000
numkids	0.038	0.027	1.391	0.164
cons	1.008	0.163	6.179	0.000

Table 5.2: Female labour market participation equation estimates

Number of obs = 2647
Chi-squared = 406.89
Pseudo R-squared = 0.1115

Log Likelihood = -1621.3968

VARIABLE	COEF	STD. ERROR	Z	P> |Z|
drink	0.539	0.099	5.460	0.000
age30-34	-0.056	0.079	-0.702	0.483
age35-39	0.143	0.086	1.670	0.095
age40-44	0.113	0.101	1.116	0.264
age45-49	0.107	0.112	0.955	0.340
age50-54	-0.135	0.112	-1.207	0.228
age55-59	-0.005	0.123	-0.042	0.967
hpress	-0.070	0.079	-0.882	0.378
heart	-0.207	0.139	-1.489	0.136
resp	-0.096	0.094	-1.021	0.307
arth	-0.020	0.071	-0.286	0.775
hsgrad	-0.042	0.088	-0.474	0.636
collinc	0.180	0.100	1.800	0.072
cgrad	0.222	0.114	1.959	0.050
married	-0.322	0.066	-4.853	0.000
forborn	0.201	0.078	2.559	0.011
smoker	-0.193	0.070	-2.740	0.006
interest	5.99e-07	0.000	0.026	0.979
govt	-0.0001	0.000	-8.337	0.000
numkids	-0.104	0.021	-5.016	0.000
cons	1.317	0.186	7.091	0.000

Table 5.3: Male drinking equation estimates

Number of obs = 2040
Chi-squared = 204.71
Pseudo R-squared = 0.1559

Log Likelihood = -554.19845

VARIABLE	COEF.	STD. ERROR	Z	P> |Z|
employed	0.112	0.164	0.682	0.495
age30-34	-0.203	0.117	-1.733	0.083
age35-39	-0.302	0.138	-2.191	0.028
age40-44	-0.359	0.164	-2.186	0.029
age45-49	-0.340	0.176	-1.934	0.053
age50-54	-1.039	0.273	-3.813	0.000
age55-59	-0.513	0.217	-2.362	0.018
hpress	0.103	0.124	0.831	0.406
heart	-0.039	0.248	-0.159	0.874
diab	-0.140	0.478	-0.293	0.770
resp	-0.177	0.165	-1.070	0.285
arth	0.121	0.140	0.859	0.390
hsgrad	-0.240	0.143	-1.676	0.094
collinc	-0.396	0.157	-2.523	0.012
cgrad	-0.700	0.184	-3.804	0.000
married	-0.368	0.110	-3.341	0.001
forborn	-0.374	0.149	-2.507	0.012
yngdrnk	0.487	0.088	5.529	0.000
nofaith	0.164	0.114	1.447	0.148
religus	-0.601	0.180	-3.346	0.001
relcath	0.288	0.209	1.383	0.167
smoker	0.289	0.087	3.311	0.001
Nfld.	0.193	0.263	0.734	0.463
PEI	0.393	0.506	0.776	0.437
NS	0.598	0.219	2.324	0.020
NB	0.520	0.236	2.207	0.027
Que.	0.170	0.202	0.841	0.400
Ont.	0.516	0.202	2.557	0.011
Man.	0.310	0.218	1.424	0.154
Sask.	0.186	0.264	0.706	0.480
AB	0.182	0.201	0.905	0.365
cons	-1.174	0.229	-5.127	0.000

Table 5.4: Female drinking equation estimates

Number of obs = 2647
Chi-squared = 100.31
Pseudo R-squared = 0.0823

Log Likelihood = -559.34352

VARIABLE	COEF.	STD. ERROR	Z	P> |Z|
employed	0.217	0.113	1.927	0.054
age30-34	0.084	0.122	0.686	0.493
age35-39	0.045	0.136	0.334	0.738
age40-44	0.169	0.148	1.139	0.255
age45-49	-0.009	0.179	-0.048	0.962
age50-54	0.104	0.180	0.578	0.563
age55-59	-0.217	0.216	-1.006	0.314
hpress	0.015	0.129	0.117	0.907
heart	-0.122	0.239	-0.511	0.609
resp	0.136	0.131	1.040	0.298
arth	0.045	0.111	0.406	0.685
hsgrad	0.209	0.149	1.407	0.160
collinc	0.259	0.162	1.605	0.109
cgrad	0.163	0.190	0.860	0.390
married	-0.184	0.102	-1.809	0.071
forborn	-0.261	0.140	-1.866	0.062
yngdrnk	0.258	0.101	2.560	0.010
nofaith	0.132	0.137	0.970	0.332
religus	-0.347	0.142	-2.436	0.015
relcath	0.320	0.154	2.080	0.038
smoker	0.331	0.088	3.772	0.000
Nfld.	-0.319	0.283	-1.130	0.258
PEI	0.795	0.370	2.149	0.032
NS	0.079	0.203	0.388	0.698
NB	0.065	0.221	0.282	0.770
Que.	-0.029	0.161	-0.179	0.858
Ont.	0.239	0.150	1.593	0.111
Man.	0.198	0.200	0.988	0.323
Sask.	-0.004	0.218	-0.018	0.986
AB	0.051	0.172	0.297	0.766
cons	-1.868	0.154	-12.108	0.000

Table 5.5: Male earnings equation estimates

Number of obs = 1699
F(24, 1674) = 17.30
Adj. R-squared = 0.1559

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)−1
drink	-0.092	0.036	-2.568	0.010	-0.088
mill	0.961	0.082	11.713	0.000	...
age30-34	-0.097	0.043	-2.255	0.024	-0.093
age35-39	-0.028	0.048	-0.575	0.565	-0.027
age40-44	0.057	0.053	1.076	0.282	0.059
age45-49	0.198	0.055	3.600	0.000	0.219
age50-54	0.030	0.072	0.413	0.680	0.030
age55-59	0.060	0.064	0.926	0.355	0.062
hpress	0.060	0.038	1.597	0.110	0.062
heart	0.079	0.069	1.139	0.255	0.082
diab	-0.027	0.114	-0.236	0.814	-0.027
resp	0.048	0.049	0.982	0.326	0.049
arth	0.218	0.044	4.904	0.000	0.244
hsgrad	0.050	0.050	1.002	0.317	0.051
collinc	0.062	0.055	1.136	0.256	0.064
cgrad	0.183	0.064	2.853	0.004	0.201
married	-0.151	0.043	-3.466	0.001	-0.145
forborn	-0.121	0.038	-3.176	0.002	-0.114
smoker	-0.009	0.030	-0.285	0.776	-0.009
manager	0.192	0.040	4.761	0.000	0.211
prof	0.120	0.043	2.769	0.006	0.127
service	-0.149	0.039	-3.862	0.000	-0.138
admin	-0.004	0.056	-0.077	0.939	-0.004
aggie	-0.111	0.050	-2.208	0.027	-0.105
cons	8.402	0.136	61.943	0.000	...

Table 5.6: Female earnings equation estimates

Number of obs = 1209
F(23, 1185) = 18.87
Adj. R-squared = 0.2538

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)-1
drink	-0.221	0.096	-2.292	0.022	-0.198
mill	1.091	0.146	7.481	0.000	...
age30-34	0.176	0.057	3.118	0.002	0.192
age35-39	0.132	0.058	2.289	0.022	0.141
age40-44	0.102	0.066	1.547	0.122	0.108
age45-49	0.057	0.077	0.739	0.460	0.058
age50-54	0.415	0.085	4.870	0.000	0.514
age55-59	0.230	0.094	2.440	0.015	0.258
hpress	-0.002	0.060	-0.031	0.976	-0.002
heart	0.154	0.111	1.386	0.166	0.166
resp	0.008	0.069	0.121	0.904	0.008
arth	-0.138	0.053	-2.628	0.009	-0.129
hsgrad	-0.180	0.067	-2.690	0.007	-0.165
collinc	-0.284	0.077	-3.711	0.000	-0.248
cgrad	-0.163	0.089	-1.828	0.068	-0.151
married	0.150	0.056	2.673	0.008	0.162
forborn	-0.139	0.059	-2.374	0.018	-0.130
smoker	0.054	0.056	0.961	0.337	0.055
manager	0.175	0.077	2.273	0.023	0.191
prof	0.175	0.072	2.415	0.016	0.191
service	-0.483	0.072	-6.715	0.000	-0.382
admin	-1.180	0.243	-4.863	0.000	-0.363
aggie	-0.093	0.063	-1.464	0.144	-0.088
cons	8.384	0.300	27.978	0.000	...

Table 5.7: Male labour market participation equation estimates, drinking held exogenous

Number of obs = 2040
Chi-squared = 163.80
Pseudo R-squared = 0.0889

Log Likelihood = -838.85178

VARIABLE	COEF	STD. ERROR	Z	P> |Z|
drink	0.152	0.122	1.247	0.212
age30-34	0.213	0.105	2.028	0.043
age35-39	0.253	0.115	2.196	0.028
age40-44	0.171	0.131	1.303	0.192
age45-49	-0.084	0.137	-0.610	0.542
age50-54	-0.007	0.150	-0.046	0.963
age55-59	-0.153	0.156	-0.979	0.327
hpress	-0.029	0.100	-0.296	0.767
heart	-0.105	0.173	-0.610	0.542
diab	-0.272	0.260	-1.121	0.262
resp	-0.114	0.119	-0.957	0.3389
arth	-0.307	0.096	-3.208	0.001
hsgrad	-0.086	0.139	-0.619	0.536
collinc	-0.021	0.150	-0.143	0.886
cgrad	-0.092	0.157	-0.588	0.557
married	-0.331	0.081	4.091	0.000
forborn	-0.039	0.100	0.394	0.694
smoker	-0.011	0.074	-0.143	0.886
interest	9.30e-06	0.000	0.401	0.689
govt	-0.0001	0.000	-8.949	0.000
numkids	0.033	0.027	1.238	0.216
cons	0.876	0.159	5.518	0.000

Table 5.8: Female labour market participation equation estimates, drinking held exogenous

Number of obs = 2647
Chi-squared = 390.10
Pseudo R-squared = 0.1069

Log Likelihood = -1629.7927

VARIABLE	COEF	STD. ERROR	Z	P> |Z|
drink	0.417	0.111	3.737	0.000
age30-34	-0.030	0.078	-0.388	0.698
age35-39	0.150	0.085	1.770	0.077
age40-44	0.195	0.099	1.984	0.047
age45-49	0.107	0.115	0.962	0.336
age50-54	-0.111	0.111	-1.001	0.317
age55-59	-0.160	0.117	-1.363	0.173
hpress	-0.075	0.079	-0.947	0.344
heart	-0.324	0.137	-2.376	0.018
resp	-0.008	0.093	-0.083	0.934
arth	0.016	0.071	0.226	0.821
hsgrad	0.035	0.101	0.343	0.732
collinc	0.327	0.111	2.955	0.003
cgrad	0.335	0.126	2.665	0.008
married	-0.431	0.060	-7.186	0.000
forborn	0.119	0.076	1.564	0.118
smoker	0.012	0.058	0.216	0.829
interest	0.000	0.000	0.689	0.491
govt	-0.0001	0.000	-8.595	0.000
numkids	-0.141	0.020	-7.227	0.000
cons	0.381	0.112	3.390	0.001

Table 5.9: Male drinking equation estimates, employment held exogenous

Number of obs = 2040
Chi-squared = 205.35
Pseudo R-squared = 0.1564

Log Likelihood = -553.87638

VARIABLE	COEF.	STD. ERROR	Z	P> |Z|
employed	0.126	0.120	1.048	0.295
age30-34	-0.186	0.113	-1.655	0.098
age35-39	-0.277	0.130	-2.135	0.033
age40-44	-0.335	0.159	-2.103	0.035
age45-49	-0.346	0.176	-1.968	0.049
age50-54	-1.029	0.272	-3.779	0.000
age55-59	-0.514	0.216	-2.386	0.017
hpress	0.100	0.124	0.810	0.418
heart	-0.059	0.248	-0.238	0.812
diab	-0.171	0.476	-0.360	0.719
resp	-0.192	0.161	-1.190	0.234
arth	0.089	0.130	0.684	0.494
hsgrad	-0.250	0.142	-1.763	0.078
collinc	-0.398	0.157	-2.540	0.011
cgrad	-0.709	0.183	-3.873	0.000
married	-0.336	0.091	-3.706	0.000
forborn	-0.368	0.148	-2.470	0.014
yngdrnk	0.495	0.087	5.674	0.000
nofaith	0.157	0.113	1.389	0.165
religus	-0.596	0.179	-3.323	0.001
relcath	0.271	0.207	1.309	0.191
smoker	0.285	0.087	3.277	0.001
Nfld.	0.238	0.252	0.944	0.345
PEI	0.492	0.472	1.043	0.297
NS	0.551	0.207	2.661	0.008
NB	0.555	0.231	2.402	0.016
Que.	0.217	0.184	1.181	0.238
Ont.	0.575	0.169	3.402	0.001
Man.	0.333	0.213	1.567	0.117
Sask.	0.245	0.242	1.014	0.311
AB	0.223	0.186	1.198	0.231
cons	-1.221	0.237	-5.145	0.000

Table 5.10: Female drinking equation estimates, employment held exogenous

Number of obs = 2647
Chi-squared = 107.80
Pseudo R-squared = 0.0884

Log Likelihood = -555.60141

VARIABLE	COEF.	STD. ERROR	Z	P> |Z|
employed	0.303	0.086	3.513	0.000
age30-34	0.099	0.120	0.818	0.413
age35-39	0.076	0.136	0.559	0.576
age40-44	0.216	0.147	1.467	0.142
age45-49	0.003	0.180	0.017	0.987
age50-54	0.111	0.176	0.631	0.528
age55-59	-0.215	0.211	-1.019	0.308
hpress	0.004	0.129	0.032	0.976
heart	-0.150	0.236	-0.635	0.526
resp	0.129	0.131	0.986	0.325
arth	0.038	0.111	0.341	0.733
hsgrad	-0.126	0.150	-0.836	0.403
collinc	0.0178	0.162	0.109	0.913
cgrad	-0.068	0.188	-0.363	0.716
married	-0.223	0.088	-2.8545	0.011
forborn	-0.243	0.140	-1.740	0.082
yngdrnk	0.290	0.100	2.907	0.004
nofaith	0.124	0.137	0.904	0.366
religus	-0.363	0.141	-2.583	0.010
relcath	0.332	0.153	2.166	0.030
smoker	0.319	0.088	3.633	0.000
Nfld.	-0.235	0.276	-0.852	0.394
PEI	0.797	0.370	2.154	0.031
NS	0.143	0.201	0.710	0.478
NB	0.164	0.217	0.755	0.450
Que.	0.041	0.157	0.259	0.795
Ont.	0.334	0.142	2.346	0.019
Man.	0.276	0.196	1.406	0.160
Sask.	0.050	0.217	0.232	0.817
AB	0.122	0.170	0.719	0.472
cons	-1.825	0.199	-9.149	0.000

Table 5.11: Male earnings equation estimates, drinking held exogenous

Number of obs = 1699
F(24, 1674) = 17.58
Adj. R-squared = 0.1898

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)-1
drink	-0.013	0.044	-0.299	0.765	-0.013
mill	0.959	0.080	12.003	0.000	...
age30-34	-0.073	0.041	-1.790	0.074	-0.070
age35-39	0.009	0.043	0.211	0.833	0.009
age40-44	0.106	0.048	2.219	0.027	0.111
age45-49	0.248	0.053	4.706	0.000	0.281
age50-54	0.147	0.053	2.744	0.006	0.158
age55-59	0.128	0.059	2.173	0.030	0.137
hpress	0.053	0.038	1.408	0.159	0.054
heart	0.078	0.069	1.126	0.260	0.081
diab	0.005	0.114	0.041	0.967	0.005
resp	0.060	0.049	1.218	0.223	0.061
arth	0.204	0.043	4.718	0.000	0.226
hsgrad	0.080	0.049	1.642	0.101	0.084
collinc	0.105	0.053	1.988	0.047	0.110
cgrad	0.255	0.059	4.320	0.000	0.291
married	-0.112	0.037	-2.995	0.003	-0.106
forborn	-0.091	0.036	-2.552	0.011	-0.087
smoker	-0.041	0.027	-1.499	0.134	-0.040
manager	0.191	0.040	4.765	0.000	0.211
prof	0.119	0.043	2.751	0.006	0.126
service	-0.008	0.056	-0.135	0.893	-0.008
admin	-0.111	0.050	-2.206	0.028	-0.105
aggie	-0.150	0.038	-3.895	0.000	-0.139
cons	8.456	0.124	68.335	0.000	...

Table 5.12: Female earnings equation estimates, drinking held exogenous

Number of obs = 1209
F(24, 1674) = 18.40
Adj. R-squared = 0.2488

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)-1
drink	-0.125	0.077	-1.628	0.104	-0.117
mill	0.972	0.120	8.090	0.000	...
age30-34	0.136	0.055	2.446	0.015	0.145
age35-39	0.123	0.057	2.142	0.032	0.130
age40-44	0.067	0.066	1.016	0.310	0.069
age45-49	0.053	0.077	0.690	0.490	0.054
age50-54	0.386	0.085	4.553	0.000	0.472
age55-59	0.253	0.093	2.729	0.006	0.288
hpress	-0.013	0.060	-0.218	0.827	-0.013
heart	0.166	0.112	1.480	0.139	0.180
resp	-0.043	0.067	-0.641	0.522	-0.042
arth	-0.156	0.052	-3.000	0.003	-0.145
hsgrad	-0.037	0.078	-0.474	0.636	-0.036
collinc	-0.173	0.088	-1.969	0.049	-0.159
cgrad	-0.043	0.102	-0.422	0.673	-0.042
married	0.140	0.058	2.414	0.016	0.151
forborn	-0.105	0.054	-1.944	0.052	-0.100
smoker	-0.048	0.041	-1.155	0.248	-0.047
manager	0.130	0.073	1.766	0.078	0.139
prof	0.119	0.069	1.727	0.084	0.126
service	-0.535	0.068	-7.817	0.000	-0.415
admin	-0.142	0.060	-2.370	0.018	-0.133
aggie	-1.190	0.244	-4.870	0.000	-0.696
cons	8.840	0.149	59.235	0.000	...

Table 5.13 : Male earnings equation estimates, occupational variables omitted

Number of obs = 1699
F(19, 1679) = 17.76
Adj. R-squared = 0.1579

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)-1
drink	-0.098	0.036	-2.697	0.007	-0.094
mill	1.011	0.083	12.197	0.000	...
age30-34	-0.115	0.044	-2.614	0.009	-0.108
age35-39	-0.031	0.049	-0.638	0.524	-0.031
age40-44	0.049	0.054	0.918	0.359	0.051
age45-49	0.203	0.056	3.634	0.000	0.225
age50-54	0.016	0.073	0.218	0.828	0.016
age55-59	0.066	0.066	1.012	0.312	0.069
hpress	0.073	0.038	1.903	0.057	0.076
heart	0.090	0.070	1.289	0.198	0.095
diab	-0.036	0.116	-0.313	0.754	-0.036
resp	0.051	0.050	1.030	0.303	0.053
arth	0.211	0.045	4.679	0.000	0.235
hsgrad	0.049	0.051	0.971	0.332	0.050
collinc	0.103	0.055	1.868	0.062	0.109
cgrad	0.289	0.062	4.685	0.000	0.335
married	-0.165	0.044	-3.765	0.000	-0.152
forborn	-0.125	0.039	-3.232	0.001	-0.118
smoker	-0.016	0.031	-0.533	0.584	-0.016
cons	8.322	0.137	60.544	0.000	...

Table 5.14: Female earnings equation estimates, occupational variables omitted

Number of obs = 1209
F(18, 1190) = 14.06
Adj. R-squared = 0.1629

VARIABLE	COEF.	STD. ERROR	T	P> |T|	EXP(β)-1
drink	-0.283	0.101	-2.798	0.005	-0.247
mill	1.236	0.153	8.060	0.000	...
age30-34	0.186	0.059	3.134	0.002	0.204
age35-39	0.096	0.061	1.583	0.114	0.101
age40-44	0.105	0.070	1.503	0.133	0.111
age45-49	0.016	0.080	0.195	0.845	0.016
age50-54	0.422	0.090	4.693	0.000	0.525
age55-59	0.190	0.099	1.909	0.056	0.209
hpress	-0.019	0.064	-0.304	0.761	-0.019
heart	0.198	0.117	1.689	0.091	0.219
resp	-0.006	0.073	-0.086	0.931	-0.006
arth	-0.169	0.055	-3.047	0.002	-0.156
hsgrad	-0.199	0.067	-2.988	0.003	-0.181
collinc	-0.214	0.073	-2.915	0.004	-0.192
cgrad	0.009	0.082	0.106	0.916	0.009
married	0.159	0.059	2.700	0.007	0.172
forborn	-0.160	0.062	-2.575	0.010	-0.148
smoker	0.064	0.059	1.089	0.276	0.066
cons	8.084	0.313	25.794	0.000	...

Table 5.15: Alcohol's effect on human capital, males
Dependent variable: Log earnings - t values in parentheses

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
drink	-0.119	-0.097	-0.136	-0.166	-0.153	-0.204	-0.138	-0.092
	(-5.929)	(-4.025)	(-5.259)	(-6.097)	(-4.96)	(-6.379)	(-4.252)	(-2.568)
age30-34		-0.062	-0.090	-0.103	-0.097	-0.156	-0.113	-0.097
		(-1.496)	(-2.141)	(-2.449)	(-2.291)	(-3.577)	(-2.633)	(-2.255)
age35-39		0.016	-0.011	-0.019	-0.011	-0.092	-0.053	-0.028
		(0.344)	(-0.258)	(-0.425)	(-0.237)	(-1.907)	(-1.125)	(-0.575)
age40-44		0.094	0.070	0.059	0.068	-0.009	0.035	0.057
		(1.856)	(1.380)	(1.169)	(1.321)	(-0.177)	(0.699)	(1.076)
age45-49		0.201	0.212	0.212	0.217	0.159	0.180	0.198
		(3.665)	(3.872)	(3.889)	(3.964)	(2.856)	(3.306)	(3.600)
age50-54		0.024	-0.005	-0.023	-0.005	-0.129	-0.031	0.030
		(0.387)	(-0.082)	(-0.369)	(-0.084)	(-1.873)	(-0.450)	(0.413)
age55-59		0.048	0.057	0.058	0.065	-0.027	0.020	0.060
		(0.779)	(0.925)	(0.936)	(1.050)	(-0.417)	(0.316)	(0.926)
married			-0.153	-0.176	-0.170	-0.247	-0.181	-0.151
			(-4.034)	(-4.588)	(-4.331)	(-5.915)	(-4.305)	(-3.466)
forborn				-0.132	-0.128	-0.149	-0.132	-0.121
				(-3.428)	(-3.291)	(-3.847)	(-3.469)	(-3.176)
smoker					-0.029	-0.004	0.000	-0.009
					(-0.945)	(-0.115)	(0.015)	(-0.285)
hpress						0.082	0.062	0.061
						(2.128)	(1.647)	(1.597)
heart						0.087	0.073	0.079
						(1.235)	(1.052)	(1.139)
diab						-0.060	-0.041	-0.027
						(-0.514)	(-0.357)	(-0.236)
resp						0.039	0.043	0.048
						(0.769)	(0.875)	(0.982)
arth						0.230	0.225	0.218
						(5.066)	(5.075)	(4.904)
manager							0.220	0.192
							(5.653)	(4.761)
prof							0.178	0.120
							(4.585)	(2.769)
service							-0.143	-0.149
							(-3.695)	(-3.862)
admin							0.002	-0.004
							(0.036)	(-0.077)
aggie							-0.113	-0.111
							(-2.241)	(-2.208)
hsgrad								0.050
								(1.002)
collinc								0.062
								(1.136)
cgrad								0.183
								(2.853)
mill	0.653	0.706	0.850	0.895	0.884	1.103	0.986	0.961
	(12.758)	(12.297)	(12.617)	(13.081)	(12.729)	(13.533)	(12.172)	(11.719)
cons	8.861	8.787	8.625	8.551	8.588	8.222	8.389	8.402
	(99.622)	(93.584)	(84.820)	(82.540)	(77.525)	(63.145)	(65.360)	(61.943)

Table 5.16: Alcohol's effect on human capital, females
Dependent variable: Log earnings - t values in parentheses

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
drink	-0.228	-0.282	-0.295	-0.354	-0.468	-0.423	-0.275	-0.221
	(-3.747)	(-4.486)	(-4.677)	(-5.351)	(-5.154)	(-4.430)	(-2.988)	(-2.292)
age30-34		0.156	0.151	0.167	0.172	0.177	0.149	0.176
		(2.732)	(2.644)	(2.912)	(3.004)	(3.086)	(2.689)	(3.118)
age35-39		0.054	0.033	0.056	0.053	0.070	0.111	0.132
		(0.923)	(0.564)	(0.947)	(0.887)	(1.170)	(1.938)	(2.289)
age40-44		0.064	0.048	0.072	0.081	0.094	0.093	0.102
		(0.942)	(0.701)	(1.052)	(1.181)	(1.353)	(1.410)	(1.547)
age45-49		-0.053	-0.059	-0.038	-0.044	-0.017	0.034	0.057
		(-0.665)	(-0.744)	(-0.481)	(-0.563)	(-0.216)	(0.448)	(0.737)
age50-54		0.299	0.313	0.353	0.375	0.404	0.373	0.415
		(3.475)	(3.633)	(4.054)	(4.266)	(4.561)	(4.418)	(4.870)
age55-59		-0.018	0.005	0.044	0.031	-0.109	0.152	0.230
		(-0.206)	(0.054)	(0.487)	(0.343)	(1.131)	(1.651)	(2.440)
married			0.105	0.130	0.144	0.143	0.096	0.150
			(2.032)	(2.502)	(2.749)	(2.674)	(1.836)	(2.673)
forborn				-0.172	-0.199	-0.194	-0.154	-0.140
				(-2.864)	(-3.227)	(-3.147)	(-2.636)	(-2.374)
smoker					0.107	0.092	0.064	0.054
					(1.832)	(1.571)	(1.158)	(0.961)
hpress						-0.024	-0.010	-0.002
						(-0.373)	(-0.161)	(-0.031)
heart						0.193	0.116	0.154
						(1.649)	(1.048)	(1.386)
resp						0.007	0.007	0.008
						(0.102)	(0.105)	(0.121)
arth						-0.155	-0.132	-0.138
						(-2.780)	(-2.496)	(-2.628)
manager							0.095	0.175
							(1.292)	(2.273)
prof							0.083	0.175
							(1.317)	(2.415)
service							-0.555	-0.483
							(-8.068)	(-6.715)
admin							-0.171	-0.093
							(-2.855)	(-1.464)
aggie							-1.215	-1.180
							(-4.984)	(-4.863)
hsgrad								-0.180
								(-2.690)
collinc								-0.284
								(-3.711)
cgrad								-0.163
								(-1.828)
mill	1.018	1.112	1.232	1.325	1.439	1.391	1.043	1.091
	(12.426)	(12.814)	(11.737)	(12.092)	(11.435)	(10.558)	(8.117)	(7.481)
cons	8.389	8.161	7.976	7.793	7.476	7.603	8.282	8.384
	(54.906)	(48.822)	(41.950)	(38.970)	(28.273)	(27.150)	(30.267)	(27.978)

CHAPTER SIX: Discussion and Conclusions

Economic theory suggests that heavy alcohol use and labour market participation, and heavy alcohol use and earnings, are not exogenously determined. This thesis empirically estimated the effects of alcohol on these labour market indicators, taking into account these simultaneous relationships. An individual was defined as a heavy drinker if s/he consumed alcohol at least once a week for the past twelve months. In addition to this, male heavy drinkers consumed at least eight drinks on at least one occasion in the past week. Females who had at least four drinks at one sitting in the past week were classed as heavy drinkers.

The results from estimating the simultaneous relationships between heavy alcohol use and the labour market leads to somewhat different conclusions than previous work which does not control for endogeneity. Heavy alcohol use was found to have a statistically significant, negative impact on earnings for both males and females. This impact could reflect the physical and mental health problems associated with heavy drinking. Since drinking heavily leads to deteriorated health and possibly an unstable mental state, productivity, and therefore earnings, may be less. An alternative interpretation is that individuals who drink heavily self-select into lower paying jobs because of a possible lack of stamina to deal with stress and responsibility associated with high-paying jobs.

In addition to this direct effect, heavy alcohol use affects earnings indirectly through its effect on human capital characteristics. That is, alcohol has a negative impact on education for both males and females – individuals who

drink heavily tend to be less educated. If heavy drinking has debilitating effects at a young age, such individuals may not be able to continue or complete schooling due to their condition. It may be the case, however, that heavy drinkers tend to be less educated for unobservable reasons, rather than the case that heavy alcohol use actually causes individuals to be less educated.

This thesis focused on the sex differences in the effects of alcohol on the labour market. Alcohol affects men and women differently. Women suffer greater bodily damage from consumption of the same amount of ethanol as do men (Mullahy and Sindelar, 1996). Women are less likely than men to be heavy drinkers, even when the sex differences in the definition are taken into account. In addition, females are also more likely to be abstainers, possibly due to alcohol-related problems specific to women. That is, women who are pregnant or nursing put their children at risk of developmental problems and fetal alcohol syndrome.

With alcohol affecting women in a different way than men, it is not surprising that heavy drinking has a different effect on earnings. The negative impact of heavy drinking on earnings is over twice as large for females than for males. Heavy drinking had a 9 percent negative impact on male earnings. This impact was 22 percent for females. Women's earnings are affected more by heavy alcohol use than are men's, even when accounting for the difference in definitions of heavy drinking between sexes. This result is similar to that found by Mullahy and Sindelar (1991), who found that the negative effect of alcoholism on earnings for women was twice that of men.

The methodology utilized accounted for the causal relationship between heavy alcohol use and earnings. This endogenous relationship was not generally accounted for in the economic literature. When drinking was held exogenous to the model, it was found that there is no difference in earnings between heavy drinkers and others for either sex. The implication of this is that there is positive sample selection into drinking.

In addition to its negative effects on earnings, heavy alcohol use was found to have a statistically significant, positive impact on the likelihood of full-time labour force participation for both sexes. A possible explanation for this result is that individuals who are heavy drinkers need income to support their habit, which would drive them to become employed. As well, there could be some unobservable and unquantifiable characteristics that make them employed full-time.

When alcohol use is held exogenous to the model, it retains its significant and positive effect on female full-time labour force participation. However, the estimate loses its significance for males. This implies that, for males, there is negative sample selection into drinking. That is, males who have above average (conditional on observable characteristics) tendencies to drink heavily also have above average tendencies to be unemployed.

When examining drinking decisions for men and women, it was found that labour market participation has a significant and positive effect on the likelihood of heavy drinking for females only. It is possible that the stress of being employed increases the likelihood of a woman being a heavy drinker.

Alternatively, there may be some characteristics that cause women to both be employed and be heavy drinkers. Employment has no significant effect on the male propensity to drink. The sex difference in the effect of alcohol on labour market participation can be partially explained by the discrepancy in employment decisions between sexes. That is, males are much more likely to be engaged in full-time employment than females, in part because of childbearing and child rearing activities. Extended absences from the workplace due to these activities may cause a woman stress when she does gain employment – hence the positive effect of participation on the propensity to drink.

As seen by the Hausman Test performed in Chapter Four, as well as through economic theory, heavy alcohol use and earnings, and heavy alcohol use and labour market participation, are simultaneously determined. The importance of accounting for these causal relationships was highlighted in Chapter Five, when significant sample selection was seen in the case that heavy alcohol use was treated as exogenous. That is, results from estimation when endogeneity is not accounted for can yield erroneous conclusions.

This thesis has provided evidence that heavy alcohol use has positive impacts on full-time labour market participation, and negative impacts on earnings. The former can be explained in part by unobservable heterogeneity – that is, individuals who drink heavily also tend to be employed full-time. The negative effect of heavy alcohol use on earnings is consistent with economic theory and with previous empirical literature.

Appendix A: Listing of the variables

employed	indicates full-time employment
perinc	personal income, in dollars
age25-29	indicates age group 25-29
age30-34	indicates age group 30-34
age35-39	indicates age group 35-39
age40-44	indicates age group 40-44
age45-49	indicates age group 45-49
age50-54	indicates age group 50-54
age55-59	indicates age group 55-59
hpress	indicates high blood pressure
heart	indicates heart disease
diab	indicates diabetes
resp	indicates respiratory illness
arth	indicates arthritis
hsdrop	indicates high school dropout
hsgrad	indicates high school graduate as highest level of education
collinc	indicates some college education, or diploma from community/ technical college
cgrad	indicates college graduate
nofaith	indicates no religious faith
religus	indicates religious beliefs and regular attendance at religious services
relcath	indicates Catholicism
married	indicates marital status
forborn	indicates birth outside of Canada
yngdrnk	indicates drinking prior to age 18
smoker	indicates regular smoking habits
Nfld	indicates residence in Newfoundland
PEI	indicates residence in Prince Edward Island
NS	indicates residence in Nova Scotia
NB	indicates residence in New Brunswick
Que	indicates residence in Quebec
Ont	indicates residence in Ontario
Man	indicates residence in Manitoba
Sask	indicates residence in Saskatchewan
AB	indicates residence in Alberta
BC	indicates residence in British Columbia
govt	government transfers received, in dollars
interest	investment and interest income received, in dollars
manager	indicates employment in a management position
prof	indicates employment in a professional position
admin	indicates employment in an administrative/secretarial position
service	indicates employment in the service industry
aggie	indicates employment in agriculture, fishing, and forestry
product	indicates employment in the production industry

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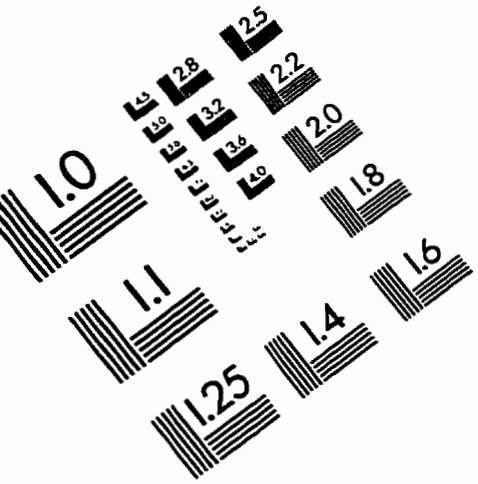
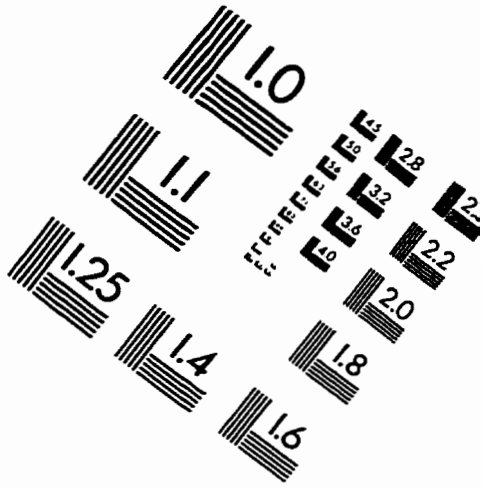
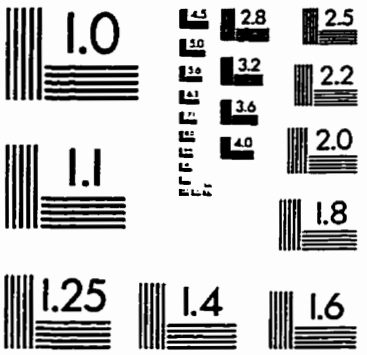
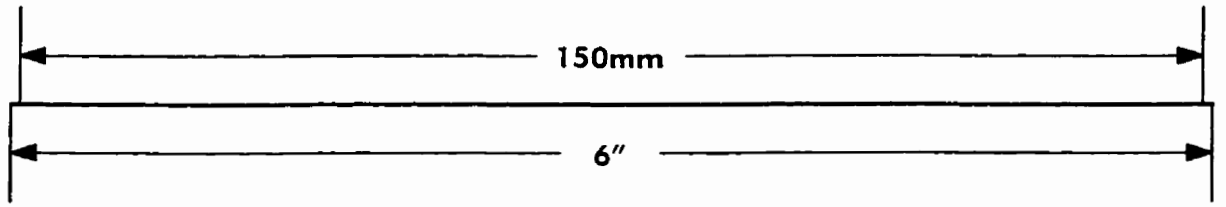
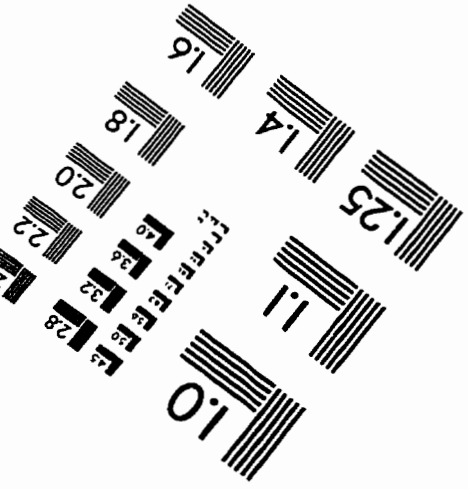
IMAGE EVALUATION
TEST TARGET (QA-3)

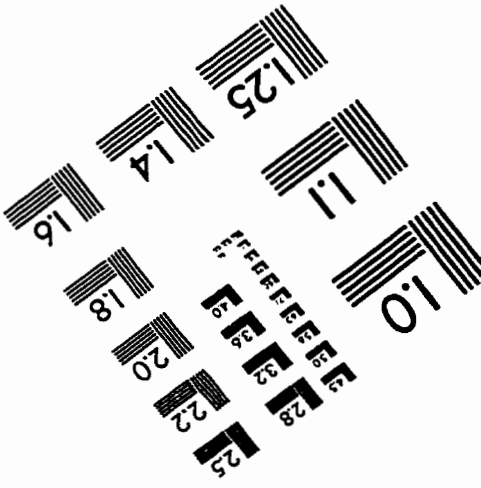












APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989