

The effect of smoking and drinking on wages in Sweden

Master Degree Project in Economics
D - Level, ECTS: 15 points
Spring term 2007

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Acknowledgement

While remaining fully responsible for any errors in this thesis, I am extremely thankful to my supervisor Per-Ola Maneschiöld, both in general, for opening my eyes to the exiting and wonderful world of economics, especially in the area of macroeconomics, and in particular, for his helpful comments and valuable advice in the process of writing this thesis.

Skövde, June 2007

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ABSTRACT

The aim of this thesis is to study the effect of smoking and drinking on wages in Sweden. The data used in this study is the Swedish Level-of-living survey (LNU) from 1991. A multinomial logit model and the marginal effects from the estimated model are used to study the effect of smoking and drinking on wages in Sweden. The empirical results conclude that medium drinking increases the probability of having a high income, i.e. there is a positive significant relationship between medium drinking and wages in Sweden. Also concluded from the empirical results is that there is not a significant relationship between smoking and wages in Sweden.

Keywords: wages; smoking; drinking; Sweden; marginal productivity; health; multinomial logit model; marginal effects; LR-test.

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1. Introduction

The wage of an individual is related to his or her marginal productivity, i.e. a low wage implies a lower marginal product of labour compared to the marginal product for a worker with a higher wage and vice versa. The marginal product of labour is also related to the level of education and how long the worker has been employed, i.e. the marginal productivity increases with skills. The relationship between the marginal product of labour and the level of education was first introduced in Becker (1964) and is called the human capital model. Becker found that human capital has a positive effect on wages. Also related to the marginal product of labour is health, e.g. smoking and drinking. Smoking is considered to be bad for an individual's health. Grossman (1972) found that wages and health are positively related. Hence, since smoking has a negative effect on an individuals' health, it may be the case that smoking has a negative effect on wages. Wages differ among people due to marginal productivity differences. This is something that many researchers have tried to explain using different variables that may explain these differences, such as age, gender, education, marriage, smoking and drinking habits, etc. Excessive drinking is not good for a person's health. When considering the effects of heavy drinking on the marginal product of labour, the heavier the level of drinking, the less effective is the level of marginal productivity, e.g. more time absent from work, or even less productive due to hangover.

Grossman (1972) showed that there exists a significant positive relationship between health and wages. The health of an individual can be seen as a combination of different factors, some of them are uncontrollable and others are controllable. For example an uncontrollable factor can be genetics and controllable factors can be smoking and drinking. Smoking and drinking are two factors/variables that are frequently discussed when talking about health issues. For example Peto et al. (1992, 1994) estimated smoking to be the major cause of premature death during the 1990's in developed countries. Heineck & Schwarze (2003) examine the effect of smoking on wages in Germany. The empirical results when using cross-sectional models show that smoking has a negative effect on wages. The empirical results when using a fixed-effect estimation show that there is a positive effect on wages for males, while there is no such effect for females. As most people know, there also exist health problems that are associated with heavy drinking such as liver damage, heart disease etc. In a report from 1999 by the American Council on Science and Health (ACSH), it is concluded

that people in their middle-ages or older who are considered to be medium drinkers have a lower rate of mortality compared to non-drinkers. This is due to the fact that there is a positive effect of moderate drinking on coronary heart diseases. For people prior to their middle-ages, this positive effect was not found, but according to the ACSH report medium drinking may reduce the risk of heart disease later in life for this group. It is also concluded that for people considered to be heavy drinkers, the risk of having heart disease later in life is increased. Heavy drinking also increases the risk of liver damage, high-blood pressure, alcohol-related heart diseases, and even cancer. In the ACSH report medium drinking is defined as not to consume more than two standard drinks per day for males up to the age of 65. For males over the age of 65 and for females of any age medium drinking is defined as not to consume more than one standard drink per day.¹ In Poikolainen (1995) and Goatcher (2002) the relationship between alcohol consumption and mortality is described to have a J-shape, i.e. non-drinkers have a higher rate of mortality compared to medium drinkers, and heavy drinkers have a higher rate of mortality compared to non-drinkers and medium drinkers. Further, it is concluded that medium drinking increases the lifespan for individuals, due to biologic mechanisms. However, there are both positive and negative effects of medium drinking. While medium drinking decreases the risk of having a coronary hearth disease, peripheral arterial disease, ischemic stroke, and type 2 diabetes, there are an increase in the risk of injuries, breast cancer, colorectal cancer and liver disease as discussed in Goatcher (2002).

The relationship between wages and alcohol consumption was first studied by Berger & Leigh (1988) followed by Mullahy & Sindelar (1991, 1993). Using data from United States for the period 1972-1973 Berger & Leigh (1988) estimated wage equations for non-drinkers and drinkers, separately. The empirical result concludes that drinkers have a substantial wage premium relative to non-drinkers. Mullahy & Sindelar (1991, 1993) concludes that wages and heavy drinking has a negative relationship. In previous studies such as Lye & Hirschberg (2004), Barrett (2002) and Van Ours (2004), the empirical results show that medium drinking is positively related to the wage. Why this is the case is not explained by anyone of them. One possible explanation could be that medium drinking can be seen as a social activity, i.e. participation in after work activities with other employees from the company. If a person is a non-drinker he or she is not as likely to participate in those activities and may be considered

¹ According to the ACSH report a standard drink is defined as: one 12-ounce can of beer or a 5-ounce glass of wine, or a mixed drink that contains 1.5-ounces of 80-proof spirits. All definitions mentioned here are assumed to be equivalent, when talking of the amount of alcohol.

to be unsocial or boring and thereby maybe subject to smaller wage increases relative to medium drinkers.

Given the results from previous studies, the main objective of this thesis is to investigate whether or not smoking and drinking have an effect on wages in Sweden. Also of importance is to examine if the amount of alcohol consumed matters, i.e. if the individual is a non-drinker, a medium drinker or a heavy drinker. The contribution to the existing research will be a similar study as previous studies, but with focus on Sweden, using data on Sweden from LNU (1991). As a limitation only males and females between the ages of 18 and 65 will be considered, since that is the “normal” age profile for workers in Sweden. A multinomial logit model and the marginal effects are used to estimate the effects of smoking and drinking on wages in Sweden.

The outline of this thesis is as follows: Section 2 presents a brief review of previous research. Section 3 presents a theoretical framework concerning all the aspects considered in the empirical component of the paper. Section 4 presents the econometric methodology used in this thesis. In section 5 the data is presented. The empirical results are presented in section 6 and the conclusions are presented in section 7.

2. Brief review of previous research

Research conducted with smoking as theme of central focus:

Heineck and Schwarze (2003) examine the effect of smoking on earnings in Germany using data from GSOEP (German Socio-Economic Panel 1998). Cross-sectional and longitudinal models are estimated for males and females respectively. Using cross-sectional models, the empirical results show that smoking has a negative effect on earnings for males. Using a fixed-effect estimation, the empirical results show an inverted effect on wages for males between 25 and 35 years compared to non-smokers, i.e. a positive effect of smoking on earnings. When examining female wages the conclusion is that smoking has no effect on wages.

Research conducted with alcohol consumption as theme of central focus:

Hamilton and Hamilton (1997) study the relationship between alcohol consumption and wages focusing on prime-age males using a multinomial logit choice model. Wage differences are then estimated for non-drinkers, medium drinkers and heavy drinkers. The empirical results show a positive significant relationship between wages and medium drinking, i.e. medium drinking yields higher wages than non-drinking. For heavy drinkers there is a negative significant relationship between wages and the level of alcohol consumed, i.e. heavy drinking yields lower wages than medium drinking. Also concluded is that heavy drinkers have flatter age-earnings profiles and receives a lower return on higher education compared to non-drinkers and medium drinkers.

Heien (1996) studies the relationship between alcohol consumption and earnings, trying to answer the question do drinkers earn less? The data in this study comes from the National Household Survey on Alcohol Use (NHSA) from 1979 and 1984. The data is divided into two groups; drinkers and non-drinkers. Non-drinkers are then divided into two sub-groups; abstainers and ex-drinkers. The empirical results conclude that there is a positive significant relationship between medium drinking and wages, and that medium drinkers earn more than non-drinkers and heavy drinkers.

Barrett (2002) examines the effect of alcohol consumption on earnings using NHS89 (The Australian National Health Survey for 1989-1990) and a multinomial logit choice model. The empirical results show that earnings increase with the level of alcohol consumption. However there is a significant positive wage premium for moderate drinkers and a wage penalty for heavy drinkers.

MacDonald and Shields (2001) study the effect of alcohol consumption on occupational attainment in England using OLS estimations and data from a Health Survey for England between 1992 and 1996. The empirical results conclude that there is a positive effect between alcohol consumption and mean occupational wages, and that this effect has an inverted U-shaped form, i.e. non-drinkers and heavy drinkers experience a negative effect on their wages compared to medium drinkers. On the other hand medium drinkers experience a positive effect on their wages. Hence, these results coincide with the recommendations on alcohol consumption by the government in order to maintain a good health.

MacDonald and Shields (2004) examines whether or not binge drinking affects employment in England using data from a Health Survey of England, and taking the endogenous relationship between binge drinking and the probability of being employed into account. The empirical results show that if an individual is considered to be a binge drinker the probability of being employed is estimated to be between 7 percent and 31 percent. The result suggests that there might be benefits for the labour market if public health policies are aiming at either preventing or treating problem drinking.

Wolaver (2002) examines the effects of heavy drinking in college on study efforts, Grade Point Average (GPA) and major choice. Using data from the 1993 College Alcohol Study and simultaneous equation models the effects mentioned above are estimated. The main results show that heavy drinking in college increases the effect of hours studied, but not the total effect on the GPA. The empirical results in this study also show that heavy drinking increases the probability of choosing a business major and decreases the probability of choosing engineering as a major. The choice of major and GPA decreases future weekly earnings as an effect of heavy drinking in college.

Research combining both smoking and alcohol consumption as central focus:

Lye & Hirschberg (2004) and Van Ours (2004) examine the effect of smoking and drinking on wages in Australia and in the Netherlands, respectively. Lye & Hirschberg (2004) conducted their study with special attention given to the nonlinearities and interactions of these activities on health suggested in medical literature. The empirical result when examining smokers shows no significant relationship between alcohol consumption and wages were found. The empirical result when examining non-smokers, moderate drinking are shown to be more beneficial in terms of wages compared to either abstainers or heavy drinkers. Only through simultaneous considerations of smoking and drinking their separate effects can be established. Van Ours (2004) concludes that moderate drinking has a significant positive effect and smoking has a significant negative effect on wages for males. On the other hand smoking and drinking has no significant effect on wages for females. It is concluded that the use of alcohol increases the wage for males, but that smoking negates the wage gain.

3. Theoretical framework

The labour market and the relationship between wages and the marginal product of labour is a central topic in macroeconomics and are outlined in e.g. Heijdra & Van der Ploeg (2002) and Burda & Wyplosz (2005). The wage an individual receives is related to his/her marginal productivity, i.e. a low wage implies a lower marginal product compared to the marginal product for a worker with a higher wage and vice versa. When the marginal product of labour (MPL) is equal to the real wage (w), i.e. when $MPL = w$ firms are assumed to maximize their profit. The marginal product of labour is calculated in the followed way: $MPL * P = W$ (nominal wage) $\Rightarrow (MPL * P) / P = W / P \Rightarrow MPL = w$ (real wage). Also related to the marginal product of labour is health, e.g. for example smoking and drinking. As mentioned in the introduction smoking and heavy drinking are considered to be bad for an individual's health. Hence, the link between the marginal product of labour and the health of an individual, i.e. for individuals that appear to be in a good health it is implied that they have a higher marginal productivity relative to individuals that don't seem to be in good health, and vice versa. Many researchers have tried to explain the relationship between wages and the marginal product of labour using different theories, e.g. the human capital model and the theory of efficient wages. The human capital model was first introduced in Becker (1964), where he shows that human capital has a positive effect on wages. An example of human capital is education, i.e. the marginal product of labour is also related to the level of education and how long the worker has been employed. Hence, the marginal product increases with skills. The theory of efficient wages is based on the basic hypothesis that the net productivity of workers is a function of the wage rate they receive. For example Stiglitz (1986) shows that there are at least five possible explanations for the relationship between wages and marginal productivity. The first explanation is that there is a direct relationship between the marginal product of labour and the level of nutrition, especially for lower levels of nutrition, i.e. small levels of nutrition have a negative effect on the marginal product of labour. The second explanation is labour turnovers, e.g. low wages imply a higher level of labour turnover, and vice versa. High labour turnovers come with negative consequences for firms, such as increased training costs for new workers and loss of productivity. Hence, productivity increases with skills. The third explanation is the presence of asymmetric information in the labour market, i.e. the characteristics of the workers. According to the theory of efficient wages a firm that pays high wages gets "good" quality workers and vice versa. The fourth

explanation, also discussed in Shapiro & Stiglitz (1984) is based on the third explanation, i.e. the problem with asymmetric information. Since the firm doesn't have all the relevant information about the workers' actions, there is a cost of monitoring the workers. Here firms can use unemployment as a disciplinary device, i.e. if the workers are not at least producing a marginal product that is equal to their wage they will get fired. Finally, the fifth explanation is that a workers performance, i.e. productivity depends on whether or not the worker feels that he or she is being treated fairly compared to other workers. Empirical evidence shows that there is a positive relationship between wages and MPL. To further understand this relationship better knowledge of such pertinent factors as education, experience, health and smoking and drinking habits and their affects on wages is needed.

4. Econometric methodology

The main objective of this thesis is to investigate whether or not smoking and drinking has an effect on wages in Sweden. That is, explaining the effect of an individual's choice of smoking and drinking on the wage he or she receives. The multinomial logit model is a choice model that makes it possible to use a dependent variable with more than two alternatives. This model is the most frequently used model when dealing with nominal outcomes and is outlined in Heineck (2004) and Maneschiöld & Haraldsson (2007) among other papers.² To give an example of this let w_i denote the i th individual's wage variable, which can then be observed as:

$$w_i = \begin{cases} 1 = \text{if the person has a low income} \\ 2 = \text{if the person has a medium income} \\ 3 = \text{if the person has a high income} \end{cases} \quad (1)$$

The multinomial logit model is then defined by the following equation.

$$\Pr(w_i = m | X_i, Y_i) = \frac{\exp(\boldsymbol{\alpha}'_m \mathbf{X}_i + \boldsymbol{\beta}'_m \mathbf{Y}_i)}{\sum_{j=1}^3 \exp(\boldsymbol{\alpha}'_j \mathbf{X}_i + \boldsymbol{\beta}'_j \mathbf{Y}_i)} \quad (2)$$

Where $m = 1, 2$ or 3 and $j = 1, \dots, m$, w_i denotes the observed outcome, $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ denotes a vector of coefficients, \mathbf{X} is a vector consisting of health variables, \mathbf{Y} is a vector consisting of all other explanatory variables such as education, work experience and other related background characteristics, etc, i.e. covariates. The coefficients are then estimated by maximum likelihood.

² Heineck (2004) and Maneschiöld & Haraldsson (2007) studies religious norms and labour supply of married women in Germany and Sweden, respectively, using a multinomial logit model.

When estimating a multinomial logit model it is required to choose a reference group with coefficients normalized to 0.³ Due to the requirement of a reference group, the coefficients from other groups should be compared to the said reference group. The reference group is then defined by the following equation.

$$\Pr(w_i = 0 | X_i, Y_i) = \frac{1}{\sum_{j=1}^3 \exp(\boldsymbol{\alpha}'_j \mathbf{X}_i + \boldsymbol{\beta}'_j \mathbf{Y}_i)} \quad (3)$$

Taking the 1st derivative of equation (2) with respect to X_z and holding all other variables constant, the given assumption that there is a change in a single covariate, e.g. X_z on the expected probability that w_i takes one of the probable values of the wage variable then defines the marginal effect of a continuous independent variable as:

$$\frac{\partial \Pr(w = m | X, Y)}{\partial X_z} = \Pr(w = m | X, Y) \left[\beta'_{zm} - \sum_{j=1}^3 \beta'_{zj} \Pr(w = j | X, Y) \right] \quad (4)$$

Given that there is a change from 0 to 1 in X_z , the marginal effect can be calculated as a discrete change in the expected probability and can be observed as:

$$\frac{\Delta \Pr(w_i = m | X, Y)}{\Delta X_z} = \Pr(w_i = m | Y, X, X_z = 1) - \Pr(w_i = m | Y, X, X_z = 0) \quad (5)$$

³ In this study the reference group is 2, i.e. medium income earners.

The log likelihood ratio test (LR-test) is used when comparing two models, where one of the models are estimated without restrictions and the other model is estimated with a restriction. Maximizing a function subject to a restriction will not lead to a larger maximum compared to maximizing a function subject to when there is no restriction. In Gujarati (1995) the LR-statistic is defined as:

$$\lambda = 2(LR_U - LR_R) \tag{6}$$

Where LR_U denotes the unrestricted log likelihood and LR_R the restricted log likelihood and given that the null hypothesis has a chi-squared distribution with J degrees of freedom. If the difference between LR_U and LR_R is small it is an indication of that the restrictions are correct.

5. Data

This section presents the data used in this thesis and includes a discussion about the data, such as where the data is collected from and challenges that might occur when using the data. This section also presents descriptive statistics of the variables of interest for this study.

The data is collected from the Swedish Level-of-Living Survey (LNU) conducted in 1991 and was distributed by the Swedish Social Science Data Service (SSD).⁴ LNU was first conducted in 1968, followed by surveys made in 1974, 1981 and 1991.⁵ LNU is based on a random sample of 1/1000 of the population in Sweden between the ages of 18 and 75. LNU uses a multi-dimensional approach that examines how individuals allocate their resources between for example income, health, education, family, etc. In the cross-sectional analysis data from the 1991 LNU survey is used, where 6710 adults answered the questionnaire.⁶ To be able to examine the effect of smoking and drinking on wages in Sweden it is necessary to exclude respondents that reported abnormal levels of hourly wages, respondents who didn't answer all questions and respondents that are not included in the labour force, i.e. males and females that is outside the age-range 18-65. After the limitations the sample was then reduced to 1302 observations.

Table 1 gives a short presentation of the basic characteristics of the variables used in this study in the form of descriptive statistics, such as means, standard deviations, minimum and maximum values for the variables of interest. The age variable indicates a mean of 38.1528 years of age with a standard deviation of 7.5685 years of age. The wage (hourly wage) variable indicates a mean of 83.0599 SEK per hour with a standard deviation of 29.1277 SEK per hour. The wage-range is 38 to 277 SEK per hour. The variable years of work experience shows a mean of 16.6659 years with a standard deviation of 8.2901. The years of work experience-range are 1 to 46 years.

⁴ www.ssd.gu.se

⁵ In 2000 a new survey was conducted, however it is not a complete set.

⁶ 2683 males and 2623 females answered the majority of the questions in the questionnaire, which gives a response rate of 79.1 percent.

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Table 1: Descriptive statistics of the variables used in the wage equation. N = 1302.

Variable	Description	Mean	Std.dev.	Min	Max
Age	Age of the respondent in years	38.1528	7.5684	19	60
Age squared/100	Age squared divided by 100	15.1288	5.8391	3.61	36
Wage	Gross hourly wage	83.0599	29.1277	38	277
Ln wage	Log of gross hourly wage	4.3677	0.2918	3.6376	5.6240
Gender	1 if the respondent is male	0.4747	0.4995	0	1
Years of education	Respondents years of education	12.0430	3.1046	0	34
Primary education	1 if the respondent has a primary education, i.e. 0-9 years of education	0.2081	0.4061	0	1
Secondary education	1 if the respondent has a secondary education, i.e. 10-12 years of education	0.4147	0.4929	0	1
Higher education	1 if the respondent has a higher education, i.e. 13 or more years of education	0.3771	0.4848	0	1
Marriage	1 if the respondent is married	0.9217	0.2688	0	1
Years of work experience	Respondents years of work experience	16.6659	8.2901	1	46
Smoking	1 if the respondent is smoking	0.3049	0.4605	0	1
Drinking	Respondents drinking profile	1.9355	0.3144	1	3
Non-drinker	1 if the respondent is a non-drinker	0.0837	0.2771	0	1
Medium drinker	1 if the respondent is a medium drinker	0.8971	0.3039	0	1
Heavy drinker	1 if the respondent is a heavy drinker	0.0192	0.1373	0	1
If children aged 0-5	1 if the respondent has any children aged 0-5 years	0.4631	0.4988	0	1
If children aged 6-8	1 if the respondent has any children aged 6-8 years	0.2588	0.4382	0	1
If children aged 9-12	1 if the respondent has any children aged 9-12 years	0.3333	0.4716	0	1
If children aged 13-17	1 if the respondent has any children aged 13-17 years	0.4270	0.4948	0	1
Big City area	1 if the respondent lives in a city with more than 250 000 inhabitants	0.2765	0.4474	0	1
City area	1 if the respondent lives in a city with more than 30 000 inhabitants	0.1951	0.3964	0	1
Urban area	1 if the respondent lives in an urban area, i.e. less than 30 000 inhabitants	0.5284	0.4994	0	1

Source: The Swedish Level-of-living survey 1991 and calculations by the author.

The decision to include a specific variable in this study is based on variables that is used frequently in previous studies or is assumed to have specific expected effect on an individual's wage. The age of an individual is assumed have a positive effect on the wage, i.e. the wage of an individual is assumed to increase with age. Years of education and years of work experience are assumed to have a positive effect on wages, due to the assumption that the marginal product of labour increases with skills as was discussed in section 3. Years of education is also used as a measurement of human capital. Being married or in a marriage-equivalent relationship is assumed to have a positive effect on wages. The two different health variables included in this study is smoking and drinking. Given the empirical results from

previous studies and the discussion of the link between wages, marginal productivity and the health of an individual in section 1 and 3, smoking is assumed to have a negative effect on an individual's wage. When considering different categories of drinkers, i.e. non-drinkers, medium drinker and heavy drinkers the expected outcome is that there is positive relationship between medium drinking and wages, and a negative relationship between non-drinking, heavy drinking and wages, i.e. a inverted U-shape. Having children is assumed to influence the wage of an individual in a negative direction, especially younger children. Including city size as an independent variable of wages is also of importance; due to that the fact that the size of a city also governs the size of the market place available for work opportunities it can be intuitively deduced that the smaller the size of the city, the lesser scope the individual has in developing a higher wage differential. Of further interest in determining variable specific influences on wages is an individual's drinking preferences. The variable drinking was created by combining three questions from the LNU questionnaire. The three questions were the following:

Question 1: Do you at any time drink wine, strong beer or liquor?

1. Yes
2. No

Question 2: Is it ever more than a glass or two?

1. Yes
2. No

Question 3: Does it happen that you get a hangover after drinking?

1. Yes, always
2. Yes, often
3. Yes, occasionally
4. No, never

Depending on how the respondent answered to the three questions above, the respondent is coded to be a non-drinker, a medium drinker or a heavy drinker. If a respondent answered no on the first question he or she is assumed to be a non-drinker. Respondents that answered yes on the first question, yes on the second question and yes, occasionally or no, never on the third question is assumed to be a medium drinker. Respondents that answered yes on the first question, yes on the second question and yes, always or yes, often on the third question is assumed to be a heavy drinker.

The result of the combination of the above variables presented is that individual's income earnings capacities will be limited to one of three levels. To define whether or not an individual is said to belong to a group of low income, medium income and high income earners, definitions for different income categories from the SCB are used.⁷ Low income is defined as having an hourly wage less or equal to 2/3 of the median income. High income is defined by individuals with the 20 percent highest hourly wage. Hence, medium income includes all levels of wages per hour between the limitations for low income and high income.

Table 2 presents a further description of the variables used in the wage equation. The aim of presenting a further description of the variables is to increase the understanding of the characteristics of the observations in the sample data.

Table 2: Descriptive statistics of the variables expressed as frequency and percent.

Variable	Frequency	Percent	Variable	Frequency	Percent	Variable	Frequency	Percent
Drinking			Education			Children in the ages 0-5		
Non-drinker	109	8.37	Primary education	271	20.81	Yes	603	53.69
Medium drinker	1168	89.71	Secondary education	540	41.47	No	699	46.31
Heavy drinker	25	1.92	Higher education	491	37.71	Total	1302	100.00
Total	1302	100.00	Total	1302	100.00	Children in the ages 6-8		
Smoking			Marriage			Children in the ages 9-12		
Smoker	397	30.49	Married	1200	92.17	Yes	337	25.88
Non-smoker	905	69.51	Not married	102	7.83	No	965	74.88
Total	1302	100.00	Total	1302	100.00	Total	1302	100.00
Gender			"Size of city"			Children in the ages 13-17		
Male	618	47.47	Big city	360	27.65	Yes	556	42.70
Female	684	52.53	City area	254	19.51	No	746	57.30
Total	1302	100.00	Urban area	688	52.84	Total	1302	100.00
			Total	1302	100.00			

Source: The Swedish Level-of-living survey 1991 and calculations by the author.

⁷ www.scb.se

- The majority of the respondents in this study are medium drinkers, followed non-drinkers and heavy drinkers with 89.71 percent, 8.37 percent and 1.92 percent, respectively.
- 30.49 percent of the respondents are smokers.
- 47.47 percent of the respondents are males and 52.53 percent are females.
- When considering the level of education, 20.81 percent of the respondents have a primary education, 41.47 percent has a secondary education and 31.71 percent has a higher education.⁸
- 92.17 percent of the respondents are married or in a marriage-equivalent relationship.
- The majority of the respondents live in an urban area, to be more exact 52.84 percent, 27.65 percent of the respondents in the sample live in a big city and 19.51 percent live in a city.
- 53.69 percent of the respondents have children in the ages 0-5, 25.88 percent have children in the ages 6-8, 33.33 percent has children in the ages 9-12 and 42.70 have children in the ages 13-17.

The correlation between the wage (ln wage) of an individual and smoking is -0.0685, i.e. an indication that there is a negative relationship between smoking and wages. When considering the wage of an individual and whether he or she is assumed to be a non-drinker or a heavy drinker there is also a negative correlation, -0.1422 and -0.0165, respectively, i.e. an indication that non-drinking and heavy drinking has a negative effect on an individual's wage. However in the case of medium drinking and wages, the correlation is 0.1370. Hence, this result gives an indication of a positive relationship between medium drinking and wages. The results from the correlation between the wage of an individual and his or her smoking and drinking habits are in line with the majority of the empirical results presented in previous

⁸ The mandatory pre-university school in Sweden is 9 years, which in this study is called primary education. The political declaration in Sweden after the 1997 reform is 12 years of pre-university education, and 11 years of pre-university education before the 1997 reform, but after the 1967 reform. In this study this level of education is called secondary education.

studies. However in this stage of this study it is too early to make any conclusions without further investigation. The correlation between the different variables is only used as an indication of what one could expect to be the outcome after estimating the multinomial logit model and the marginal effects.

6. Empirical results

This section presents the empirical results of the effect on wages of smoking and drinking in Sweden. First the results from the estimated multinomial logit model and the marginal effects related to the wage variable are presented and discussed. In the end of this section the results from the LR-test is presented.

Table 3: Results from the multinomial logit model, where the base category is a respondent with a medium income.

Variable	Wage profile	Low income	High income
Age		-0.1933 (0.1339)	0.2739** (0.1077)
Age squared/100		0.2870 (0.1812)	-0.2744 (0.1316)
Gender (1 if male)		-1.1052*** (0.3099)	1.8544*** (0.1831)
Secondary education		-0.8347** (0.2787)	0.4681** (0.2549)
Higher education		-1.3028*** (0.3354)	1.7618*** (0.2736)
Marriage		0.2566 (0.3801)	0.6279 (0.3903)
Years of work experience		-0.0910*** (0.0244)	0.0026 (0.0217)
Smoking		0.1947 (0.2463)	-0.1884 (0.1766)
Medium drinker		-0.8443** (0.3045)	1.0009** (0.3812)
Heavy drinker		-0.4065 (0.8339)	0.1907 (0.7186)
If children aged 0-5		0.2050 (0.3129)	-0.2198 (0.2147)
If children aged 6-8		0.0334 (0.2588)	-0.1635 (0.1815)
If children aged 9-12		0.7241** (0.2624)	0.0288 (0.1706)
Big City area		0.2478 (0.2667)	0.5933** (0.1795)
City area		0.0360 (0.3022)	0.3014 (0.2059)
Constant		3.1825 (2.4471)	-11.2048*** (2.2649)

Note: (a) The notation ***, **, and * denotes significance at the 1 percent, 5 percent and 10 percent

(b) Standard errors are presented in paranthesis with N = 1302.

Source: The Swedish Level-of-living survey 1991 and calculations by the author.

Table 4: Marginal effects of the multinomial logit model by wage category for males and females in Sweden 1991.

Variable	Wage profile	Low income	Medium income	High income
Age		-0.0109*	-0.0269*	0.0379**
		(0.0063)	(0.0145)	(0.0140)
Age squared/100		0.0152**	0.0235	-0.0387**
		(0.0085)	(0.0180)	(0.0172)
Gender (1 if male)		-0.0646***	-0.2035***	0.2681***
		(0.0134)	(0.0279)	(0.0255)
Secondary education		-0.0399**	-0.0305	0.0704*
		(0.0124)	(0.0363)	(0.0359)
Higher education		-0.0658***	-0.2164***	0.2822***
		(0.0136)	(0.0467)	(0.0461)
Marriage		0.0074	-0.0767**	0.0682*
		(0.0152)	(0.0369)	(0.0353)
Years of work experience		-0.0043***	0.0032	0.0011
		(0.0012)	(0.0029)	(0.0029)
Smoking		0.0107	0.0152	-0.0259
		(0.01224)	(0.0239)	(0.0222)
Medium drinker		-0.0632**	-0.0427	0.1059***
		(0.0274)	(0.0362)	(0.0267)
Heavy drinker		-0.0167	-0.0132	0.0292
		(0.0262)	(0.1083)	(0.1089)
If children aged 0-5		0.0111	0.0195	-0.0306
		(0.0146)	(0.0302)	(0.0282)
If children aged 6-8		0.0028	0.0187	-0.0214
		(0.0121)	(0.0245)	(0.0228)
If children aged 9-12		0.0372**	-0.0348	-0.0024
		(0.0155)	(0.0258)	(0.0231)
Big City area		0.0064	-0.0904**	0.0840**
		(0.0129)	(0.0290)	(0.0282)
City area		-0.0082	-0.0415	0.0424
		(0.0137)	(0.0318)	(0.0308)

Note: (a)The notation ***, ** and * denotes significance at the 1 percent, 5 percent and 10 percent level, respectively. (b) Standard errors are presented in paranthesis with N = 1302.

Source: The Swedish Level-of-living survey 1991 and calculations by the author.

The empirical results from the estimated multinomial logit model and the marginal effects are presented in table 3 and 4. In general these results are in line with previous research. However, several of the health variables included has produced different results to previous findings.

In the previous section smoking was hypothesised to have a negative effect on wages, due to the fact that smoking has a negative effect on the individual's health, which in turn is assumed to have a negative effect on the marginal product of labour. However, the empirical results from the multinomial logit model and the marginal effects show that the coefficient for the variable smoking is not statistically significant for any of the wage categories. This leads to the conclusion that smoking has no effect on wages in Sweden.

Consideration was also given to non-drinking, medium drinking and heavy drinking. It was hypothesised that non-drinking and heavy drinking would have a negative effect on wages while medium drinking was hypothesised to have a positive effect, i.e. an inverted U-shape. The empirical results concludes that medium drinking is significant for low income at the 5 percent level and for high income at the 5 percent level, i.e. being a medium drinker increases the probability of having a high income and decreases the probability of having a low income. That is medium drinking has a positive effect on wages in Sweden. This is in line with previous research. Hence, these results coincide with the recommendations on alcohol consumption by the government in order to maintain a good health.⁹ In the case of non-drinkers and heavy drinkers the effect on wages is not statistically significant, which leads to the conclusion that being a non-drinker or a heavy drinker has no effect on wages in Sweden. This is not in line with the majority of previous research.

When considering the age of an individual all three wage categories are significant. For the categories low and medium income the effect is significant at the 10 percent level and at the 1 percent level for high income, i.e. the probability of having a high income increases with age, or probability of having a low or medium income decreases with age. Hence, there is a positive relationship between the age of an individual and the wage he or she receives.

⁹ The government in England.

The gender variable is a dummy variable, where 1 = male and 0 = female. The results from the estimated multinomial logit model and the marginal effect suggest that being a man increases the probability of having a high income, and decreases the probability of having a low or medium income. This result is significant at the 1 percent level.

Having a secondary education, i.e. 10-12 years of pre-university education increases the probability of having a high income, and decreases the probability of having a low income. Medium income is not significant; however the sign of the estimated coefficient is negative, which can be seen as an indication showing that the probability of having a medium income if the respondent has a secondary education is decreased. Having a higher education, i.e. more than 13 years of education increases the probability of having a high income and decreases the probability of having a low or medium income. This is significant at the 1 percent level. The different levels of education discussed in this section are compared to having a primary education, i.e. 0-9 years of pre-university education.

Being married or in a marriage-equivalent relationship is significant at the 5 percent and the 10 percent level for medium income earners and high income earners, respectively. That is being married or in a marriage-equivalent relationship increases the probability of having a high income and decreases the probability of having a medium income. For low income the estimated coefficient is not significant, however the sign of the coefficient is negative, which can be seen as an indication of being not married increases the probability of having a low income. Recall that this is not statistically significant.

Years of work experience for low income earners is significant at the 1 percent level, which means that, the more years of work experience a person have, the probability of having a low income decreases. For medium and high income earners the estimated coefficients are not significant, but the signs of their coefficients are positive, i.e. an indication of that as the number of years or work experience increases so does the probability of having a medium or high income. However, this is just an indication since they are not statistically significant. This result is in line with previous research and the discussion about marginal productivity increases with skills in section 1 and 3.

Having children in the ages of 9-12 years of age increases the probability of having a low income. This is significant at the 5 percent level, i.e. there is a negative relationship between having children in the ages of 9 to 12 years of age and the wage of an individual. When considering having children in other ages, especially children in younger ages, the empirical

results don't support the hypothesis outlined in the previous section, i.e. having children in younger ages are assumed to have a negative relationship to the wage of an individual.

Concerning the size of city an individual lives in, the empirical results concludes that living in a big city, i.e. a city with more than 250 000 inhabitants increases the probability of having a high income and decreases the probability of having a medium income. This is significant at the 5 percent level. In general the labour market is more diversified in larger cities compared to smaller cities, which increases the probability of finding a new job in the same sector. To give an example; suppose that you are living in a small city and work as an accountant and that this is the only company within your specific area of interest, i.e. the company you work has monopsony power. Due to the monopsony situation it is difficult to find a new job in the area of interest or to increase your wage. On the other hand; suppose that you live in a larger city and has the same job as in the previous example, it is not as likely that the firm has monopsony power; instead there will be more competition. So, the probability of finding a new job in your area of interest is higher compared to the previous example. Hence, due to that the level of competition in the market increases so does the opportunity of finding a new job, and thereby the possibility of having a wage increase.

The LR-test was used to further test the predictability of the model.¹⁰ As specified in the section econometric methodology the LR-test is used to compare two models, where one of the models is estimated without restrictions and the other model is estimated with a restriction. The LR-test for each variable is conducted by restricting the stated variable to equalize zero.¹¹ The results from the LR-test are presented in table 5. The results from the LR-test show that the LR-test statistics for the explanatory variables that are restricted to be equal to zero are significant at the 1 percent level for all variables included in the model.

¹⁰ The LR-test is one of many measures of fit for the selected model.

¹¹ When conducting the LR-test for each variable included in the model, the variable education consist of different dummies for education, i.e. primary education, secondary education. The variable drinking consist of different dummies for drinking, i.e. non.-drinking, medium drinker and heavy drinker. For the variable children, where children is represented by different "children" dummies, i.e. children in the ages of 0-5, children in the ages of 6-8, children in the ages of 9-12 and children in the ages 13-17. The same thing holds for the variable size of city, where size of city is represented by different dummies for size of city, i.e. big city area, city area and urban area.

Table 5: The LR-test by restricting the stated variable to equalise zero.

Likelihood Ratio-test	Log likelihood restricted model	Number of restrictions	LR-test statistics
Age	-818.3195	26	12.2148***
Gender	-884.2551	28	144.0860***
Education	-856.0111	26	87.5980***
Marriage	-813.8013	28	3.1784***
Experience	-819.1080	28	13.7918***
Smoking	-813.1567	28	1.8892***
Drinking	-821.3073	26	18.1904***
Children	-817.0097	24	9.5952***
Size of the city	-817.9671	26	11.5100***

Note: (a) The notation ***, ** and * denotes significance at the 1 percent, 5 percent and 10 percent level, respectively. (b) The log likelihood for the unrestricted model is -812.2121

7. Conclusions

This thesis aims to investigate the effect of smoking and drinking on wages in Sweden. The wage an individual receives is related to his or her marginal productivity, i.e. a low wage implies a lower marginal product of labour compared to the marginal product for a worker with a higher wage and vice versa. The marginal product of labour is also related to the health of an individual, the level of education how long the worker has been employed, i.e. the marginal productivity increases with skills. Grossman (1972) concludes that there is a negative relationship between wages and the health of an individual. Smoking and heavy drinking is assumed to have a negative effect on an individual's health, and thereby a negative effect on marginal productivity, which in turn has a negative effect on wages.

To study the effect on wages of different variables, such as age, education, gender, smoking and drinking, etc. data from the Swedish Level-of-living survey (LNU) from 1991 is used. The econometric method used in this study is a multinomial logit choice model and the marginal effects from the estimated model are the used to study the effect of smoking and drinking on wages in Sweden. The empirical results conclude that medium drinking increases the probability of having a high income, i.e. there is a positive significant relationship between medium drinking and wages in Sweden. This is in line with previous research such as Barrett (2002), Lye & Hirschberg (2004) and Van Ours (2004). When considering non-drinking and heavy drinking, the empirical results suggest that there is no significant relationship between non-drinking or heavy drinking and wages in Sweden. Also concluded from the empirical results is that there is not a significant relationship between smoking and wages in Sweden.

Some of the results empirical results were unexpected. Especially, the findings that smoking and heavy drinking do not have an effect on wages in Sweden. Intuitively, since smoking and heavy drinking have a negative effect on an individual's health and marginal productivity, one would expect a negative relationship between smoking, heavy drinking and wages. Another unexpected result was that having children in the ages of 9-12 years of age has a negative relationship on the individual's wage. Intuitively, the negative effect would be expected for having children in younger ages, due to a larger need to stay home with sick children. The majority of the empirical results are in line with previous research, such as the positive relationship between the wage of an individual and the age, level of education, years of work

experience, size of city and gender. The result showing that being a man increases the probability of having a high income and decreases the probability of having a low or medium income does not come as a surprise, due to that it common knowledge that wages differ between males and females.

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