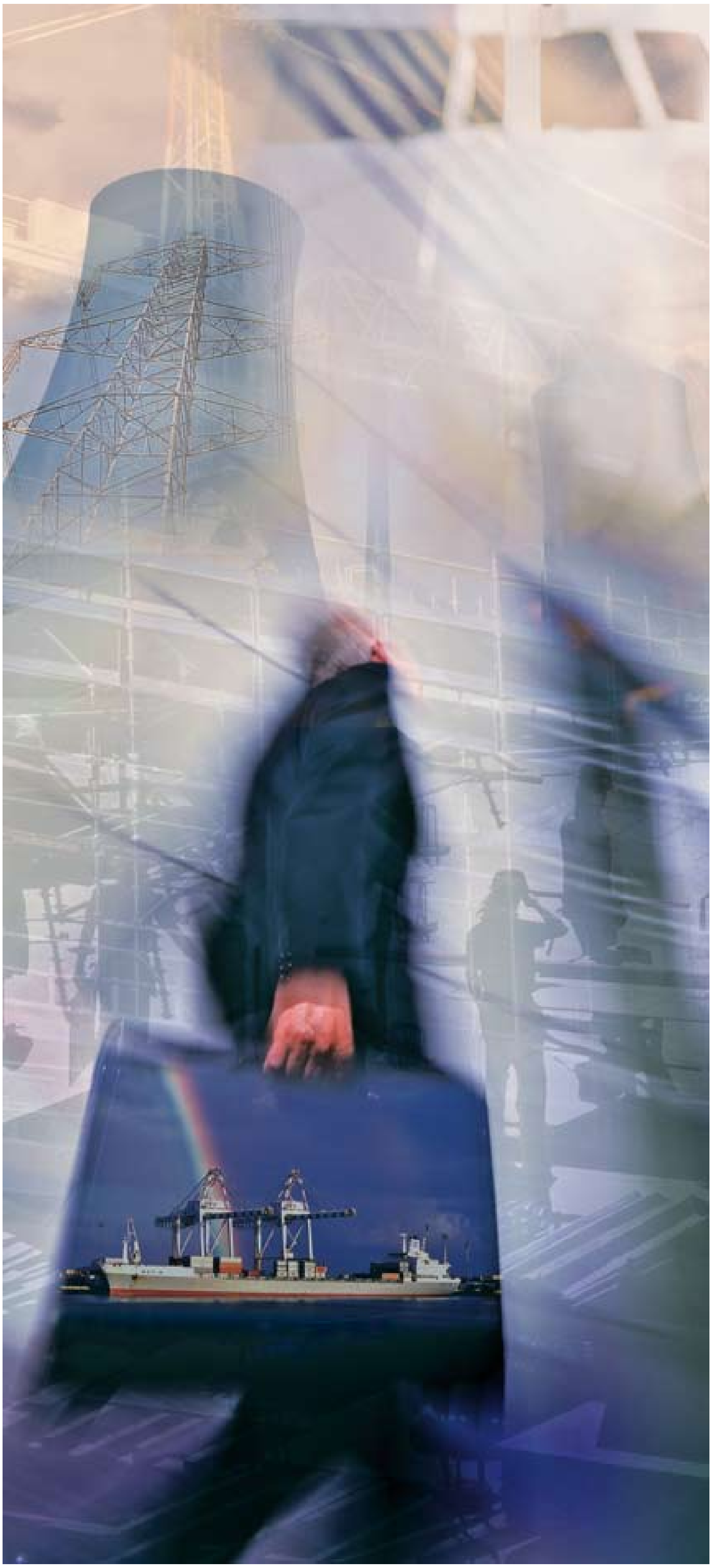

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The Economic Society of Australia warmly welcomes you to the Gold Coast, Queensland, Australia for the 37th Australian Conference of Economists.

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This year we have a large number of papers dealing with Infrastructure, Central Banking and Trade.

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The Paper following forms part of - *Proceedings of the 37th Australian Conference of Economists*
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A Re-evaluation of the Relationship between Drinking and Earnings

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November 2007

Abstract:

A number of papers have reported a link between the consumption of alcohol and wages earned. This relationship has been found to be positive for low to moderate levels of alcohol but then turns to negative as the level of consumption reaches a certain level of consumption. Although this relationship differs between men and women and it also appears to be mitigated by other activities such as smoking very little of this research attempts to make inferences concerning the location of the point of inflection - the level of consumption where the negative aspects begin to dominate the relationship. Although this inflection point as been defined and in fewer cases a confidence interval has been constructed (for example MacDonald and Shields, 2001). In this paper we use the published evidence to make inferences concerning the turning points found in these studies.

The aim of this study to determine whether earlier studies' results can be used to draw conclusions as to the nature of the turning point for the relationship between alcohol consumption and earnings. Alternatively, it may be that these studies do not have sufficient information to draw inferences about the level of alcohol consumption at which the down turn occurs. The rationale for the beneficial aspects of alcohol consumption is mainly due to conjecture about the socializing aspects of drinking and the allusion to the medical literature.

The analysis we use is the Fieller solution for the construction of confidence intervals of the ratio of means. We can use the published results to infer sufficient information to apply the traditional Fieller method when the models in use are quadratic in the level of alcohol.

1. INTRODUCTION

Multiple studies in medical research (Klatsky et al. 1992; Rimm et al. 1991; Jackson et al. 1991; Razay et al. 1992; DeLabry et al. 1992; Coate, 1993) describe a ⋃-shaped or J-shaped relationship between alcohol consumption and risk of death from all causes. This implies that non-drinkers and heavy drinkers have an increased risk of death compared with moderate drinkers as illustrated in Figure 1. This association is largely due to lower death rates from coronary heart disease among moderate drinkers. Numerous studies have indicated that drinking in small to moderate amounts decreases the risk of dying from coronary heart disease by almost one third (Klatsky 2003).

In addition, there have been a number of studies that examine the relationship between alcohol consumption and earnings for those individuals with a relatively stable employment pattern. Many of these studies claim to find an inverse ⋃-shaped relationship exists between alcohol use and job performance with light or moderate alcohol positively related to workplace performance compared to abstinence and heavy drinking. This is illustrated in Figure 1.

There are three main justifications for the existence of such a relationship between alcohol consumption and earnings:

1. Improved health may lead to reduced absenteeism from the workplace and increased productivity which may generate greater promotional opportunities and hence wages. Using workers from the Netherlands, Vasse et al (1998) found that when stress was present abstinence increased the risk of sickness absence compared with moderate drinking (defined as < 21 glasses per week for men and <14 glasses per week for women). This is illustrated in Figure 2 (see Vasse 1998, pg. 240).

Figure 1: Relationship between alcohol consumption and risk of death from coronary heart disease and alcohol consumption and earnings.

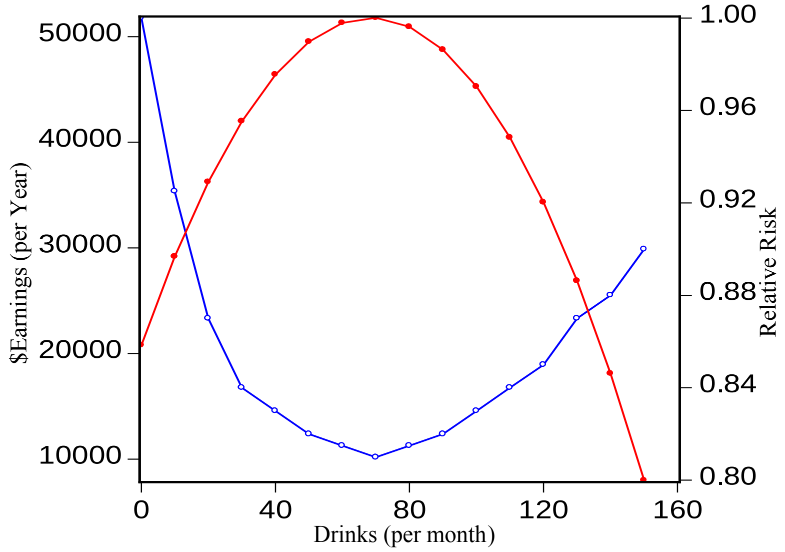
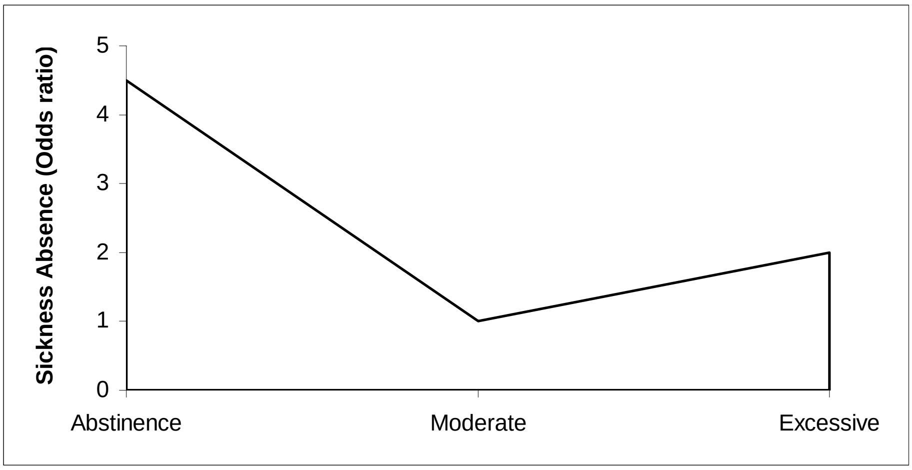


Figure 2: Association between Alcohol Consumption and Sickness



2. The increased psychosocial benefits such as relaxation, stress reduction, mood elevation, and increased sociability obtained from moderate alcohol consumption. A report by the UK Mental Health Foundation (2006) suggests that among daily drinkers (about 5 million people) alleviation of anxiety and depression is cited as a common reason for drinking.

3. The time spent consuming alcohol with work colleagues enables the development of informal mechanisms such as "*networking*" through additional social time spent with colleagues and this may also act as a "*signal*" to senior members of staff regarding motivation and commitment to job.

The papers that relate alcohol to earnings under review in this survey are of two types. First we consider those that specify an earnings model where the amount of alcohol consumed is included in the model using a quadratic form. Then we consider those that use alternative functional forms.

The following papers use the quadratic specification for alcohol consumption.

French, M. and G. Zarkin (1995), Heien, D. (1996a) Heien, D. (1996b) MacDonald, Z. and M. Shields (2001), Tekin, E. (2004) Lye, J.N. and J. Hirschberg (2004)

These papers use alternative specifications that do not necessarily result in an extremum value.

Auld, M. C. (2005) Peters, B. (2004) Van Ours, J. (2004)

2. MODEL SPECIFICATION

The basic model employed by the researchers in this work is of the form:

$$W_i = \gamma_0 + \gamma_1 D_i + \gamma_2 X_i + \beta_1 A_i + \beta_2 A_i^2 + u_i \qquad (1)$$

where W is the natural logarithm of wages for individual i

D is a vector of demographic variables (gender, race, marital status etc), X is a vector of human capital variables (experience, education, health status occupation, etc,), A is a measure of alcohol consumption, and u represents the error term.

A range of estimation techniques have been used including OLS, and IV methods to account for the possibility that drinking may not be exogenous to wages. In addition a series of fixed effects may be included to control for unobserved heterogeneity.

The value of alcohol consumption (*A*) at the extremum is $\theta = \frac{-\beta_1}{2\beta_2}$. θ is either the maximum (when $\beta_2 < 0$) or the minimum (when $\beta_2 > 0$). The usual estimate of the extremum is $\hat{\theta} = \frac{-\hat{\beta}_1}{2\hat{\beta}_2}$, where $\hat{\beta}_1$ and $\hat{\beta}_2$ are the estimates of β_1 and β_2 respectively. Once $\hat{\theta}$ is determined it is necessary to establish if this is a relevant value in the context of the application (i.e. whether $\hat{\theta}$ falls within the range of values that the regressor can take). Although all quadratic functions have an extremum value, $\hat{\theta}$ may be too distant from the range of the regressor to be meaningful in the context of the analysis. In addition, since the estimate of the extremum point ($\hat{\theta}$) is a random variable, confidence intervals can be used to determine if it is a feasible value for *A*.

3. CONFIDENCE INTERVALS FOR THE VALUE OF THE EXTREMUM

The confidence bounds for the extremum of a quadratic relationship can be estimated in a number of different ways (see Hirschberg and Lye 2004 for a number of alternatives). The most common methods are the application of the delta method and the Fieller method.

3.1 The Delta Method

The estimated variance of $\hat{\theta}$ based on the Delta method is given by:

$$\tfrac{1}{4}\begin{bmatrix}\left(\frac{-1}{\hat{\beta}_2}\right) & \left(\frac{\hat{\beta}_1}{\hat{\beta}_2^2}\right)\end{bmatrix}\begin{bmatrix}\sigma_1^2 & \sigma_{12}\\ \sigma_{12} & \sigma_2^2\end{bmatrix}\begin{bmatrix}\left(\frac{-1}{\hat{\beta}_2}\right)\\ \left(\frac{\hat{\beta}_1}{\hat{\beta}_2^2}\right)\end{bmatrix} = \frac{\sigma_1^2\hat{\beta}_2^2 - 2\hat{\beta}_1\hat{\beta}_2\sigma_{12} + \hat{\beta}_1^2\sigma_2^2}{4\hat{\beta}_2^4} \qquad (2)$$

where σ_1^2 and σ_2^2 are the variances of $\hat{\beta}_1$ and $\hat{\beta}_2$ and σ_{12} is their covariance. A $100(1-\alpha)$% confidence interval for θ is given by:

$$\hat{\theta} \pm t_{\alpha/2}\sqrt{\frac{\hat{\sigma}_1^2\hat{\beta}_2^2 - 2\hat{\beta}_1\hat{\beta}_2\hat{\sigma}_{12} + \hat{\beta}_1^2\hat{\sigma}_2^2}{4\hat{\beta}_2^4}} \qquad (3)$$

where $t_{\alpha/2}$ is the appropriate critical value with an $(\alpha/2)\%$ level of significance and $\hat{\sigma}_1^2, \hat{\sigma}_2^2$ and $\hat{\sigma}_{12}$ are the estimated values of σ_1^2, σ_2^2 and σ_{12}, respectively.

3.2 The Fieller Method

The Fieller method (Fieller 1932, 1954) provides a general procedure for constructing confidence limits for statistics defined as ratios. A $100(1-\alpha)\%$ confidence interval for θ is determined by solving the quadratic equation $a\theta^2 + b\theta + c = 0$, where

$$a = 4\hat{\sigma}_2^2\left(\hat{t}_2^2 - t_{\alpha/2}^2\right) \quad b = 4\left(\hat{\beta}_1\hat{\beta}_2 - t_{\alpha/2}^2 r\hat{\sigma}_1\hat{\sigma}_2\right) \text{ and } c = \hat{\sigma}_1^2\left(\hat{t}_1^2 - t_{\alpha/2}^2\right), \tag{4}$$

where $\hat{t}_1 = \hat{\beta}_1/\hat{\sigma}_1$ and $\hat{t}_2 = \hat{\beta}_2/\hat{\sigma}_2$ and r is the correlation between $\hat{\beta}_1$ and $\hat{\beta}_2$. If $\hat{t}_2^2 > t_{\alpha/2}^2$ there are two real roots and one can construct a finite confidence interval. This condition corresponds to rejecting $H_0 : \beta_2 \neq 0$ when α is the level of significance (Buonaccorsi 1979). In addition to the finite interval case, the resulting confidence interval may be the complement of a finite interval ($b^2 - 4ac > 0$, $a < 0$) or of the whole real line ($b^2 - 4ac < 0$, $a < 0$).

The usual practice is to present delta standard errors and corresponding confidence intervals as these are widely available in statistical packages (see i.e. MacDonald and Shields 2001). However, Monte Carlo simulations indicate that the Fieller-based methods work reasonably well under a range of assumptions including departures from normality however the delta-based method is a consistent poor performer and often underestimates the upper limit of the intervals (see Hirschberg and Lye 2004). In the analysis that follows we estimate both the delta and Fieller method intervals for previously published studies.

4. COMPARISON

Summary of Papers

Table 1 reports an overview of the papers that have used a quadratic functional form to define the relationship between earnings and alcohol consumption. Only 2 cases do not have negative signs on the quadratic term, thus not indicating an inverse $\cup$ - shape. The t-statistics associated with the coefficient of the quadratic term vary widely from a minimum absolute value of 0.5 to a maximum absolute value of 10.17. However, in the majority of cases one can reject the null hypothesis that the coefficient of the quadratic term is equal to 0 at the 5% level of significance.

Table 1: Summary of Papers

Papers	**Data**	**Model type**	$\hat{\beta}_1$	$\hat{\beta}_2$
French and Zarkin(1995)	Uses a sample of randomly selected employees at 4 worksites.	Full Effect – Unbounded Model	5.44x10^{-5} (0.76)	-4.22x10^{-8} (-2.12)
		Direct Effect-Unbounded Model	6.71x10^{-5} (1.12)	-3.99x10^{-8} (-2.69)
		Full Effect – Bounded Model	1.61x10^{-4} (1.81)	-1.31x10^{-7} (-2.12)
		Direct Effect-Bounded Model	9.7210^{-5} (1.63)	-5.56x10^{-8} (-2.25)
Hein (1996 a,b)	Uses data from the National Household Survey on Alcohol Use (NHSA) for 1979 and 1984 and data from Quality of Employment Survey(QES)	1979-NHSA OLS	70.62 (3.4)	-0.454 (-3.6)
		1979-NHSA NL3SLS	332.9 (2.2)	-3.1 (-2.3)
		1984 – NHSA OLS	48.54 (3.2)	-0.235 (-2.6)
		1984 – NHSA NL3SLS	128.2 (2.4)	-0.61 (-2.6)
		QES– OLS	75.4 (3.4)	-0.55 (-2.3)
MacDonald and Shields (2001)	Uses samples of employees from the Health Survey for England between 1992 and 1996	OLS - males OLS - females	0.0033 (11.83) 0.013 (2.06)	-0.000038 (-10.17) -0.00004 (-6.27)
		IV-1 - males IV-1 – females	0.0278 (2.45) 0.0273 (2.77)	-0.000519 (-2.64) -0.0005 (-2.02)
		IV-2 - males IV-2 - females	0.0107 (1.74) 0.0295 (1.82)	-0.00026 (-2.58) -0.001063 (-2.38)
		IV-3 – males IV-3 - females	0.0103 (2.81) 0.0136 (3.65)	-0.000144 (-2.52) -0.000286 (-3.11)
Tekin (2004)	Uses data from Russia Longitudinal Monitoring Survey between November 1994-December 2000	Cross-Section – males	0.075 (1.786)	-0.021 (-1.50)
		Cross-Section – females	0.081 (1.688)	-0.010 (-2.00)
		Fixed Effects – males	0.012 (1.714)	0.001 (0.50)
		Fixed Effects – females	0.023 (1.643)	-0.011 (-1.375)
Lye and Hirschberg (2004)	Uses Data from the 1995 Australian National Household Survey	Males – smokers	-0.001163 (-0.817)	0.000003 (1.057)
		Males – non-smokers	0.005659 (3.374)	-0.000009 (-2.321)

1. t-statistics in parentheses.
2. French and Zarkin (1995) *A* measures the total number of drinks had during past year."Full" -no human capital variables included in estimation."Bounded" – uses bounded influence estimation to account for outliers. OLS estimation used.
3. Heien (1996a,b) *A* measures the number of drinks per month. Uses OLS and Non-linear Three Stage Least Squares (NL3SLS) using a large number of religious preference variables as instruments
4. MacDonald and Shields (2001) *A* measures the number of units of alcohol consumed per week where 1 unit of alcohol equals 8 grams of ethanol. Uses OLS and 3 IV estimators. IV-1 uses binary indicators for long-term non-acute illnesses; IV-2 uses binary indicato for whether or not the interviewee's mother or father smoked and IV-3 uses binary indicators based on individual's self-assessment on how much they drink
5. Tekin (2004) Ln(*A*+1) is variable used where *A* measures ethanol consumed in grams last week.

6. Lye and Hirschberg (2004) *A* is measured as the mls of Alcohol consumed per week.
IV used where instruments include country of birth, total exercise time, body mass index and state dummy variables

4.0 Comparison Across Papers

In order to compare across these studies we need to find the equivalence of the definition of a standard drink as used in each study. The definition of a standard drink varies across countries. Official *drinks* or *units* generally using the International Centre for Alcohol Policies (ICAP) definitions contain between 8 grams and 20 grams of pure ethanol.

Table 2: Standard Units of Alcohol

Standard drink/unit size(grams of ethanol)	Country
8.00	UK
9.90	Netherlands
10.00	Australia, NZ, Poland, Spain
11.00	Finland
12.00	Denmark, France, Italy, South Africa
13.60	Canada
14.00	Portugal, USA
19.75	Japan
20.00	Austria

In addition to the variation in the definition of a standard drink there are also variations in the definition of moderate or heavy drinking. Table 3 summarizes the definitions of drinking intensity as used in the different studies. .

Table 3: Definitions of Drinking Intensity: as defined in papers

French and Zarkin (1995) Randomly selected employees at 4 worksites in US.	**Heien (1996b) Data from NHSA and QES**	**MacDonald and Shields(2001)[1] 1 std drink=8 grams of ethanol Data from Health Survey for England**		**Lye and Hirschberg (2004)[2] 1 std drink=10 grams of ethanol Data from Australian National Household Survey**	
Men/Women	Men/Women	Males/per week	Females/per week	Males/per week	Female/per week
Moderate Approximately 2 drinks per day	*Moderate* 2-3.5 drinks per day	*Light* 1-7 *Light-Mod* 8-21 *Mod* 22-43 *Mod - Heavy* 44-64 *Heavy* 65-86 *Very Heavy* > 86	*Light* 1-4 *Light - Mod* 5-14 *Mod* 15-29 *Mod-Heavy* 30-44 *Heavy* 45-59 *Very Heavy* > 59	*Light* < 28 *Mod* 28-42 *Heavy* > 42	*Light* < 7 *Mod* 7-14 *Heavy* > 14

Notes:
1. MacDonald and Shields (2001) defined categories using fractions and increments of "*Health of the Nation*" alcohol consumption targets.
2. Lye and Hirschberg (2004) use definitions based on the three categories of relative alcohol used by the Australian Bureau of Statistics (1996). Converted to standard drinks per week using relationship 1 standard drink = 12.5 ml.

In addition, each country publishes guidelines for recommended drinking levels which are listed below in Table 4. The definitions in Tables 2-4 will be used later in the paper to make conversions so that the results are both comparable across the papers and with the medical literature

Table 4: Official Drinking Guidelines from Government bodies and medical literature[1]

Country	Source	Men	Women
Australia[2] 1 unit = 10 grams ethanol	National Alcohol Strategy 2006-2009 *www.alcohol.gov.au*	Long-term[2] *Low Risk* ≤ 4 units/ per day ≤ 28 units /per week *Risky* 5-6 units / per day 29-42 units / per week *High Risk* ≥ 7 units/per day ≥ 43 units /per week	Long term *Low Risk* ≤ 2 units/per day ≤ 14 units /per week *Risky* 3-4 units /per day 15-18 units /per week *High Risk* ≥ 5 units/per day ≥ 29 units /per week
United Kingdom[3] 1 unit = 8 grams ethanol	Department of Health *www.ah.gov.uk* Alcohol in moderation *www.drinkingandyou.com*	3-4 units/day, not to exceed 21 units/week	2-3 units/day, not to exceed 14 units/week
US 1 unit = 14 grams ethanol	Alcohol in moderation *www.drinkingandyou.com*	*Moderate* ≤ two drinks a day	*Moderate* ≤ one drink a day
	Klatsky (2003)	*light/moderate* up to 2/per day *heavy* 3+/per day	*light/moderate* up to 1/per day *heavy* 2+/per day

1. Drinking guidelines are lower for women than for men because women achieve higher blood alcohol levels than men at an equivalent amount of alcohol. This difference is mainly due to gender differences in the distribution and metabolism of alcohol in the body.
2. Guidelines are often given on a daily rather than weekly basis, as you should not 'save up' units and drink heavily at the weekends.
3. Long term is defined as risk to people's health and social well-being

5.0 Turning Point and Confidence Intervals

For each specification reported in the papers the estimated value of the extremum is calculated and the corresponding 95% Confidence Intervals are calculated using both the Delta and Fieller approach and are reported in Table 5. In the majority of cases the Fieller upper bound is larger than the Delta upper bound. The confidence intervals are wide. There are 7 cases for which the lower bound of the Fieller interval is negative and the upper bound generally falls well above the definition of the moderate range. In 13 cases the lower bound of the Fieller interval is greater than 0. Of those 11 are well within the light and moderate defined categories. This indicates that there may be a positive effect of alcohol but it is small and plateaus quickly. Overall there is not much evidence of an inverse ⋃ shape however due to the use of different measures in each paper cross-country comparisons are not possible.

Table 5: Turning Point and Confidence Intervals (units vary by study)

Paper	Model	$\hat{\theta}$	Delta Confidence bounds – 95%		Fieller Confidence bounds – 95%	
			Lower bound	Upper bound	Lower bound	upper bound
French & Zarkin (1995)[1] Std Drinks per day	Full – UB	1.77	-1.57	5.10	-27.91	4.35
	Direct – UB	2.30	-0.24	4.85	-5.83	4.01
	Full - B	1.68	0.74	2.63	-0.66	3.46
	Direct – B	2.40	0.65	4.14	-2.02	5.26
Heien (1996 a, b)[2] Std Drinks per day	1979-OLS	2.78	0.57	4.98	1.10	6.68
	1979-IV	1.92	-0.45	4.28	0.32	8.54
	1984-OLS	3.69	0.11	7.27	1.22	16.06
	1984-IV	3.75	-0.41	7.92	0.66	16.46
	QES	2.45	-0.07	4.96	0.84	17.30
MacDonald & Shields (2001)[3] Units per week	OLS- males	43.42	36.12	50.72	36.79	51.76
	IV1- males	26.78	4.36	49.20	6.92	83.17
	IV2 - males	20.58	-2.83	43.98	-3.63	74.07
	IV3 - males	35.76	10.50	61.03	14.76	112.66
	OLS - fem	40.00	31.55	48.46	33.00	51.32
	IV1 - fem	27.30	6.95	47.66	12.54	507.00
	IV2 - fem	13.88	-3.76	31.51	-1.23	77.87
	IV3 - fem	23.78	10.63	36.92	13.15	50.74
Tekin (2004)[4] Drinks per week	CS – males	0.5	0.3	1	0.4	∞
	CS – fem	6	2	15	-0.1	8
	Fixed – fem	0.2	0.1	0.3	0.2	∞
Lye& Hirschberg (2004)[5] Std drinks per week	Nonsmokers	25.15	17.42	32.88	20.89	83.11

1. Reported t-stats for turning point based on delta standard errors. This was used to compute *r*.
2. Used reported F-statistics to approximate value of *r*.
3. Used reported delta standard errors to compute *r*.
4. Approximated r=-0.99. Obtained using reported F-statistics
5. Based on own calculation.

6.0 A Cross-Study Comparison and the Relationship to the Medical Literature

A number of meta-analyses have been performed in the medical literature to estimate the level of alcohol consumption at which mortality is minimized. These are summarized in Table 6.

Table 7 reports the results for the wage equations. To make a comparison with the medical literature the turning point and bounds have been expressed as grams per day. A comparison of the two tables indicates the value of the estimated turning point is generally higher in the labour market than the medical literature. However, many of the values of the lower Fieller bounds are consistent with values from the medical literature particularly for Heien (1996a, b) and MacDonald and Shields (2001).

Table 6: Level of Alcohol Consumption at which Mortality is Minimized (grams of alcohol per day

Study	Years	Males	Females
White (1999) - US	1950-1995	9.90g/per day	3.73g/per day
White (1999) - UK	1950-1995	16.59g/per day	
Corrao et al. (2000)	1966-1998	25g/day	10g/day
Bagnardi et al. (2003)	1966 -2000	6-7g/day	5g/day
Gmel et al. (2003)	until 2000	9-15g/day	3-13g/day
Fillmore et al. (2006) Takes into account misclassification of abstainers and/or occasional drinkers	1950s-mid 2004	2g/day	2g/day

Table 7: Extremum estimates for Wage Equation Results (in grams of alcohol per day).

Paper	Model	$\hat{\theta}$	Fieller Confidence bounds – 95%	
			Lower bound	**Upper bound**
French & Zarkin (1995)	Full – UB	24.78	-390.74	60.90
	Direct – UB	32.20	-81.62	56.14
	Full - B	23.52	-9.24	48.44
	Direct – B	33.60	-28.28	73.64
Heien (1996 a, b)	1979-OLS	38.92	15.40	93.52
	1979-IV	26.88	4.48	119.56
	1984-OLS	51.66	17.08	224.84
	1984-IV	52.50	9.24	230.44
	QES	34.30	11.76	242.20
MacDonald & Shields (2001)	OLS- males	49.62	42.05	59.15
	IV1- males	30.61	7.91	95.05
	IV2 - males	23.52	-4.15	84.65
	IV3 - males	40.87	16.87	128.75
	OLS - fem	45.71	37.71	58.65
	IV1 - fem	31.20	14.33	579.43
	IV2 - fem	15.86	-1.41	88.99
	IV3 - fem	27.18	15.03	57.99
Lye& Hirschberg (2004)	Nonsmokers	35.93	29.84	118.73

Notes 1. Tekin (2004) not included as no definition of a standard alcohol unit for Russia could be found.
2 To make the conversion to grams per day the standard drink size per country was used and if the original results were reported as per week values these were divided by 7.

7.0 Other Functional Forms

In addition to the quadratic functional form that specifies the relationship between alcohol consumption and earnings a number of other functional forms have been considered. In this section we consider the results of 3 additional papers that specify alternative relationships to determine if the results are consistent with those found above.

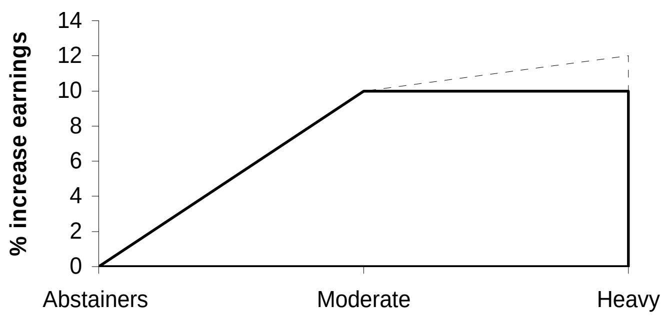
Auld (2005) uses data from Cycles 1 (1985) and Cycle 6 (1991) of the Canadian General Social Survey. Men between the ages 29-59 are considered and the pooled sample contains 3891 observations. Alcohol consumption is defined using 3 dummy variables specified as: *Abstainer* defined as not had a drink at least once per month in last year; *Heavy* defined as drinks at least once a week and had 8 or more drinks in one sitting on at least one occasion in the last week (that is includes both frequent drinking as well as binge drinking) and *Moderate* defined as everyone else. Table 8 summarizes the results. Moderate drinkers earn about 10% more than abstainers and 2% less than heavy drinkers. However, heavy drinkers are not significantly different from moderate drinkers as illustrated in Figure 3 again indicating that there is a plateau.

Table 8: Summary of Results from Auld (2005)

Alcohol Consumption	Coefficients
Abstainers	-0.099 (0.0219)
Heavy	0.019 (0.0345)

Note: Std errors in parentheses. Results based on dinking and smoking treated as exogenous

Figure 3: A Graphical Summary of Auld(2005) results

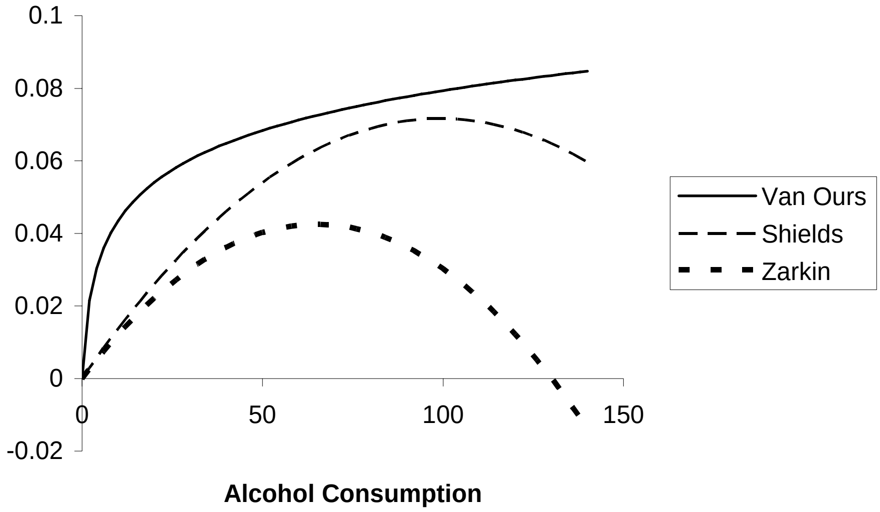


Van Ours (2004), uses data on the use of alcohol and tobacco that was collected in the week before Christmas 2001 from the CentER-data. The focus is on individuals aged between 26-55. The results indicate the wages of females are not affected by smoking and drinking. Here we just discuss the results for males.

Alcohol use is specified as a continuous variable of the form $\ln(ac+1)$ where *ac* is number of glasses of alcohol the individual normally drinks in a period of 30 days (a month). Also included in the model is tobacco use as defined by the number of cigarettes, cigars or pipes per day and entered into the equation in a similar form. For males a number of specifications are estimated including methods to account for possible joint unobserved determinants of the wage and the use of alcohol and tobacco. The coefficient of $\ln(ac+1)$ is estimated to be around 0.02.

Figure 4 illustrates a comparison of the estimated functional form with the OLS specification for the direct effect bounded model in French and Zarkin (1995) and for males in MacDonald and Shields (2001). The logarithmic specification is not associated with an inverted $\cup$ shape but it does assume decreasing returns to drinking. However, since the results above associated with a quadratic specification did not find much evidence of the downturn, but more of a plateau, the empirical functional forms are similar.

Figure 4: Comparison of functional forms



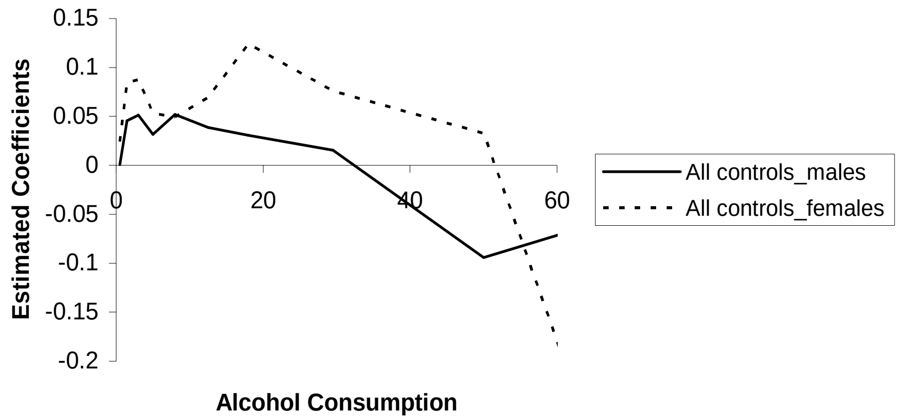
Note: Alcohol Consumption variables are transformed to equal 1 US standard drink

Peters (2004), uses data from the National Longitudinal Survey of Youth for years 1982-1985, 1988-1989, 1992 and 1994. Individuals were aged 17-25 in 1982 and 29-37 in 1994. The sample was restricted to full-time workers.

The drinks per week variable is defined as a set of dummy variables with limits 0-1, 1-2, 2-4, 4-6, 6-10, 10-15, 15-21, 21-38, 38-62 and > 62. A binge variable is also defined if the individual reported drinking 6 or more drinks at least 4 times in the previous 30 days.

Figure 5 graphs the estimated coefficients on the dummy variables for alcohol consumption in the wage equation for males and females corresponding to the richest specification (labelled "All Controls"). Figure 5 illustrates that there are positive spikes for lower levels of alcohol consumed and the values of the estimated coefficients become negative at higher levels of alcohol consumed.

Figure 5: Graphical Summary of Peters(2004) Results



To determine if there were any minimum or maximum values within the values of the estimated coefficients we examined the first derivative function defined as

$$\frac{D_i - D_{i-1}}{m_i - m_{i-1}} \tag{5}$$

where *D* is the estimated coefficient and *m* is the corresponding midpoint of the interval. This function and the corresponding 95% confidence intervals are illustrated in Figure 6 and indicates that the marginal effect of alcohol over all levels of alcohol consumption. The results of a specification containing only a single dummy variable for current drinking and another for binge drinking are reported in Table 9. These results indicate a significant positive linear effect for current drinkers and a significant negative effect for binge drinking.

Figure 6: Marginal Effects of Alcohol

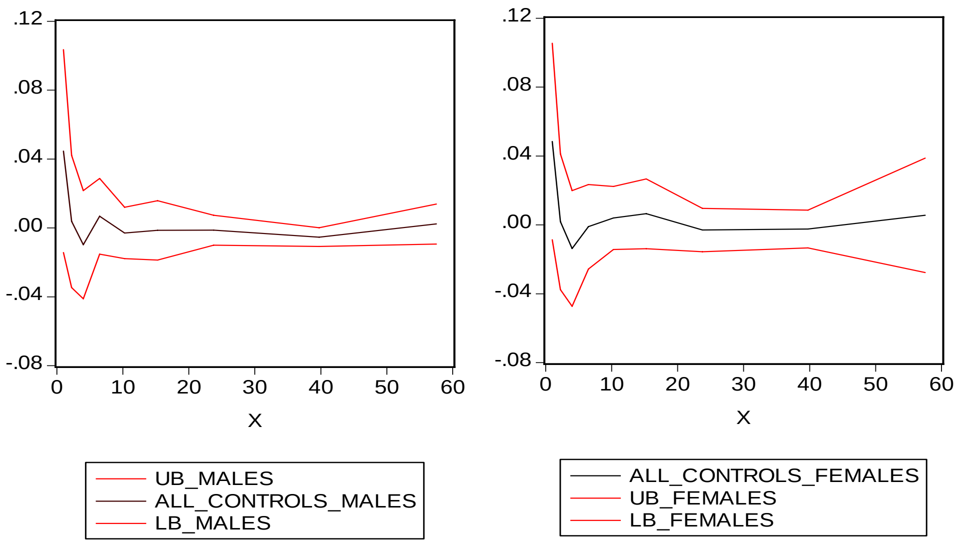


Table 9: The Effect of Current and Binge Drinking on log wages

	All Controls Males	**All Controls Females**
Drink	0.0408 (0.0181)	0.0575 (0.0163)
Binge	-0.0193 (0.0166)	-0.0627 (0.0266)

Note: Std Errors in Parentheses

8.0 Conclusions

A consistent finding in the medical literature is a ∪-shaped or J-shaped relationship between alcohol consumption and risk of death from all causes. A number of studies have examined the relationship between alcohol consumption and earnings for those individuals with a relatively stable employment pattern. Many have claimed to show an inverse ∪-shaped relationship exists between alcohol use and job performance with light or moderate alcohol positively related to workplace performance compared to abstinence and heavy drinking.

In this paper we re-evaluate these results by examining the estimated extremum and constructing 95% Confidence Intervals based on the Fieller approach. We find that many of the values of the lower bounds of the Fieller Interval are consistent with values from the medical literature. Unlike the medical literature though there is not much evidence of an inverse ∪ shape. We find that although there is a positive relationship with alcohol little evidence is present to conclude that there is a downward portion in the relationship – the relationship appears to reach a plateau. These results are also shown to be consistent when other functional forms specifying the relationship between earnings and alcohol consumption are considered.

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