Executive Agency for Health and Consumers

This paper arises from the project Standardizing Measurement of Alcohol Related Troubles (SMART) which has received funding from the European Union, in the framework of the Public Health Programme
Agreement Number: 2007308

Cost benefit analyses of alcohol policy - a primer

Prepared for SMART project

November 2010

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Draft paper. Not to be quoted without communication with the authors.

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1. INTRODUCTION

Alcohol is no ordinary commodity (Babor et al 2010). In health terms, it is a toxic substance. In legal terms, it is a licit drug whose sale and consumption are highly regulated. In economic terms, its use results in major external costs (consumption externalities), and its use leads to both short-term irrationality (i.e., intoxication) and long-term irrationality, and to information failures (Marsden Jacob Associates 2009).

Alcohol is a cause of considerable health and social burden to the European Union. Alcohol is a cause of over some 60 conditions and disorders (Rehm et al 2010), and is the third leading risk factor for ill-health and premature death in the European Union after hypertension and tobacco use (Anderson & Baumberg 2006). The harm done by alcohol is exacerbated by health inequalities (Anderson & Baumberg 2006), and alcohol is a major cause itself of health inequalities within and between countries. It has been calculated that some 25% of the differences in middle aged life expectancy between eastern and western Europe is due to alcohol (Zatonksi et al 2008). It is estimated that the overall social cost of alcohol to the Union is some €125billion each year (Anderson& Baumberg 2006).

There is a very extensive evidence base for the impact of policies in reducing the harm done by alcohol (WHO 2009a; Anderson et al 2009; Babor et al 2010). Systematic reviews and meta-analyses show that policies that regulate the environment in which alcohol is marketed (particularly its price and availability) are effective in reducing alcohol-related harm. Enforced legislative measures to reduce drinking and driving and individually-directed interventions to already at-risk drinkers are also effective. On the contrary, school-based education is found not to reduce alcohol-related harm, although public information and education type programmes have a role in providing information, and in increasing attention and acceptance of alcohol on the political and public agendas.

Despite the extent of harm and the evidence for effective policy, there remains a gap between current practice and what could be done to reduce the harm done by alcohol (WHO 2009a). One tool that can be used to advocate for and inform policies to fill this gap is economic analysis (WHO 2009b). For example, the World Health Organization has undertaken cost effectiveness analysis[1] for a range of alcohol policies and concluded that making alcohol more expensive and less available are highly cost-effective strategies to reduce harm (Chisholm et al 2004; Anderson et al 2009; Chisholm et al 2009). Banning alcohol advertising, drink driving counter measures and individually directed interventions to already at risk drinkers are also found to be cost-effective. In settings with relatively high levels of unrecorded production and consumption, increasing the proportion of alcohol that is taxed may be a more effective pricing policy than a simple increase in tax.

Others have extended this work in Australia and Canada to estimate the proportion of the present social costs due to alcohol that could be averted by implementing incremental alcohol policies (Collins & Lapsley 2008; Rehm et al 2008).

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[1] Cost-effectiveness analysis (CEA) is a form of economic analysis that compares the relative costs and outcomes (effects) of two or more courses of action. Last, J.M. Ed. A dictionary of epidemiology. 4th Edition. Oxford, Oxford University Press, 2001.
A technique which seeks to identify the least cost option for meeting a particular objective . It enables prioritisation between options, but ultimately cannot assess whether an option is economically worthwhile. www.environment-agency.gov.uk/static/documents/Research/glossary_777199.doc.

A complete economic analysis to better inform alcohol policy would estimate the overall societal costs and benefits of alcohol policies, as summarized in the table below, a cost-benefit analysis (Weimer & Vining 2009; Vining & Weimer 2010)[2].

COSTS	BENEFITS
Implementation costs	Reduced health and welfare costs
Costs to industry	Reduced labour and productivity losses
Non-financial welfare costs	Reduced non-financial welfare losses

On the cost side, the implementation costs refer to the actual costs of implementing any specific policy, such as collecting taxes, enforcing anti-drink driving measures, or implementing identification and brief advice programmes in primary care. Since alcohol policy is likely to lead to reductions in alcohol consumption, there are potential costs to the alcohol industry, such as lost jobs – although these costs will be offset to some degree by jobs created elsewhere in the economy. Finally, there can be non-financial welfare costs, for example the economic value that consumers place on the pleasure from drinking.

On the benefit side, there are obvious reduced health and welfare costs and reduced labour and productivity costs, since alcohol impacts on health and welfare and is related to both absenteeism and presenteeism. Finally, there are reduced non-financial welfare losses, for example the value consumers place on improved health, social well-being and life expectancy.

It should be noted, that the four cells above the red line are real tangible monetary costs, whereas the two cells below the red line are monetary valuations of non-tangible costs, and thus do not represent real tangible money.

The aim of this primer

This primer discusses some of the issues in undertaking cost benefit analyses of alcohol polices, and works through a simple example. It is based on a systematic review of the relevant literature. Pub Med, Medline, Econ Lit and Google scholar were searched using the terms cost benefit analysis, cost effectiveness analysis, alcohol and alcohol policy. However, the main data for this primer were collected by examining current reports by the World Health Organization (WHO 2010), which led to the identification of further grey literature. There have been no published CBAs on alcohol policy. One study in London (Aslam et al., 2003) provided some data on social costs of consumption, costs of crime (including drunk driving), and workplace costs. However, a complete CBA study of alcohol

[2] Cost-benefit analysis (CBA) is an analysis in which the economic and social costs and benefits of a policy are considered. The general rule for the allocation of funds in a CBA is that the ratio of the marginal benefit to cost should be equal to or greater than 1. Last, J.M. Ed. A dictionary of epidemiology. 4th Edition. Oxford, Oxford University Press, 2001.
A term used to describe analysis, which seeks to quantify in money terms as many of the costs and benefits of a policy or project as possible, including those for which the market does not provide a measure of economic value. www.environment-agency.gov.uk/static/documents/Research/glossary_777199.doc.

policy is still a gap in the current literature. The Sheffield Alcohol Policy Model (Purshouse et al.; 2009; Purshouse et al.; 2010) in England is the closest approach to a cost-benefit analysis and could supply data on implementation costs, health and welfare costs, costs to industry, labour and productivity losses, costs to pleasure and non-financial welfare losses.

The primer discusses the six cells of the summary table above, under the chapter headings the costs of alcohol polices and the benefits of alcohol policies. It uses a simple worked example based on a hypothetical counterfactual of an increase in alcohol excise taxes that would result in an across the board 10% increase in alcohol prices in England, with estimates of the impact of such a price increase obtained from the Sheffield alcohol policy model. A price rise is chosen, since this is one of the most cost-effective policy options to reduce the harm done by alcohol (Anderson et al 2009).

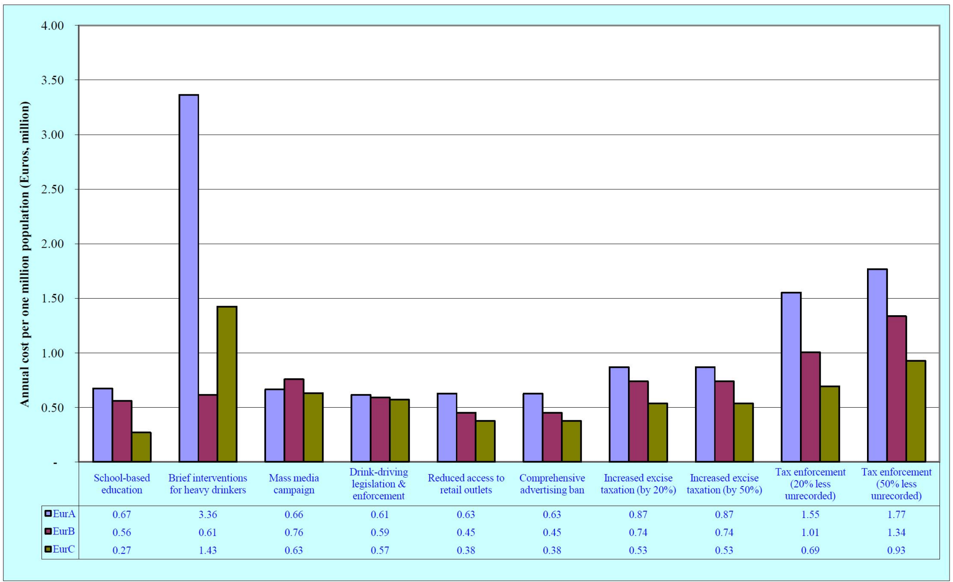
2. THE COSTS OF ALCOHOL POLICIES

The costs of alcohol policy are considered under the headings of the direct costs of implementing alcohol policy, the costs to the alcohol industry, and non-tangible costs, including the value expressed in financial terms that consumers place on the pleasure derived from consuming alcohol.

2.1 Implementation costs

COSTS	BENEFITS
Implementation costs	Reduced health and welfare costs
Costs to industry	Reduced labour and productivity losses
Non-financial welfare costs	Reduced non-financial welfare losses

The best available, and indeed the only readily accessible, Europe-wide data set for implementation costs is derived from the WHO CHOosing Interventions that are Cost Effective (WHO-CHOICE) model (WHO 2009) [http://www.who.int/choice/sitemap/en/]. These have been reproduced at the country level for 2005 costs in Euros (Chisholm et al 2009), and are summarized in Figure 1 for the three sub-regions of the European Region of the World Health Organization. The policy option with the greatest cost is implementing brief interventions for heavy drinkers, since there are relatively high health system and staff resource costs. The other policy options have similar costs, with the exception of increasing tax enforcement in jurisdictions with relatively high levels of unrecorded alcohol consumption, where enforcement costs increase.



	School-based education	Brief interventions for heavy drinkers	Mass media campaign	Drink-driving legislation & enforcement	Reduced access to retail outlets	Comprehensive advertising ban	Increased excise taxation (by 20%)	Increased excise taxation (by 50%)	Tax enforcement (20% less unrecorded)	Tax enforcement (50% less unrecorded)
EurA	0.67	3.36	0.66	0.61	0.63	0.63	0.87	0.87	1.55	1.77
EurB	0.56	0.61	0.76	0.59	0.45	0.45	0.74	0.74	1.01	1.34
EurC	0.27	1.43	0.63	0.57	0.38	0.38	0.53	0.53	0.69	0.93

Figure 1 Annual alcohol policy implementation costs, €/person. Source: See WHO (2009a) [3]

Specific data for the United Kingdom are illustrated in Table 1. What this table shows is that even the most comprehensive range of policy options cost only €358 million, some €6 per person, with a cost per healthy year of life gained of €800, only 2.7% of gross national income, and thus very highly cost-effective. The incremental cost of increased taxation (25% increase) over current taxation is €3.7 million.

Table 1 Policy implementation costs for the United Kingdom (Column 3). Source: Chisholm et al 2009.

Column 1		Column 2	Column 3		Column 4
Country	United Kingdom	Annual healthy life years gained per 1 million population	Annual cost (Euros, 2005)		Cost per healthy year of life gained (Euros, 2005)
Population	60,226,500		Total	Per person	
Gross national income per person (Euros, 2005)	29,609				
Euro exchange rate (2005)	1.45				
Current taxation		4,378	€ 14,514,556	€ 0.24	€ 55
Increased taxation (Current + 25%)		4,821	€ 18,236,576	€ 0.30	€ 63
Increased taxation (Current + 50%)		5,162	€ 18,236,576	€ 0.30	€ 59
Reduced access to retail outlets (50% coverage)		232	€ 14,422,266	€ 0.24	€ 1,033
Comprehensive advertising ban (80% coverage)		988	€ 21,905,308	€ 0.36	€ 368
Brief advice in primary care (30% coverage)		1,338	€ 291,526,553	€ 4.84	€ 3,619
Roadside breath-testing (RBT; 80% coverage)		89	€ 30,049,062	€ 0.50	€ 5,600
Current Scenario - combination of interventions		4,620	€ 135,075,385	€ 2.24	€ 485
Combination 1: Increased tax and RBT		5,146	€ 45,871,356	€ 0.76	€ 148
Combination 2: Increased tax and Advertising Ban		6,027	€ 38,134,790	€ 0.63	€ 105
Combination 3: Increased tax and Brief advice		6,369	€ 303,053,206	€ 5.03	€ 790
Combination 4: Increased tax + Ad Ban + Reduced access		6,190	€ 51,835,942	€ 0.86	€ 139
Combination 5: Increased tax + Brief Advice + Ad ban + Reduced access		7,333	€ 329,025,564	€ 5.46	€ 745
Combination 6: Increased tax + Brief Advice + Ad ban + Reduced access + RBT		7,418	€ 357,572,173	€ 5.94	€ 800

Since the Sheffield Alcohol Policy Model did not estimate the costs of policy implementation, the figure of €3.7 million is used as an approximate estimate of the cost of a tax increase that would hypothetically result in an across the board 10% increase in the price of alcohol.

Eur-A: very low adult/very low child mortality
Andorra, Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom.
Eur-B: low adult/low child mortality
Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Montenegro, Poland, Romania, Serbia, Slovakia, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Uzbekistan.
Eur-C: high adult/low child mortality
Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine.

2.2 The costs of alcohol policy to industry

COSTS	BENEFITS
Implementation costs **€3.7 million**	Reduced health and welfare costs
<u>Costs to industry</u>	Reduced labour and productivity losses
Non-financial welfare costs	Reduced non-financial welfare losses

A report by RAND Europe suggested that the alcohol industry makes a modest contribution to the total economy of the European Union (Horlings and Scoggins 2006). This included €25bn of value-added in the production of beer, wine and spirits; nearly €20bn of value-added in supplying industries to the production of beer, wine and spirits; and an unquantified additional amount of value-added from other forward and backward linkages within the economy; €10bn added to the EU overall balance of trade; around 600,000 workers in production of beer, wine and spirits; around 600,000 workers in supplying industries to beer and spirits production and 2.6m jobs in the retail of beer alone.

It should be noted that many of these estimates come either directly from the alcohol industry or via commissioned research that is designed to demonstrate the importance of the alcohol industry – and that therefore some of these estimates may be inflated. For example, the RAND report points out that the 2.6m retail jobs for beer will include many part-time jobs, and will be dependent on much more than just alcohol. In the tobacco field, it has been estimated that the full-time equivalent number of jobs is around one-third of the total number of jobs calculated in industry-commissioned research (Jacobs et al 2000). Further, it should also be noted that the greatest impact on reducing the number of jobs in production and distribution has resulted from mechanization and in increased efficiency (Baumberg 2008).

The more important point is that such figures simply cannot be taken as estimates of the economic benefit of the alcohol industry (Anderson and Baumberg 2006; Baumberg 2008). If, due to alcohol policy, people reduced their spending on alcohol, they would spend their money in other areas or save it. The jobs that are lost related to alcohol would therefore be counterbalanced by jobs created in other areas. While no studies have investigated the consequences of this for alcohol, several studies in the tobacco field suggest that the net result can be either positive or negative depending on the particular pattern of spending and particularly whether the replacement spending is more likely to be domestically produced than the tobacco it replaced (Jacobs et al 2000).

The main financial cost of an alcohol price increase will be in the transition costs required to move from producing alcohol to producing replacement goods and services. At the outset, it is important to note that the productivity of each worker is a key determinant of industry employment, alongside the total output level. It is technological innovation that has led to improved productivity that explains the fivefold increase in the amount of beer produced per employee in the brewing industry in the UK 1963-2003 (see Baumberg 2008). Similarly for wine, mechanical harvesting and pruning are increasingly used in lower-quality as well as higher-quality production, while the labour intensity of winegrape production has been reduced by mechanisation and computerisation of irrigation. When considering employment transition costs, workers with transferable skills and low-skilled workers will find adjustment easier than workers with specialist skills that cannot be used in alternative employment. Much of the capital invested in drinks production will be unsuited to any other use (e.g. brewing equipment). However, if the change in demand is slow then the replacement of equipment at the end of its lifespan will be able to reflect the changing economic realities.

The transition costs in the retail sectors will vary depending on the type of establishment. Those businesses depending relatively little on alcohol sales will be able to adjust easily to changes in alcohol sales, which will fall within the usual sales fluctuations that are experienced. Remembering that spending on alcohol will be replaced by alternative spending, these businesses will also see new areas of spending within their own stores (depending on exactly where this spending goes), further reducing the transition costs. In contrast, those businesses depending primarily on alcohol sales, which in practice means specialist alcohol retailers and bars, will be more affected by changes in alcohol sales, less likely to receive the replacement spending, and less able to adjust. Even for these workers though, most work is low-skilled and badly paid, and the transition to other low-skilled work incurs much lower transition costs than movement among higher-skilled, more specialised occupations.

The transition costs of a 10% price increase subsequent to a tax increase to the alcohol sector are not known. They are likely to be small, particularly for a relatively small consumption change of 4-5%, which is what the Sheffield Alcohol Policy Model finds for a 10% price rise.

2.3 Valuing the pleasure of alcohol

COSTS	BENEFITS
Implementation costs **€3.7 million**	Reduced health and welfare costs
Costs to industry **Not known, but likely to be small**	Reduced labour and productivity losses
Non-financial welfare costs	Reduced non-financial welfare losses

The pleasure of drinking alcohol has sometimes been acknowledged in the public health literature (Anderson and Baumberg 2006), and should ideally be included as a potential cost of alcohol policy. The main way that internal benefits of a good are measured economically is through the idea of consumer surplus, how much more people would have been willing to pay for the good than the actual price they paid (Aslam et al 2003; Leontaridi 2003). The problem is that we do not always know how much people would have been willing to pay, and strong assumptions about this are often required before we can estimate the consumer surplus. One study estimated the consumer surplus in London as half of the actual price: Londoners were, on average, willing to pay an extra 50% more compared to the prevailing average price in the market (Aslam et al 2003). However, this study makes a number of simplifying assumptions that are unlikely to be true, which makes this figure unreliable (WHO 2010).

Consumer surplus is defined as the difference between the value at which a consumer (or the sum of consumers) values his or her consumption and the price that he or she paid for the consumption. Thinking about the demand curve for a product (Figure 2), this value is represented by the area between the demand curve (D) and the horizontal line representing the price paid by (all) consumers (P0).

Policy measures that affect the demand for goods will impact on consumer surplus, and hence changes in consumer surplus are important criteria by which to assess policies. For example, a tax on a product will reduce consumer surplus, as the gap between what consumers are willing to pay and the price (after tax) is reduced (Figure 3). Typically, the bulk of the loss in consumer surplus is transferred to the government in the form of taxation revenue (area b), but some part of the consumer surplus disappears altogether. This is because the price rise as a result of the tax leads to a fall in consumption of the product, eliminating the consumer surplus that accrued over that range (area a). This is called the deadweight loss, and is the loss in consumer surplus from the declining level of alcohol consumption: drinkers received more pleasure from this than they paid, which is then lost.

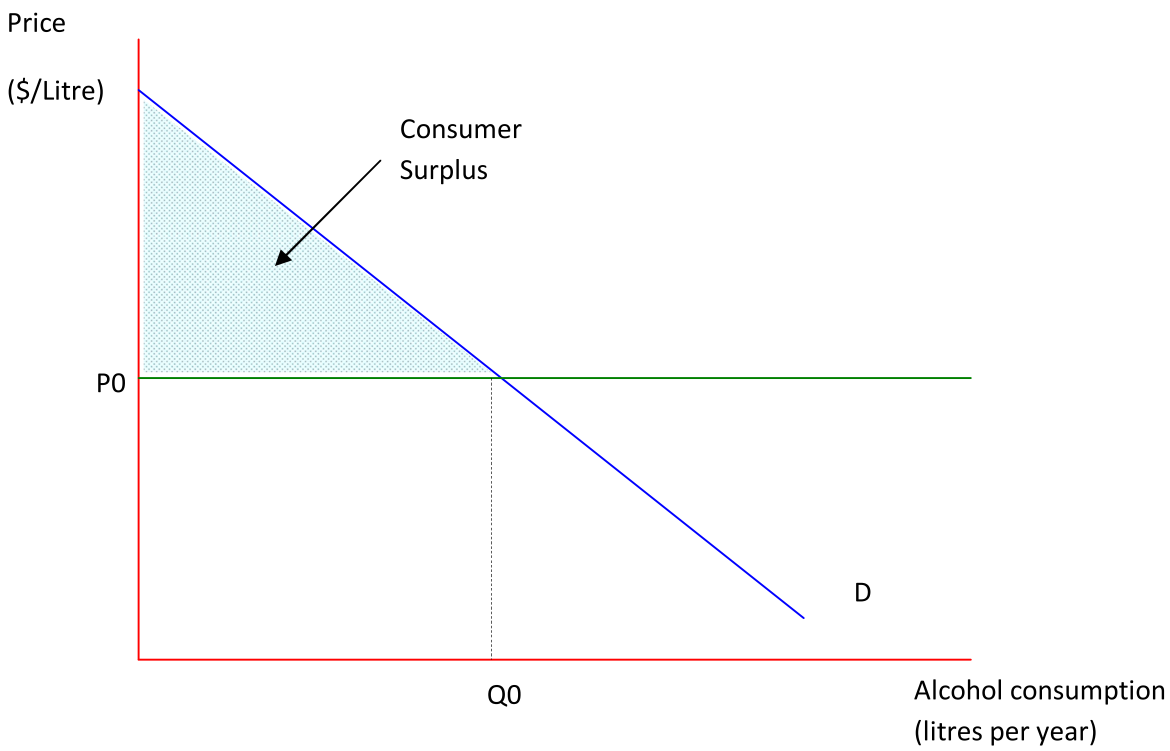
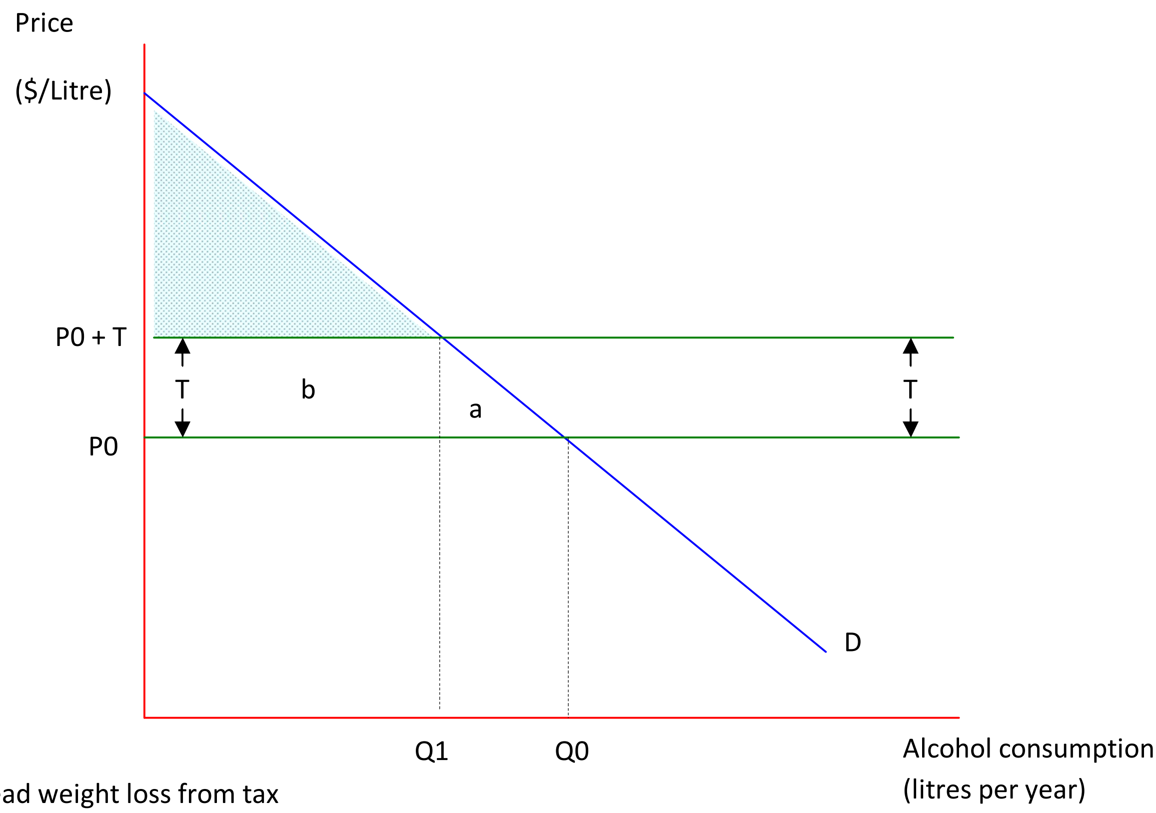


Figure 2 Consumer surplus is the excess of willingness to pay over price.



a: dead weight loss from tax
b: transfer to government in form of alcohol tax revenue

Figure 3 A tax increase reduces consumer surplus.

The Sheffield alcohol policy model provides data that allows some estimates of the loss in consumer surplus that is transferred to the government in the form of taxation revenue (area b), and the loss in consumer surplus due to the fall in consumption due to the price rise as a result of the tax increase (area a). It is found that area b is some 38 times the size of area a.

From the Sheffield Alcohol Policy Model, we can estimate the overall increased spend on the constant amount of alcohol that is still consumed following a 10% price rise. The new average price was €0.120/gram alcohol, €0.012/gram alcohol more than the old average price, €0.108/gram alcohol. Following the price increase, 186bn grams of alcohol were still being consumed by the 29.5 million drinkers. Multiplying the 186bn grams of alcohol by the price difference of €0.012/gram gives us an increased spend on the constant quantity of alcohol of €2.2 billion, which, in the case of a hypothetical tax increase that resulted in a 10% price increase, is transferred to the government in the form of taxation revenue (area b).

If we accept that the loss of consumer surplus is transferred to the government in terms of revenue, it can be either rebated to general taxpayers or used to reduce revenue from less efficient taxes, thus improving the efficiency of the total tax structure. An alcohol tax increase can be regarded as revenue neutral, since the money raised can be rebated to consumers by allowing an equal reduction in other taxes; in this case, moderate drinkers, who would pay less excise tax than heavier drinkers, would receive proportionately more of the rebate than heavier drinkers. Alcohol tax increases can also be used to reduce income taxes and thus reduce the dead weight burden of the system as a whole (Ramsey 1927), since the marginal cost of raising and collecting alcohol taxes are considerably lower than the marginal costs of collecting income taxes.

To measure area a, the loss in consumer surplus due to the fall in consumption due to the price rise as a result of the tax increase, we can first take an estimate of the value of the consumer surplus per gram of less alcohol consumed. From the Sheffield Alcohol Policy Model, this can be taken as the half way point between the old average price (€0.108/gram alcohol) and the new average price (€0.120/gram alcohol), €0.006. Alcohol consumption dropped by an average of 324 grams as an estimated consequence of the price increase. Multiplying the average change in price (€0.006) by the average change in consumption (324grams) by the number of drinkers (29.5 million) gives an estimate in the loss in consumer surplus due to the fall in consumption due to the price rise as a result of the tax increase (area a) of €58 million.

Accounting for irrationality

The above calculations assume that the consumption of alcohol is, in economic terms, fully rational. However, there are several factors of alcohol consumption that are described in economic terms as irrational (Vining & Weimer 2010) and which will impact on the magnitude of the consumer surplus (Marsden Jacob Associates 2009). First, some consumers are poorly informed on the delayed impact of alcohol consumption, and there is a perception, especially among young drinkers, that whatever the risks 'they don't apply to me'; second, there is a change in preferences and behaviours with age, with alcohol consumption and heavy drinking occasions normally declining with age; third, family and welfare systems that look after people if they become ill, disabled or unemployed create a 'moral hazard', meaning people are likely to take on more risks than if the safety net were unavailable; fourth, the heavy expenditure on the promotion and advertising of alcohol by the industry which stimulates alcohol consumption amongst youth, a strong predictor of lifetime drinking patterns, raises the question in what sense can the preferences of individual consumers be said to be 'sovereign', as distinct from 'manipulated'?; fifth, the evidence suggesting that peer group pressure is strongly influential in individual values, preferences and drinking behaviour, which again raises the question of the sovereignty of the preferences of individual consumers; and, finally, sixth, there is neurobiological evidence, that the brain reward circuitries overvalue the pleasure of psychoactive drugs, and thus the consumer puts more effort to obtain them, even if they provide no objective or subjective benefit to the user (Redish 2004).

The consequences of irrational consumption are that the demand curve shifts downwards (Australian Productivity Commission 1999; Vining & Weimer 2010). Thus, the consumer surplus is estimated to be much lower (a in Figure 4), and, there is a range of alcohol consumption over which the price of alcohol exceeds the true willingness to pay for alcohol (according to the adjusted demand curve), meaning there are costs to consumers that are unmatched by benefits, area b. Estimates for nicotine addiction suggest that a reasonable (though conservative) tentative rule-of-thumb is to consider only 75% of the loss in consumer surplus as measured by the market demand for cigarettes as actual welfare loss in CBA (Vining & Weimer 2010).

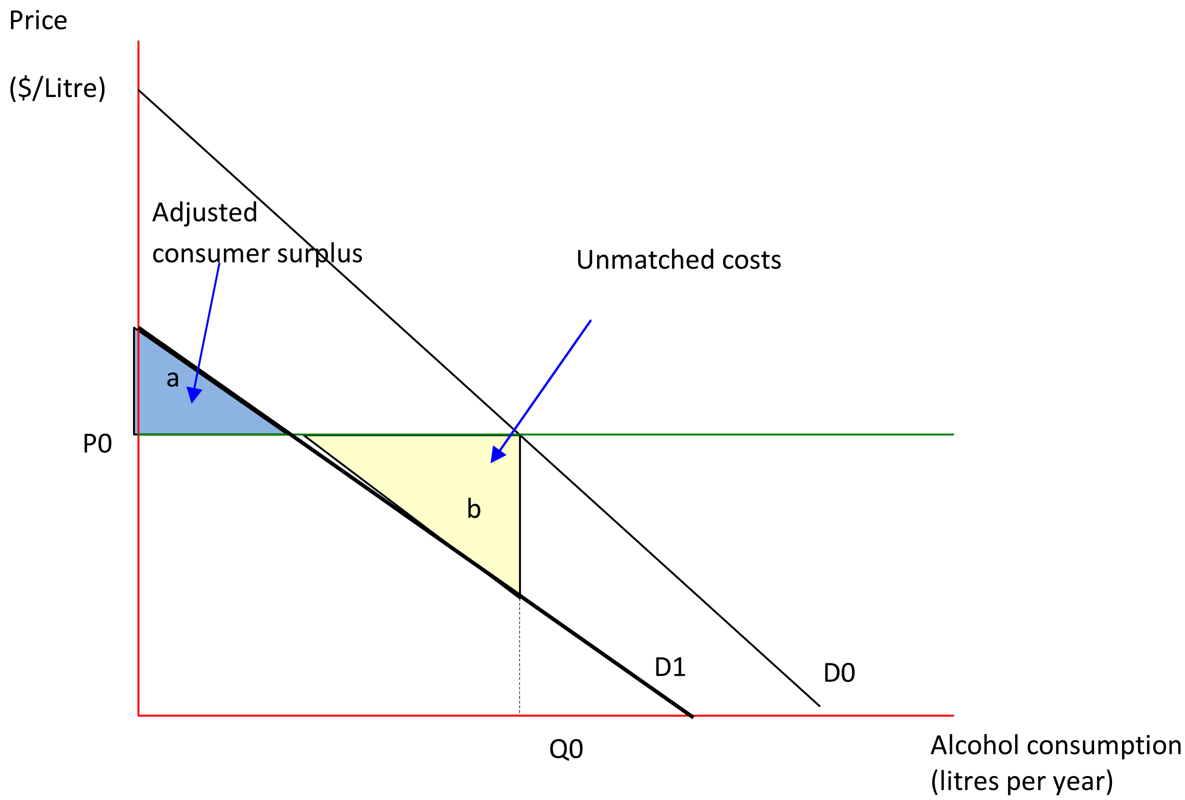
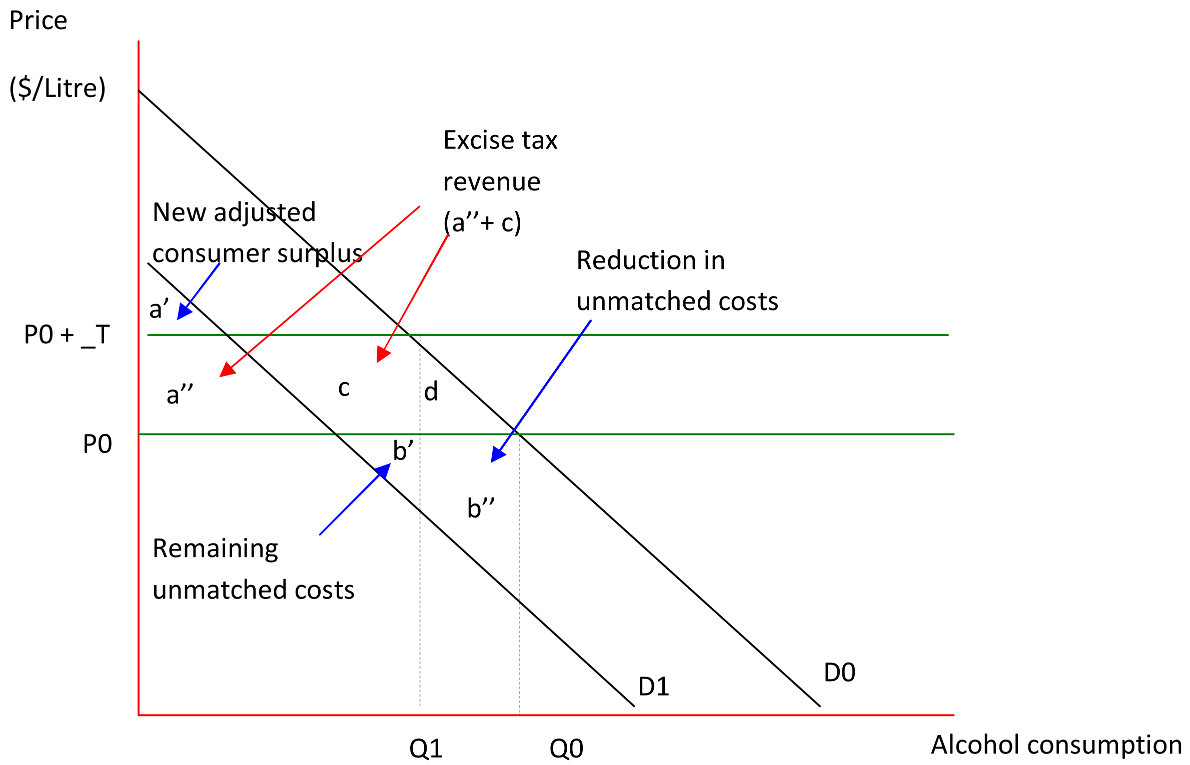


Figure 4 Adjusting the demand curve for 'irrationality'

The welfare implications of an excise tax increase are also different from the case of a normal good, Figure 5. An excise tax increase leads to the following benefits: a reduction in unmatched costs of *b´´*; and, excise tax revenue of *a´´* + *c*. At the same time it leads to a cost of a reduction in consumer surplus of *a´´*. In net terms, the benefits of the excise tax increase are b´´ + *c*. Thus, for irrational alcohol consumption, true (adjusted) consumer surplus and the loss of consumer surplus due to excise increases is more than offset by the gain in excise tax revenue; and there may be significant costs of consumption unmatched by consumer surplus benefits, and these costs can be reduced through an excise tax increase.

Crucial to assessing the impact of policy measures, such as an increase in the rate of excise, it is important to know the proportion of alcohol consumption at hazardous or harmful levels that could be considered irrational? In the UK, for example, 82% of all alcohol is consumed by men who drink >32g alcohol per day and women >24g/day, and 55% of all alcohol is consumed by men who drink 64g/day and women more than 48g/day (Baumberg 2009). The relevance of this discussion is that where it is assumed that some part of alcohol consumption is irrational, any resulting correction of the observed demand curve may well impact on between three an four fifths of total consumption, and therefore be very material in its impact on the welfare benefits and costs of an excise increase or any other policy intervention.



Benefits of increased tax: Reduction in unmatched costs: b''; Tax revenue: a'' + c
Costs of increased tax: Surplus reduction
Net benefit: -c + b''

Figure 5 Impact of an excise tax increase in the presence of 'irrationality'.

Based on the data provided by the Sheffield alcohol policy model, and not counting for irrationality, it can thus be estimated that the total consumer loss from a 10% price increase is €2258 million, of which €2200 million is transferred to the government in terms of revenue, and rebated to consumers and thus revenue neutral.

3. THE BENEFITS OF ALCOHOL POLICY

3.1 Reducing health and welfare costs

COSTS	BENEFITS
Implementation costs **€3.7 million**	**Reduced health and welfare costs**
Costs to industry **Not known, but likely to be small**	Reduced labour and productivity losses
Consumer loss not transferred to government in terms of revenue **€58 million**	Reduced non-financial welfare losses

Alcohol has impacts on health and welfare (Anderson & Baumberg 2006). These impacts can be costed in monetary terms, thus allowing estimates of the avoidable burden of the costs following changes in alcohol policy. However, there are a range of issues in calculating health and welfare costs.

Estimating health costs
Alcohol has certain beneficial effects on health and, although their size is disputed, they need to be taken into account in cost studies. WHO guidelines recommend presenting the net costs (after taking into account health benefits) alongside the gross cost estimates (Single et al 2001). It should be borne in mind, however, that this net cost is different from the cost in a counterfactual where everybody drank at the lowest-risk level.

A greater problem when estimating health costs is what to do with future health care costs (Anderson and Baumberg 2006). That is, if people do not die from an alcohol-related cause, then they will ultimately die of a different cause instead. Yet, nearly all studies fail to take the health care costs for this other disease into account. It is even possible that reducing the incidence of a disease could raise health care costs, if the diseases prevented are fatal in a relatively short time period but the diseases replacing them lead to long periods of ill-health that are expensive to treat. A methodology that would enable future health costs to be taken into account is the demographic method (Collins and Lapsley 2002). The demographic method creates a hypothetical population and disease structure if people had stopped drinking a long time ago, and then estimates the health care costs of this new population. This method produces much lower estimates of the health care costs.

In many countries, health care costs include inpatient care, outpatient hospital care, primary care, pharmaceuticals, and ambulance services – and often in both the state and private systems. The most common way of estimating the share of hospital treatment that is caused by alcohol is to use epidemiological research to calculate Alcohol Attributable Fractions (AAFs) for each condition (i.e. the share of each condition caused by alcohol). This combines epidemiological evidence on the risks of particular diseases at different levels of consumption, with nationally representative data on how common different levels of drinking are in a particular country, see Tables 2 and 3 for Australian examples.

Table 2 Alcohol-attributable fractions for chronic disease mortality, by standard drinks per day (1 drink = 10g alcohol) Where two AAFs are given, the first applies to men; the second to women. If only one AAF is given, attributable risk did not vary significantly by gender. Source: NHMRC (2009)

1	2	3	4	5	6	7	8	9	10
Lip, oral and pharyngeal cancer									
23.5	40.0	51.9	60.5	66.9	71.7	75.4	78.2	80.4	82.1
24.7	41.9	54.0	62.9	69.4	74.2	77.9	80.7	82.9	84.6
Oesophageal cancer									
14.6	27.1	37.7	46.7	54.3	60.7	66.1	70.7	74.6	77.9
Laryngeal cancer									
7.0	13.3	18.9	23.9	28.4	32.4	36.0	39.2	42.1	44.7
Breast cancer									
7.4	14.2	20.6	26.4	31.9	36.9	41.5	45.9	49.9	53.6
Hypertensive diseases									
13.3	24.8	34.8	43.4	50.9	57.4	63.1	68.0	72.2	75.9
Ischaemic heart disease									
*	*	*	*	*	*	*	1.0	2.9	11.5
Ischaemic stroke									
*	*	*	10.9	28.3	42.0	51.0	54.8	52.8	41.8
Haemorrhagic stroke									
13.9	25.9	36.2	45.1	52.8	59.3	65.0	69.9	74.1	77.7
Cirrhosis of liver									
17.3	31.0	41.8	50.5	57.5	63.2	67.8	71.5	74.6	77.1
24.4	42.2	55.5	65.4	72.8	78.4	82.7	86.1	88.6	90.6

Table 3 Alcohol-attributable fractions for injury mortality, by age group, gender and injury type Source: NHMRC (2009)

15–29 Yrs		30–44 Yrs		45–59 Yrs		60–69 Yrs		70–79 Yrs		80+ Yrs	
M	F	M	F	M	F	M	F	M	F	M	F
Road traffic accidents											
30.5	10.7	30.5	10.7	30.5	10.7	30.5	10.7	30.5	10.7	30.5	10.7
Poisoning											
29.0	23.0	16.0	15.0	16.0	15.0	16.0	15.0	8.0	7.0	8.0	7.0
Falls											
22.0	14.0	22.0	14.0	22.0	14.0	12.0	04.0	12.0	04.0	12.0	4.0

Fire											
44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0
Drowning											
34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
Other unintentional injuries											
29.0	23.0	29.0	23.0	24.0	19.0	24.0	19.0	24.0	19.0	24.0	19.0
Suicide											
32.3	28.5	32.3	28.5	32.3	28.5	32.3	28.5	32.3	28.5	32.3	28.5
Violence (homicide)											
27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Other intentional injuries											
20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	10.0	10.0	10.0	10.0

Usually, it is inpatient care on which most effort is spent estimating health costs. In a Swedish study (Johansson et al 2006), the health care cost combined (i) the AAF for each condition, as above; (ii) the number of cases for each diagnosis (from existing national data); and (iii) the cost-per-diagnosis (from data available in two regions of Sweden), excluding central health administration and pregnancy care. The Swedish study demonstrated very well how important the details of this method are. They do this by examining how their estimates would have turned out if less data were available. First, instead of using a cost-per-diagnosis, they assumed that they would only have the cost of inpatient care across *all diagnoses combined* (i.e. instead of a cost per case of liver cirrhosis and a case per case of ischaemic stroke, there would simply be a single cost for all cases). They found that this method doubled the total inpatient cost – an amazingly large effect for such a simple and seemingly reasonable change. Secondly, instead of calculating the number of cases and the cost-per-case, they use the number of days for each condition and the cost-per-day calculated across all diagnoses combined. This produced only a slightly (30%) higher estimate, suggesting that the main reason for the large rise in the first alternative method is due to differences in the absolute length of stays in hospital for different conditions, rather than in the costs of treating different conditions.

One refinement that has increasingly been done is to look at the impact of 'co-morbidity' – that is, the extra cost for people who enter hospital for a cause unrelated to alcohol but have a *secondary diagnosis* of something alcohol-related, compared to people without such a secondary diagnosis. As with the main inpatient costs, the results of this are sensitive to whether one looks at each individual condition or across all conditions. If we look at the co-morbidity cost for each condition individually, taking co-morbidity into account only raises the inpatient costs by 7%. However, if we had less data and aggregated across all conditions, then the co-morbidity costs would be four times higher.

Beyond inpatient costs, it is crucial to attempt to estimate outpatient and primary care costs. In the Swedish study only 35% of the total health costs related to inpatient care. However, the data available on outpatient and primary care costs is usually less available than for inpatient costs. Other health care costs are typically very difficult to estimate as they are not usually attached to a particular condition in the administrative records.

The cost of helping people with alcohol use disorders to recover can also be included. It is usually easily identifiable and can be entirely attributed to alcohol, or at least a combination of alcohol and drugs. However, due to differences in treatment systems it is often difficult to separate these costs out from other types of cost; some countries seemingly include this as part of the health care system (and the cost is therefore covered above), while for others it is separate.

The cost to social services of looking after the welfare of children with parents who are alcohol dependent can also be estimated. In Sweden, this came from a review of small-scale studies where 10%-45% of child services were due to parental alcohol or drug problems. They used the midpoint of this in their analysis, reduced this by the proportion of alcohol and drug problems users who mainly use alcohol problematically (as for treatment), and found a cost that is only marginally lower than the cost of treatment and accounted for 9% of the total financial cost. While it is possible that the costs are higher in Sweden than elsewhere, a Scottish study similarly found that 7-9% of the total financial cost came from welfare services (Guest and Varney 2001), suggesting that omitting these costs introduces a significant downward bias. Other social service costs have also been mentioned as theoretical possibilities – such as supported accommodation (Collins and Lapsley 2002), other elderly care and orphanages (Johansson et al 2006) – but these are not usually estimated in practice.

Social security payments are transfer costs – they move money between different people rather than using up any resources. They therefore should not be included when looking from a societal perspective, although they should be included in an external cost study , and in practice they have been included in several studies that fall between societal and external cost studies (Salomaa 1995; Harwood 2000; Guest and Varney 2001). The costs of *administering* alcohol-attributable social security payments should be included even in attributable cost studies; this was missed out of the Swedish study but has occasionally been included elsewhere (Salomaa 1995; Single et al 1996; Harwood 2000).

The Sheffield model aimed to capture policy impacts for 47 health conditions for which evidence suggests alcohol plays a contributory role (Jones *et al.*, 2008), Table 4.

Table 4 Health conditions included in the Sheffield model. For references, see Purshouse et al 2009.

	Condition	ICD-10 code	Con. type	Source of AAF or risk function
Wholly attributable chronic conditions	Alcohol-induced pseudo-Cushing's syndrome	E24.4	Mean	100% attributable
	Degeneration of the nervous system	G31.2	Mean	
	Alcoholic polyneuropathy	G62.1	Mean	
	Alcoholic myopathy	G72.1	Mean	
	Alcoholic cardiomyopathy	I42.6	Mean	
	Alcoholic gastritis	K29.2	Mean	
	Alcoholic liver disease	K70	Mean	
	Chronic pancreatitis	K86.0	Mean	
Wholly attr. acute conditions	Mental and behavioural disorders due to use of alc.	F10	Peak	100% attributable
	Ethanol poisoning	T51.0	Peak	
	Methanol poisoning	T51.1	Peak	
	Toxic effect of alcohol, unspecified	T51.9	Peak	
	Accidental poisoning by exposure to alcohol	X45	Peak	
Partially attributable chronic conditions	Malignant neoplasm of lip, oral cavity and pharynx	C00-C14	Mean	Corrao *et al.* (2004)
	Malignant neoplasm of oesophagus	C15	Mean	
	Malignant neoplasm of colon	C18	Mean	
	Malignant neoplasm of rectum	C20	Mean	
	Malig. neoplasm of liver and intrahepatic bile ducts	C22	Mean	
	Malignant neoplasm of larynx	C32	Mean	
	Malignant neoplasm of breast	C50	Mean	Hamajima *et al.* (2002)
	Diabetes mellitus (type II)	E11	Mean	Gutjahr *et al.* (2001)
	Epilepsy and status epilepticus	G40-G41	Mean	Rehm *et al.* (2004)

	Hypertensive diseases	I10-I15	Mean	Corrao *et al.* (2004)
	Ischaemic heart disease	I20-I25	Mean	Corrao *et al.* (2000)
	Cardiac arrhythmias	I47-I48	Mean	Gutjahr *et al.* (2001)
	Haemorrhagic stroke	I60-I62, I69.0-I69.2	Mean	Corrao *et al.* (2004)
	Ischaemic stroke	I66-I66,I69.3, I69.4	Mean	
	Oesophageal varices	I85	Mean	
	Gastro-oesophageal laceration-haemorrhage synd.	K22.6	Mean	English *et al.* (1995)
	Unspecified liver disease	K73, K74	Mean	Corrao *et al.* (2004)
	Cholelithiasis	K80	Mean	Gutjahr *et al.* (2001)
	Acute and chronic pancreatitis	K85, K86.1	Mean	Corrao *et al.* (2004)
	Psoriasis	L40 excludes L40.5	Mean	Gutjahr *et al.* (2001)
	Spontaneous abortion	O03	Mean	
Partially attributable acute conditions	Road traffic accidents - non pedestrian	V (various)	Peak	Ridolfo *et al.* (2001)
	Pedestrian traffic accidents	V (various)	Peak	
	Water transport accidents	V90-V94	Peak	Single *et al.* (1996)
	Air/space transport accidents	V95-V97	Peak	
	Fall injuries	W00-W19	Peak	Ridolfo *et al.* (2001)
	Work/machine injuries	W24-W31	Peak	English *et al.* (1995)
	Firearm injuries	W32-W34	Peak	Single *et al.* (1996)
	Drowning	W65-W74	Peak	English *et al.* (1995)
	Inhalation of gastric contents	W78	Peak	Single *et al.* (1996)
	Fire injuries	X00-X09	Peak	
	Accidental excessive cold	X31	Peak	
	Intentional self-harm	X60-X84	Peak	English *et al.* (1995)
	Assault	X85-Y09	Peak	Single *et al.* (1996)

When modelling the link between consumption and harm, one important input is the assumption surrounding the ‘time lag’ – the time needed to achieve the full benefit (reduction in harms) associated with a reduction of consumption. Such data is necessary for chronic conditions. A review of the literature found little evidence for population-level time lags for chronic conditions. However evidence was found for the time lag between onset of chronic consumption and onset of disease in individuals. The average time lag to full effect varies between 5 and 15 years, depending on the condition. Such evidence was reported for neurological disorders, chronic pancreatitis induced by alcohol, alcohol cardiomyopathy, alcoholic liver disease, oesophageal cancer, epilepsy, heart failure and oral cancer, although it is acknowledged that the exact onset of harmful consumption is very difficult to establish. The time lag for full effect associated with certain types of cancer was reported to be slightly higher, for example the lag between consumption and onset of laryngeal and rectal cancer (between 15 and 20 years). A mean lag of 10 years was assumed for all chronic conditions. While such a lag may under/over-estimate the true mean time lag for some conditions, given the lack of consensus it is considered to be a plausible estimate. The time lag for acute conditions was assumed to be zero since benefits associated with a reduction of acute harms occur instantaneously. The 10 year lag compares well to that reported by Norstrom (2001) the only paper identified which specifically mentions population-level lags. The authors suggest an overall lag of 4 or 5 years (for combined chronic and acute conditions).

The Sheffield model estimated that a 10% increase in the price of alcoholic beverages would reduce the annual number of deaths by 297 within the first year and 1513 per year after 10 years. In addition, hospital admissions would decline by an estimated 12,550 in the initial year, reaching full effect after 10 years with 50,691 avoided admissions annually. The savings to the health service were estimated at €65 million in the first year.

Estimating crime costs

Crime costs include the costs in response to crime, that is the costs of police, courts and prisons (the criminal justice system) as the organised reaction to crimes that occur (Anderson and Baumberg 2006; Johansson et al 2006; Rehm et al 2006), as well as costs in anticipation of crime and costs as a consequence of crime. Costs as a consequence of crime are costs that result from the crime itself rather than society's response. The most widely estimated part of this is criminal damage, which, where it has been estimated for alcohol (Leontaridi 2003), is lower than the costs in response to crime, but is still sizeable. Costs in anticipation of crime are the most-ignored costs, but, at least when they are included (Leontaridi 2003), they were almost as large as the costs in response to crime. These refer to those costs that are done to try and prevent crimes happening, in particular burglar alarms and security guards.

While it is often difficult to estimate the total costs of particular types of crime, the main problem in estimating alcohol-attributable crime costs is in estimating the role of alcohol. The first decision is which crimes to consider as alcohol-related at all. Some studies look at all crimes (Collins and Lapsley 2002; Leontaridi 2003). Others in contrast only look at certain crimes that are expected to be alcohol-related, such as violence, property offences, and crimes that by their nature are linked to alcohol like drink-driving and public drunkenness (Collins and Lapsley 2002; Johansson et al 2006).

The second decision is how to estimate how many crimes are committed while the perpetrator (or the victim) is under the influence of alcohol. There are several approaches here:

1. Asking the victims of crime whether they thought their attacker was under the influence of alcohol (Leontaridi 2003);
2. Asking perpetrators of crimes if they had drunk alcohol before an attack, often when they are in prison (Harwood et al 1998; Collins and Lapsley 2002; Johansson et al 2006; Rehm et al 2006);
3. Breathalysing (or doing other tests) on people who have just been arrested and brought back to a police station (Leontaridi 2003); and
4. Police estimates of whether a person is under the influence of alcohol.

Perhaps most crucial however is the final step in estimating the role of alcohol: adjusting these associational figures to show the *causal* role of alcohol. Some studies simply give up on this, explicitly describing the crime costs as 'up to' their estimated figure, conceding that this is a maximum rather than an unbiased estimate (Guest and Varney 2001; Leontaridi 2003). Yet others have started to make efforts to create unbiased (if imprecise) estimates, primarily by asking prisoners and arrestees if they thought the offence they committed was *caused* by their drinking (Pernanen et al 2000; Collins and Lapsley 2002; Pernanen et al 2002). Pernanen et al found this reduces the associational figures down by around 20-30%. However, this requires us to assume that offender perceptions are accurate (Room and Rossow 2001).

The main defence of this approach is simply that there is little in the way of alternatives (Harwood et al 1998) – or rather that there are alternatives, but that these alternatives also have problems. The Swedish study uses a time-series analysis by Nörstrom 1998 for assaults, which found that 40% of assaults are alcohol-related. However, the process of going from time-series analyses to AAFs can be problematic, as it means assuming that there is linear relationship between aggregate alcohol consumption and aggregate mortality that can be applied from the observed range of alcohol consumption down to no alcohol consumption at all (Rossow 2001).

In the end, some combination of these methods together with 'reasoned judgement' may be necessary. The WHO guidelines on estimating the cost of substance abuse simply state that any assumptions "should be backed up by a chain of logic and the best data that are available" (Single et al 2001). For example, the Swedish study uses the time-series AAF for assault, and then also applies this to rape (an extension which is slightly supported by small-scale studies) and graffiti on school buildings. They do not see this as valid for theft, so instead use the figures from Canadian/American research with arrestees and come to an estimate of 20% - which they then decide to halve to 10% on the basis that this applies to the number of offences rather than the value of the offences (given alcohol-caused thefts are less likely to be professional and therefore high-value than others). The AAF for theft is then applied to all costs in anticipation of crime.

Drink-Driving Damage The main non-labour financial cost here is the damage that results from drink-driving accidents (Miller et al 1998; Miller and Blewden 2001), although the value-added in the manufacture and repair of cars should be subtracted from this, on the assumption that the cars will be replaced (Horlings and Scoggins 2006).

Miscellaneous Other Costs There are a number of other miscellaneous costs including the cost of organised crime that relates to avoiding taxes on alcohol (Horlings and Scoggins 2006); the cost of fires caused by people who are drunk. This is generally a very small cost, being only 1% of the total financial cost in all four cases where it has been estimated (Salomaa 1995; Harwood et al 1998; KPMG 2001; Rehm et al 2006); the cost of alcohol-attributable litter has also been estimated (Easton 1997; Collins and Lapsley 2002); and the cost of damage in alcohol-attributable workplace accidents. Workplace accidents impose a considerable cost across the EU (Eurostat 2004), although the one study to estimate the role of alcohol finds this only adds 2% to the total financial cost (Bergmann and Horch 2002).

In the Sheffield model, the modelling of crime-related harms adapted original work by the Cabinet Office, recently updated by UK Government analysts, Table 5.

Table 5 Crime conditions included in the Sheffield model.

Crime	Offence code
Causing death by dangerous driving	4.6
More serious wounding	5
Less serious wounding	8A, 8D
Assault on a constable	104
Assault without injury	105A, 105B
Criminal damage	56-59
Theft from a person	39
Robbery	34
Robbery (business)	34A
Burglary in a dwelling	28, 29
Burglary not in a dwelling	30,31
Theft of a pedal cycle	41
Theft from vehicle	45
Aggravated vehicle taking	37.2
Theft of vehicle	48
Other theft	49
Theft from shops	46
Violent disorder	65
Sexual offences	
Homicide	1,4, 37

The model estimated that a 10% increase in the price of alcoholic beverages would reduce the annual number of crimes by 97000 per year, with a saving of €118 million.

3.2 Reducing labour and productivity costs

COSTS	BENEFITS
Implementation costs **€3.7 million**	**Reduced health and welfare costs** **€183 million**
Costs to industry **Not known, but likely to be small**	**Reduced labour and productivity losses**
Consumer loss not transferred to government in terms of revenue **€58 million**	Reduced non-financial welfare losses

Alcohol is considered to have an impact on unemployment, absenteeism, productivity at work (presenteeism), and lost productivity due to premature mortality (Anderson & Baumberg 2006). However, estimating the size of the impact and placing an economic value on the impact is not straightforward.

Unemployment
Only a limited number of studies have tried to estimate the role of alcohol in unemployment. These are based on the finding that heavy drinkers usually have a higher unemployment rate than other people. However, some studies show that abstainers are more likely to be unemployed than lighter drinkers (Johansson et al 2006). Given the lack of any plausible causal mechanism this is likely to be due to the sick quitter effect (as below, Lye & Hirschberg 2010), but this still causes problems in estimating the role of alcohol. To get around this, most studies generally assume that they should only look at people with alcohol use disorders, on the assumption that the effect of alcohol on unemployment occurs primarily through the impact of addiction.

The excess unemployment among those with alcohol use disorders is not likely to be solely due to the causal effect of alcohol; those with alcohol use disorders are likely to be different to other people in many ways, some of which also have an effect on unemployment (e.g. low education). This is often called a 'selection bias', which refers to the particular types of people that are 'selected' into suffering from an alcohol use disorder. In the absence of any further information, some cost studies either use the available but biased estimates of excess unemployment (Guest and Varney 2001), or make arbitrary assumptions as to how far this relationship is causal (Easton 1997; KPMG 2001).

A recent meta-analysis of papers that have reported a positive impact of alcohol consumption on earnings suggested a lack of labour force participation by those individuals who consume large amounts of alcohol (Lye & Hirschberg 2010). They reported the 95% confidence intervals of the lower and upper bounds of the turning points reported in the individual studies, where the turning point can be interpreted as that level of alcohol consumption past which further consumption leads to a negative impact on wages. The 95% confidence intervals of the bounds of the turning point are reproduced in Figure 6.

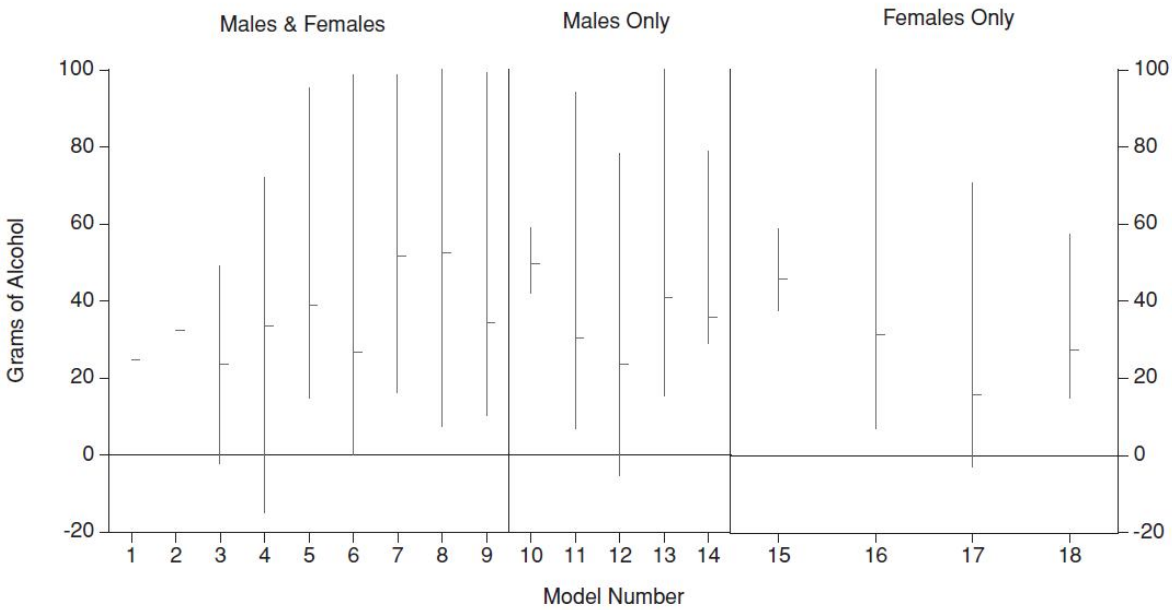


Figure 6 Plot of 95% confidence intervals of the bounds of the turning point from selected studies that investigate the relationship between alcohol consumption and wages, where the turning point is that level of alcohol consumption past which further consumption leads to a negative impact on wages. Source: Lye & Hirschberg 2010.

The confidence intervals are wide and indicate that there may be a positive effect of alcohol on wages. However, when the lower bound is less than zero, the relationship between wages and alcohol becomes insignificant. Conversely, when the level of consumption exceeds the upper bound the relationship between alcohol consumption and wages becomes negative. There are six cases for which the lower bound is negative, suggesting that it could well be the that there is no level of alcohol consumption for which there is a positive relationship. In all cases, the upper bounds were generally higher than the reported maximum levels of alcohol consumption in the various studies. The higher the upper bound the greater the evidence that the relationship between alcohol consumption and wages may be more of an inverted J-shape which would be present if the impact of alcohol consumption plateaus. This conclusion is consistent with heavy drinkers engaging in compensatory measures to conceal the problem as well as a negative relationship between heavy drinking and labour force participation.

In England, MacDonald and Shields (2004) showed that “problem drinking”, measured by a combination of psychological and physical symptoms, or in terms of quantity and frequency of alcohol consumption, was negatively associated with the probability of being in work. This study analysed data from the Health Survey for England (1997-98) and focused on males aged 22 to 64 years. Being a problem drinker lead to a reduction in the probability of working of between 7% and 31%.

Absenteeism

One study has investigated the relationship between per capita alcohol consumption and sickness absence, which was undertaken in Sweden for the period 1935-2002, analyzed through the Box-Jenkins method for time-series analyses (Norström 2006). Two indicators of sickness absence were used, one based on sickness insurance data, the other on data from the labour force surveys. Alcohol consumption was gauged by sales of pure alcohol (100%) per inhabitant 15 years of age and older. Because changes in the economy may affect alcohol consumption as well as sickness absence, two macroeconomic indicators were included as control variables: unemployment and real wages. A 1-litre increase in total consumption was found to be associated with a 13% increase in sickness absence among men ($P < 0.05$). The relationship was not statistically significant for women. This relationship is supported by micro-level data from Finland (Johansson et al 2009), which showed that alcohol consumption measured by drinks per week was positively associated with the number of sickness absence days for both men and women. However, there are methodological problems with such approaches, and there is a need for robust individual-level studies to accompany such time-series analyses (WHO 2010).

An earlier overview analyzing absenteeism rates of people at all levels of alcohol consumption yielded mixed results (Gmel and Rehm 2003). Some studies have found no association between drinking and absenteeism. For example, Ames *et al.* (1997) found no significant association between the drinker's usual volume of consumption or frequency of heavy drinking occasions (which they defined as occasions during the past year when a person had 10 or more drinks) and absenteeism. Moreover, though drinking at the workplace and hangovers at work were related to other negative consequences, such as workplace injuries, they were not related to absenteeism. A longitudinal study in the UK found that male abstainers had an increased risk of sickness absence compared with lighter drinkers (Marmot *et al.* 1993). A J-shaped relationship has been found in other studies for sickness absence (Vahtera *et al.* 2002), as well as for unemployment (Mullahy and Sindelar 1996) and earnings (Hamilton and Hamilton 1997), although it is not clear in all these studies the extent to which characteristics of the non-drinkers explain the findings, or the extent to which the absenteeism simply reflects a higher extent of health problems in the abstainers as opposed to the light drinkers (see below). A small scale US study found a significant relationship between alcohol use and workplace absences (McFarlin & Fals-Stewart (2002). Workers were roughly two times more likely to be absent from work the day after alcohol was consumed.

A study of 13,582 Australian workers found clear evidence for the impact of drinking patterns on absenteeism (Roche et al 2008). Workers' alcohol consumption was classified according to short- and long-term risk levels. After adjusting for age, gender and marital status, the likelihood of alcohol-related absenteeism was larger for workers who drank at risky or high-risk levels compared to workers who were low-risk drinkers. For both short- and long-term risk levels, as consumption increased so did the likelihood of alcohol-related absenteeism. Compared to low-risk drinkers, workers drinking at short-term high-risk levels (110g alcohol or more on any one day for a man and 70g alcohol or more on any one day for a woman)at least yearly, at least monthly or at least weekly were 3.1, 8.7 and 21.9 times (respectively) more likely to report alcohol-related absenteeism, Figure 7. Workers drinking at long-term risky (290g-420g per week for a man and 150g-280g per week for a woman) or high-risk levels (430g or more per week for a man and 290g or more per week for a woman) were 4.3 and 7.3 times (respectively) more likely to report alcohol-related absenteeism, compared to low-risk drinkers, Figure 8.

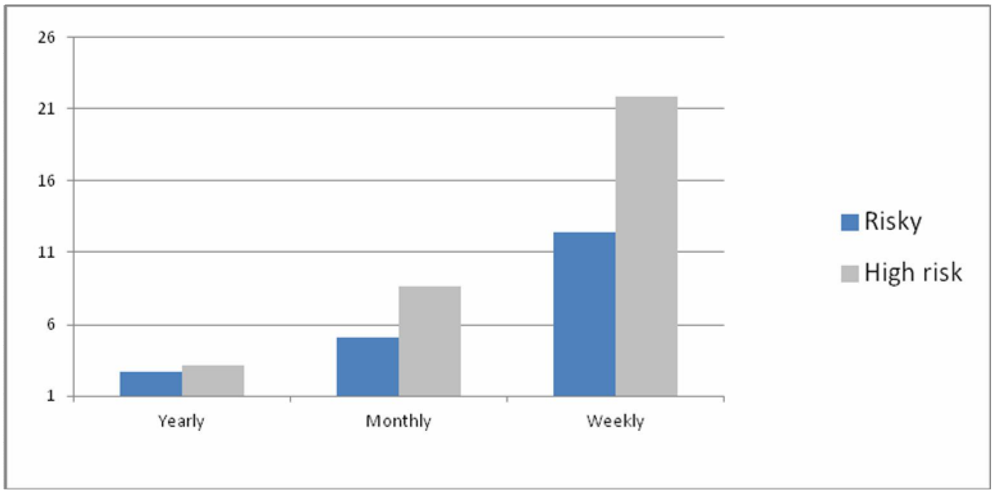


Figure 7 Adjusted ORs for absenteeism in previous 3 months by drinking category (short term risk levels). For definitions of risky and high risk, see text. Source: Roche et al 2008.

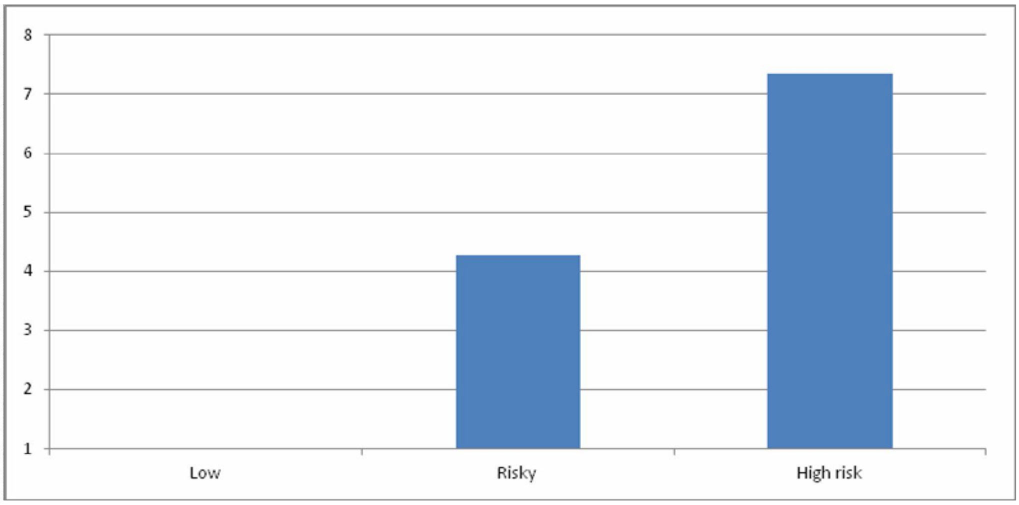


Figure 8 Adjusted ORs for absenteeism in previous 3 months by drinking category (long term risk levels) For definitions of risky and high risk, see text. Source: Roche et al 2008.

Reduced productivity

For most people, it seems simple common-sense that alcohol impacts on people's productivity when they are at work. Drinkers with hangovers are likely to do less work, while those who drink at work are likely to achieve less and make worse decisions (Horlings and Scoggins 2006). If one asks either drinkers (Jones et al 1995) or employers (Leontaridi 2003), then they both report that they believe that such alcohol use reduces workers' productivity at the workplace. A low-quality survey in the UK suggested that people turn up to work hungover approximately 2.5 days per year, and on these days they only work at around 75% capacity (reed.co.uk 2004).

It is, however, very difficult to accurately estimate the cost that result from this. The initial problem is that it is very difficult to measure productivity, outside of occasional exceptions like assembly-line manual work. To get around this, economists usually use wages as a proxy for productivity, on the assumption that the labour market works smoothly enough that lower productivity will be reflected in people's pay. However, aside from finding that heavy drinking is usually bad for people's pay, wages tend to be lower for abstainers than light drinkers (Zarkin et al 1998; Barrett 2002; Tekin 2004; van Ours 2004).

The meta-analysis of papers that have reported a positive impact of alcohol consumption on earnings, referred to above, has shown the relationship to be an artefact (Lye & Hirschberg 2010). The abstainers in the study samples included two types, those that have never had a drink and those that are ex-drinkers. Ex-drinkers may have health problems, partly or wholly as a result of past drinking patterns and as a result have become abstainers. Also as the sample becomes older, there may be an increase in ex-drinkers being defined as abstainers in the sample. In the medical literature, Fillmore *et al.* (2006) concluded that the cardiac protection associated with alcohol consumption may be over-estimated due to the inclusion of ex-drinkers in the abstainers. This may also be true in the wage models – the higher the proportion of abstainers in a sample indicates the higher the proportion of ex-drinkers that are now counted as abstainers. Possibly these individuals have stopped drinking due to negative impacts on their productivity and their potential for job mobility. Thus, the greater the number of ex-drinkers the greater the difference between the human capital of those in the still-drinking group and those that have had to stop drinking. The meta-analysis in fact confirmed this conclusion (Lye & Hirschberg 2010). When the proportion of the abstainers in the sample was less than 28%, there was no beneficial impact of alcohol on wages; this only became apparent when the proportion of abstainers was greater than 28%.

Lye & Hirschberg (2010) performed a meta-analysis of the studies reported turning points, which are interpreted as the level of alcohol consumption past which further consumption leads to negative impacts on wages and thus would be detrimental to the return on human capital. Up to the turning point there would be a positive though diminishing benefit gained from additional consumption of alcohol. A meta-analysis of the lower bound of the 95% confidence intervals for the turning point obtained from the studies, accounting for the potential simultaneity of alcohol consumption and wages found that the lower bound for the turning point was indistinguishable from zero, and thus, there was no level of alcohol consumption that had a positive impact on wages (Table 6 of Lye & Hirschberg 2010). It was concluded that alcohol consumption was a proxy, albeit imperfect, for all personality traits that have a positive influence on human capital.

Premature mortality

Of all the labour costs, the premature mortality costs are usually the largest. The role of alcohol for premature mortality costs can be estimated using the same AAFs that were calculated for health care costs (see above), noting the difference in the morbidity and mortality AAFs.

The conventional way of estimating the cost of an early death, the human capital method, is to estimate how much economic value a person would have created if they had instead lived to an average age. The human capital is based on two different figures: (i) the value they would have created in a single year, usually estimated as the wage plus labour taxes of an average worker (often of that age and sex), and (ii) the number of additional working years that that person could have been expected to live, based on average life expectancy (again for people of that age and sex) (Johansson et al 2006). Often the latter is based on the official retirement age, and does not take into account the fact that many people retire before the official retirement age.

The human capital method is, however, based on the assumption that there is full employment such that people who die are absolutely irreplaceable in the labour market. This is a clear overestimate, as it is more likely that some of the people who die prematurely are replaced by people who would otherwise have been unemployed. If we go as far as assuming that *all* of the people dying prematurely would be replaced, then the only cost is the 'friction cost' of replacing workers, primarily the time taken to recruit a new worker (Koopmanschap et al 1995). Several studies have compared the human capital and friction cost methods, and these find that the friction cost method is often only 1-3% of the human capital estimate (Rehm et al 2006). Yet the friction cost method has been criticised in turn for requiring predictions of macroeconomic variables that are inaccurate, and for making unwarranted assumptions that lead it to be an overestimate (Godfrey et al 2005). For example, it is necessary to guess how long the frictional period is; an assumption that there will be a three month gap before someone is replaced leads to cost only a quarter the size of assuming that there will be a twelve month gap (Johansson et al 2006). More importantly, the friction cost ignores the cost of people who cannot be replaced by currently unemployed people and the probable chains of vacancies that arise by replacing workers with people employed elsewhere, as well as the cost of training new workers. The true cost is likely to lie between the two estimates.

Unlike the friction cost method or the demographic method, the human capital method requires a value of the costs of current deaths into the future. Because €100 today is valued more highly than €100 in 10 years time, it is therefore necessary to 'discount' future costs to create a total value in the present; the parameter determining how much future costs are discounted is called the 'discount rate'. The WHO guidelines suggest that discount rates of 5% and 10% should be used in all studies to facilitate comparison (Single et al 2001). However, a review by Anderson and Baumberg (2006) found that six studies only looked at one discount rate (but that these were five different rates), while even studies comparing different discount rates had little overlap and rarely used both of the suggested values. Johansson et al (2006) compare rates of 0%, 3% (their preferred option) and 6%, and found enormous differences in the estimates produced: compared to the 3% base case, a 0% rate quadrupled the cost while a 6% rate made it only one-twentieth of the size. Furthermore, it is necessary to estimate future productivity growth alongside this, with similar effects on the resulting estimate.

When considering premature mortality costs, it should be noted that people use up resources through their life as well as generating them, and it is unclear whether these should be taken into account. One US study estimated that people over the age of 55 years used more resources than they created over the course of the rest of their lifetime (Meltzer 1997). Such concerns may be particularly important in the current political climate given worries about the increase as to how to fund pensions given an ageing population (Horlings and Scoggins 2006).

There are two ways to try to take this into account. One is to use the conventional method, but to create a separate estimate of the annual value of resources used by people of different ages (Jeanrenaud et al 2003). The other is to adopt the 'demographic method' and create an entire counterfactual population structure (Collins and Lapsley 2002). In both these cases, the total premature mortality cost was reduced by around 30%.

An increasing number of studies attach a value to production outside of the workplace, such as housework and voluntary work (Easton 1997; Harwood et al 1998; Leontaridi 2003; Rehm et al 2006). This may often be difficult to estimate as it requires national data on productive activities outside the workplace. In the Swedish case this made no overall difference to the total cost, but elsewhere the costs involved have been noticeable. The main problem with these costs is that they are non-financial costs, and are therefore completely different to the other cost components that are financial (Jeanrenaud et al 2003; Collins and Lapsley 2002). These should therefore be excluded from the financial cost estimates (as in Anderson and Baumberg 2006) but incorporated (without double-counting) in the full economic welfare costs.

Other labour costs

Through two main causal chains, alcohol is likely to reduce the time available for people to work. Firstly, people imprisoned due to their own alcohol-attributable crime will not be working (Salomaa 1995; Harwood et al 1998; Collins and Lapsley 2002), and may therefore incur a cost similar to that of alcohol-attributable unemployment and disability pension. For example, the Swedish study combined the number of people imprisoned for alcohol-attributable offences with an estimate of what an average 30-49 year old male would produce over the rest of his life (Johansson et al 2006).

Secondly, people who are affected by other people's drinking are also more likely to be absent from work or receiving a disability pension. This could include costs that are very rarely included in cost studies, such as the time spent giving evidence in alcohol-attributable trials (Johansson et al 2006) or the time spent caring for people disabled due to their drinking. More commonly – and probably also more importantly – alcohol cost studies can estimate the lost time spent working by victims of drink-driving accidents (Horlings and Scoggins 2006) or alcohol-attributable violent crime (Leontaridi 2003).

An Australian study reviewed the magnitude and range of alcohol's harm to others (Laslett et al 2010). The total cost was Australian$14.2 billion. Of this, $9.3 billion resulted from lost productivity costs due to lost and spent time as a result of a heavy drinker. $801 million was due to work related costs, split between extra hours worked ($453 million) and absenteeism ($348 million). The annual cost of extra hours worked by workers because of a co-worker's drinking ($453 million) is comparable with estimates of absenteeism due to one's own drinking, $368 million (Collins & Lapsley 2008). And, the cost of absenteeism due to someone else's drinking ($348 million) is almost as large as that due to one's own drinking ($368 million). Overall, it was found that including the harm done by alcohol to others than the drinker, after deducting any double-counting doubled the social costs from $12.2 billion to $23.5 billion.

Alcohol-attributable traffic accidents could lead to congestion and therefore add to the economic cost of transport (Miller et al 1998; Miller and Blewden 2001; Horlings and Scoggins 2006). Another effect on productivity could be through alcohol-attributable workplace accidents; this has never been estimated for alcohol, but has been estimated in a more general cost study (Eurostat 2004).

Although contested there is evidence that alcohol, and particularly heavy drinking and alcohol use disorders, while in education may affect the educational qualifications that such drinkers ultimately receive, either through reduced working, truancy, or even expulsion (Bray 2005; Horlings and Scoggins 2006). This could influence the skills of the labour force and reduce the amount of available human capital, and ultimately lead to labour costs (Lye & Hirschberg 2010).

Overall, there remain problems in trying to estimate labour costs that occur when an individual worker's productivity is reduced. They cannot account for more 'indirect' effects and the dynamic ways in which affects in one area ripple through the rest of the economy more generally (WHO 2009; Suhrcke et al 2008), such as:

- People with better health may be more likely to invest in education and training, which will increase growth (Suhrcke et al 2008; WHO 2009);
- People with better health will earn more on average, which could either reduce the labour supply if people use this extra income to retire earlier, or increase labour supply if the higher wages make work more appealing relative to leisure (Suhrcke et al 2008; WHO 2009);
- People with better health will need to save more for their (longer) retirement. This increase in saving will ultimately be matched by greater dis-saving at older ages, but the short-term increase in saving levels may increase aggregate investment and thereby growth (WHO 2009);
- People with better health make a country more appealing to foreign investors, particularly in low- and middle-income countries (WHO 2009);
- Changing age structures of society will affect growth (WHO 2009); and
- All of these costs will have further impacts on the rest of the economy. For example, to the extent that these reduce demand, this in itself may lead firms to reduce investment, which will then further deepen the decline in demand (WHO 2009; Suhrcke et al 2008.

Moreover, there may be labour and productivity impacts of the health/crime costs described in the previous section, as money is diverted from potentially growth-enhancing uses such as investment to paying for the costs of alcohol-related harm (WHO 2009), which needs to be balanced against the value-added created in law enforcement, health care etc (Horlings and Scoggins 2006). For example, economists argue that higher costs to governments lead to higher taxes, which in turn lead to economic inefficiencies (known as 'deadweight losses'); this means higher taxes per se lead to a labour and productivity cost. This has only recently been mentioned in the alcohol field (Horlings and Scoggins 2006; Johansson et al 2006), with the Johansson et al (2006) sensitivity analysis showing that this could increase the government costs (health, criminal justice etc.) by 30-130%.

The cost of a day's work to an employer is conventionally estimated as the wage plus labour taxes. However, this cost may be misleading (Horlings and Scoggins 2006), because there are 'coping strategies' for people that are absent (WHO 2009). Most work does not have to be done at a particular time by indispensable workers, instead being covered by the additional work of colleagues (particularly in large companies), or by the individual worker when they return from absence, or cancelling unimportant tasks. Even so, these coping strategies may themselves lead to productivity losses, for example, by maintaining labour reserves to reduce risk of staff shortages (WHO 2009). Ideally one would want to value the level of *output* among people who drink different levels, rather than the *input* of the time spent at work.

In the Sheffield alcohol policy model, the excessive risk of not working was derived from the mean participation rate, the proportion of problem drinkers (considered equivalent to harmful drinkers, and therefore related to mean consumption level) and the reduced probability of not working if someone is a problem drinker. The probability of working was assumed to be driven by mean consumption rather than peak consumption. Excess risk was assumed to start after a threshold of 7.1 units per day (1 unit = 8 grams alcohol) for males and 5.0 units per day for females (equivalent to 50 and 35 units per week respectively) based on the harmful drinker definition. The Sheffield Alcohol Policy Model quantified reductions in lost productivity due to the workplace harms of sickness absence and unemployment financially based on average salaries. The study estimated that a 10% price increase would reduce employment related costs by some €405 million in the 1^{st} year in England, split as €53 million absence related costs and €352 unemployment related costs.

3.3 Valuing healthy life

COSTS	BENEFITS
Implementation costs **€3.7 million**	**Reduced health and welfare costs** **€183 million**
Costs to industry **Not known, but likely to be small**	**Reduced labour and productivity losses** **€405 million**
Consumer loss not transferred to government in terms of revenue **€58 million**	**Reduced non-financial welfare losses**

Non-financial welfare benefits of alcohol policy include reduced pain, suffering and loss of life. The health impact itself is relatively simple to estimate as long as the premature mortality/health care estimates have been conducted, such that estimates in the causal role of alcohol for each health condition are available. This health impact must then be combined with a valuation of a year of life and a year of healthy life, which is not straightforward to do.

Much of the reservation about putting a monetary value on life and health stems from a misunderstanding of what such a value actually means. In fact, economists cannot and do not seek to place a monetary value on any identified person's life. Instead, they are valuing comparatively small changes in the risk of mortality, a very different matter. Although less elegant, it would be more appropriate to say the value of small mortality risk reductions than the value of life. While normally no one would trade his or her life or health for money, most people weigh safety against cost in choosing safety equipment or against time when crossing a busy street. Those contemplating a dangerous job, such as in mining, will demand a wage premium in return for accepting greater risk. People obviously act as if life were not priceless and, in making these choices, are implicitly putting a price on or attributing a value to changes in the risk of mortality.

One way to make the value attributed to health more explicit is by measuring the extent to which one is willing to trade health for those things that have a price. So-called willingness-to-pay (WTP) methods do precisely that, either by analysing how people act or how they answer certain questions. In revealed-preference studies economists infer WTP from the premiums people implicitly demand for accepting more hazardous jobs or from the sums they pay for safety-enhancing products, such as seat belts and smoke detectors. Knowing these premiums and the risks associated with them makes it possible to calculate the value of a statistical life, which can then be used to place a value on changes in the risk of mortality. Other studies use an approach termed contingent valuation methodology, where survey respondents are asked how much they would pay to reduce their risk by a certain amount. While WTP approaches have been refined and improved recently, considerable variation remains in the estimates obtained and considerable uncertainty remains around any estimate.

These approaches were first developed in 1973 (Usher 1973), using the concept of full income to capture the sum of the value of growth in GDP and the value of years of life expectancy gained. The initial study applied this concept to six political entities (Canada, Chile, France, Japan, Sri Lanka and

Taiwan, China) and covered the middle decades of the 20th century. In the higher-income entities, about 30% of the growth in full income was attributable to declines in mortality. More recently, studies in the United States, found that the economic value of increases in longevity in the last century roughly equalled the growth measured in non-health goods and services (Nordhaus 2003).

Suhrcke et al (2008) adopted the general approach described above to estimate the monetary worth of increases in life expectancy between 1970 and 2003 in selected European countries. Conceptually, the monetary value of health gains can be measured by the amount of money people would require to forego these gains. In other words, what income would someone living with a 2003 income and life expectancy require to be willing to live with the life expectancy that prevailed in 1970? The additional income he or she would require is a measure of the monetary value of the additional life years gained between the two years. The difference in lifetime values, and thus the required compensation, is in column 6 of Table 6. This value can then be divided by the extra years of life expectancy over the period (column 7) to yield an annual figure, and it can then be expressed in relation to 2003 GDP per capita in order to reveal its size (column 8). Varying between 29% and 38% of GDP per capita, these percentages illustrate the substantial value attributed to health gains in Europe, a value far exceeding each country's national health expenditures.

Table 6 Monetary value of life expectancy gains in selected European countries, 1970-2003. Source: Suhrcke et al (2008)

Country (1)	Life expectancy at birth (years)		Real GDP per capita (PPP$)		Monetary value		
	1970 (2)	2003 (3)	1970 (4)	2003 (5)	Life expectancy gains (PPP$) (6)	Gains per life year gained (PPP$) (7)	(7) as % of 2003 GDP per capita (8)
Austria	70.02	78.93	3 020	30 094	87 986	9 875	33
Finland	70.40	78.72	2 897	27 619	74 037	8 899	32
France	72.93	79.44	3 659	27 677	54 741	8 409	30
Greece	73.82	78.93	1 613	19 954	29 085	5 692	29
Ireland	70.75	78.28	1 934	37 738	95 450	12 676	34
Netherlands	73.71	78.80	3 542	29 371	45 426	8 925	30
Norway	74.17	79.71	3 015	37 670	64 398	11 624	31
Spain	72.88	79.78	2 313	22 391	45 312	6 567	29
Sweden	74.83	80.37	4 019	26 750	42 705	7 708	29
Switzerland	73.24	80.81	5 222	30 552	69 794	9 220	30
Turkey	54.15	68.70	927	6 772	37 796	2 598	38
United Kingdom	71.95	78.45	3 189	27 147	55 106	8 478	31

However, it is necessary to go beyond value a year of extra life to valuing a year of extra health life. The most common unit to measure healthy life years is Quality-Adjusted Life Years – 'QALYs'. This simply means giving a year in a particular state a value less than one, where one would be a year with perfect quality-of-life. For example, if one valued a year with alcohol dependence as having a QALY value of 0.6, this means one values 6 years in perfect health as the same as 10 years with alcohol dependence. Numerous studies in health economics have attempted to produce financial valuations of QALYs, using the WTP techniques mentioned above.

However, both revealed valuation and stated preference approaches to measuring QALYs suffer from severe problems in practice (WHO 2009). For example, the assumption that a QALY has a fixed value that can be applied across different contexts, times and places is questionable. Research has suggested that QALY valuations vary depending on wealth, age, family status, baseline levels of risk, the change in risk, moral responsibility for the risk, and whether the risk is public or private.

This creates substantial problems in deciding which QALY valuation to use in alcohol studies. Johansson et al (2006) used a Swedish valuation survey that estimates a QALY value of €36,000, whereas the Swedish Pharmaceuticals Board uses a threshold of €54,000 (WHO 2010).

Harm to others than the drinker

A New Zealand study found that 30% of people had someone in their life who was a heavy drinker (Casswell et al, in press). An index of exposure to heavy drinkers, reflecting numbers of heavy drinkers and co-habitation, predicted measures of health status and personal wellbeing while controlling for demographic variables and respondent's own drinking, Figure 9. The greater the exposure to a heavy drinking, the risk of impairment was greater.

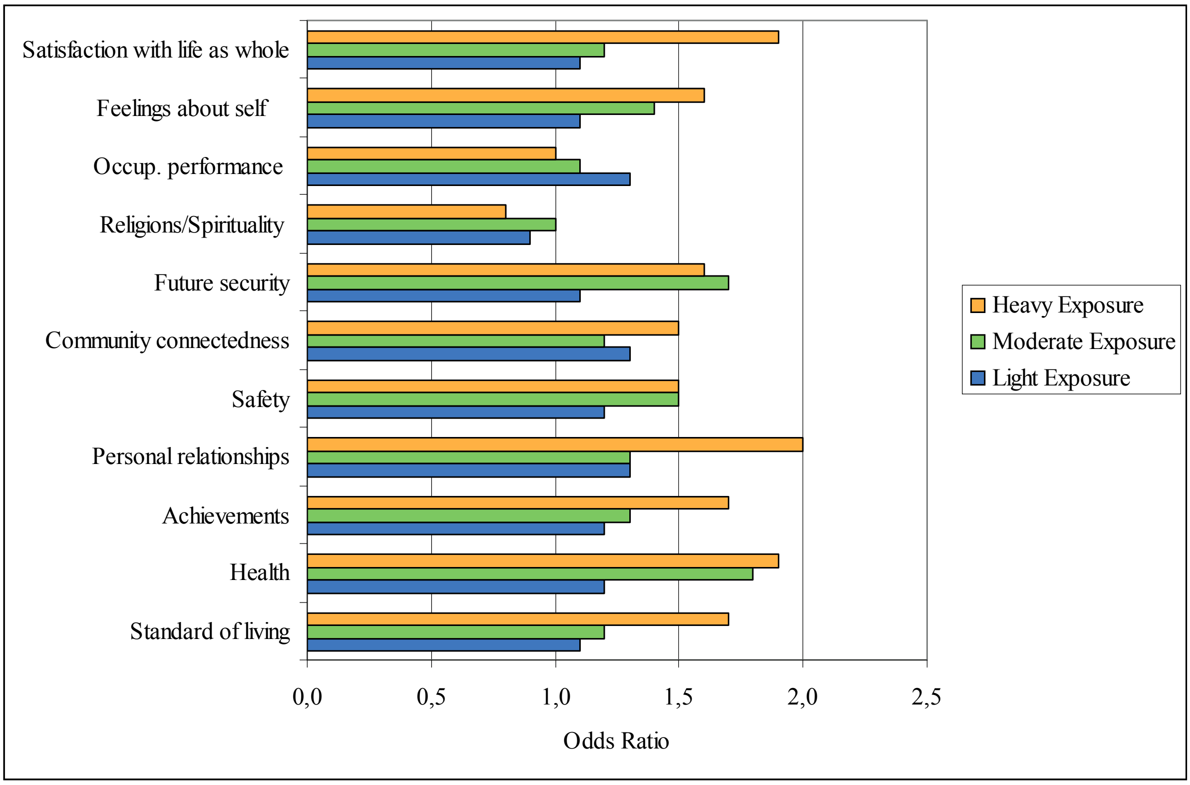


Figure 9 Odds ratios for impairment to well-being and health by exposure to heavy drinkers (number and time living in household), New Zealand residents, 2008-2009. Source: Casswell et al, in press.

As noted in section 3.2, an Australian study reviewed the magnitude and range of alcohol's harm to others (Laslett et al 2010), also based on an alcohol's harm to others survey of a national random sample of 2,649 Australians aged 18 years or older who responded to a computer-assisted telephone interviewing (CATI) during 2008, Table 7.

Table 7 Cost estimates from others' drinking from different categories of problems and relationship (AUS$ millions)

		Out of pocket expenses	Cost of time lost or spent	Intangible costs	Health service costs	Child protection costs
Health impacts	Child abuse				0.95	
	Child road crash				2.65	
	Adult road crash		3.33		27.06	
	Adult assault		5.32		38.23	
Well-being impacts	Drinker in household			1500.72		
	Drinker elsewhere			7032.98		
Assault victims		0.66	57.68		58.92	
Domestic violence victims		0.26	22.93		23.21	
Child protection						671.61
Impacts from known drinker		845.85	9333.80	6389.58		
Impacts in workplace			801.00			
Harm from strangers		1619.00		5331.81		
Service use	Alcohol treatment				2.86	
	Phone helpline		0.06		0.21	
	Help seeking	109.79	720.35			

Out of pocket expenses for damage of personal belongings were estimated at $0.66 million and $0.26 million for alcohol-related assault and alcohol-related domestic violence, respectively. Out of pocket costs from the drinking of the person in the household, family or friendship were estimated at $845 million, and due to property and personal damage associated with stranger drinking at $1,619 million.

Cost of time lost or spent in hospital as a consequence of alcohol-related road crashes and alcohol-related assaults was estimated at $3.33 million and $5.32 million, respectively. The total estimated cost of extra hours worked and the time taken off due to other people's drinking is estimated at $801 million. The largest figure in the cost of time column is for time lost or spent because of the drinking of the drinker known to the survey respondent whose drinking most adversely affected the respondent; over $9 billion worth of other people's time was absorbed by the needs and impositions of these drinkers (time spent outside the respondent's normal routine in caring for the drinker or for children the drinker was responsible for, cleaning up after the drinker or providing transport).

Respondents also reported spending substantial time – amounting to $720 million worth of time – seeking or receiving help from the police or health services because of the drinking of others.

Intangible costs related to the estimated value of fear, pain, suffering and lost quality of life, with each quality-adjusted year of life (QALY) valued at $50,000. Intangible costs were estimated, at $1,500 million and $7,000 million, for alcohol-related related loss of wellbeing associated with heavy drinkers known to the respondent, respectively, inside and outside the respondent's household. A second figure was derived from the relatively lower quality of life of respondents knowing a heavy drinker whose drinking had, in the respondent's view, had an adverse effect in the last year: over $6,300 million. While adverse effects from strangers' drinking were more widely dispersed in the population than adverse effects from the drinking of family and friends, the intangible costs were lower, around $5,300 million,

Hospital / health service costs were estimated at $0.95 million, $2.65 million, $27.06 million and $38.23 million for alcohol-related hospital admissions for child abuse, child road crash, adult road crash and adult assault, respectively. Estimates of health service costs were also derived for assault victims ($58.92 million) and victims of domestic violence ($23.21 million) as recorded by the police that were admitted to hospital. Child protection costs were estimated at $672 million.

The Sheffield model used a financial valuation of €24,000 per health QALY and €97,000 per crime QALY. The Sheffield model discounted QALYs at 3.5%. The estimated value of the harm reductions in the first year following a 10% price increase were €71 million for health related QALYs and €39 million for crime related QALYs.

5. CONCLUSIONS AND SUMMARY

COSTS	BENEFITS
Implementation costs **€3.7 million**	**Reduced health and welfare costs** **€183 million**
Costs to industry **Not known, but likely to be small**	**Reduced labour and productivity losses** **€405 million**
Consumer loss not transferred to government in terms of revenue **€58 million**	**Reduced non-financial welfare losses** **€110 million**

This primer has considered the costs and benefits of alcohol policy and has used, as an example, a hypothetical tax increase on alcohol that results in an across the board 10% price increase in England. For a more detailed examination of calculating the benefits of alcohol policy (or the costs of alcohol), the reader is referred to WHO (2010), which includes a list of recommendations for best practice.

The primer has taken a societal perspective, considering the costs and benefits of an incremental change in policy, based on data derived from the Sheffield alcohol policy model.

The Sheffield alcohol policy model did not report on implementation costs. However, the WHO CHOICE model estimated that a tax increase of 25% in the United Kingdom would cost about an extra €3.7 million to administer. This is about 0.17% of the expected revenue increase resulting from a 10% price increase (€2200 million).

The Sheffield alcohol policy model did not consider transition costs to the alcohol industry. However, based on Baumberg (2006), these are likely to be small, and certainly of an order of magnitude smaller than the estimated benefits of reduced labour and productivity losses of €405 million. This is an area for further study.

The Sheffield alcohol policy model did not estimate losses to consumer surplus. However, the model demonstrated that a 10% price increase would result in an extra spend by consumers of €2200 million. However, as pointed out in the text, this money, in the presence of a tax increase, and assuming that the tax increases follows through 100% to a price increase would return to the government as tax revenue, which can be rebated to consumers in a variety of ways. The €2200 million is thus a transfer rather than a cost. There is though, a loss to consumer surplus, representing the value that consumers place on the foregone consumption that is reduced due to the price increase. This is an intangible cost that can be estimated at €58 million.

This estimate is based on a view of rational demand for alcohol. But, as has been pointed out, this is not the case, and, in the presence of irrational demand, the loss of the adjusted consumer surplus is

more than likely offset by the gain in excise tax revenue; in addition, the tax increase reduces any extra costs of consumption unmatched by consumer surplus benefits.
On the benefit side, there are real tangible benefits due to reduced health and welfare costs (€183 million) and reduced labour and productivity losses (€405 million). These benefits do not include benefits to people other than the drinker, and may possibly be doubled when doing so.

Finally, there are non-tangible benefits due to the value of reduced health and crime-related QALYs (estimated at €110million). This estimate would increase if the values of all benefits to people other than the drinker are included.

Putting this altogether, if we just include the tangible costs, above the red line of the table, at an implementation cost of €3.7 million, a tax increase would bring benefits worth €588 million – a figure that would be even higher if we consider the benefits accruing to people other than the drinker. This favourable balance would need to be adjusted, once accurate estimates of the likely rather small transition costs to the alcohol industry are included.

If we consider add in the non-tangible costs and benefits, below the red line of the table, the value of benefits (€110 million) outweigh the estimated value of the loss consumer surplus (€54 million).

Given that the benefits substantially exceed the costs, any remaining concerns over the distribution of benefits and costs must be concerns about equity and fairness, rather than concerns about efficiency and effectiveness. Here, it should be noted that gram for gram of alcohol consumed, individuals who are socially disadvantage whether by income, education or social capital experience more harm from alcohol than those who are less socially disadvantaged. A price decrease in Finland in the early 2000s, led to a 10% increase in per capita consumption and an increase in overall alcohol-related mortality of 16% among men and 31% among women (Herttua et al 2008). Among people aged 30–59 years, the increased overall alcohol-related mortality in absolute terms was greatest among the unemployed or early pensioners and those with low education, social class or income. Those in employment and those aged over 35 years did not suffer from increased alcohol-related mortality during the two years after the change. Thus, one might expect a reciprocal relationship with greater decreases in alcohol-related mortality amongst the disadvantaged with a tax increase.

Finally, it should be pointed out that the example used in this primer of cost benefit analysis for alcohol policy used a hypothetical tax increase that would lead to an overall price increase of 10% as an example. Different outcomes and different costs would result from other policy measures. In particular, and also, the value of the consumer surplus and its transferability would differ from policy measure to policy measure. For example, an increase in the minimum legal purchase age would significantly impact on the consumer surplus of 18 to 20 year olds, but not the consumer surplus of the majority of drinkers. There would, however, be no offsetting transfer to government, as there is with an excise tax.

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