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Working Paper

Consumption Externalities and the Role of Government: The Case of Alcohol

New Zealand Treasury Working Paper, No. 02/25

Provided in Cooperation with:

The Treasury, New Zealand Government

Suggested Citation: Barker, Felicity (2002) : Consumption Externalities and the Role of Government: The Case of Alcohol, New Zealand Treasury Working Paper, No. 02/25, New Zealand Government, The Treasury, Wellington

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Consumption Externalities and the Role of Government: The Case of Alcohol

Felicity Barker

NEW ZEALAND TREASURY
WORKING PAPER 02/25

DECEMBER 2002



THE TREASURY
Kaitohutohu Kaupapa Rawa

**NZ TREASURY
WORKING PAPER
02/25**

Consumption Externalities and the Role of Government: The Case
of Alcohol

MONTH/YEAR

December 2002

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ACKNOWLEDGEMENTS

I would like to thank Tom Hall for his contribution to this work, John
Creedy for his skills as editor and Rienk Asscher for his comments.

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author(s) and do not necessarily reflect the views of the New
Zealand Treasury. The paper is presented not as policy, but with a
view to inform and stimulate wider debate.

Abstract

This paper considers the role of government in the case of externalities and, in particular, in the case of alcohol externalities. The purpose of the paper is to assess whether the current level of the alcohol excise can be justified on externality grounds.

The paper assesses various mechanisms to address externalities. These mechanisms are institutional solutions, trade in rights to generate externalities, regulatory measures and Pigouvian taxes. The paper assesses these tools in the case of alcohol and concludes that institutional, trade and regulatory solutions are limited in their ability to address the externalities of alcohol. A specific tax can be justified in the case of alcohol. The externalities are large and there is sufficient information on which to base a tax. Given the information constraints the specific tax must be applied uniformly across a range of units of consumption, rather than to particular individuals. Where an optimal uniform tax is imposed it is reasonable to assume that the amount of revenue collected by the government would be at least as large as the total externality.

In 1999/00 the amount of revenue collected from the tax on alcohol was \$580 million. This is near the mid-point of the estimated bound of the external tangible costs of alcohol. Thus the current rate of excise tax can be justified on externality grounds.

JEL CLASSIFICATION D11
 H11
 H23

KEYWORDS Externalities
 Alcohol
 Coase theorem
 Pigouvian tax

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1 Introduction

This paper considers the role of government in the case of consumption externalities and, in particular, in the case of alcohol externalities. The purpose of the paper is to assess whether the current level of the alcohol excise can be justified on externality grounds. This issue has been controversial lately, particularly given the recommendation of the New Zealand Tax Review 2001 to remove the alcohol excise.

It is important to draw a distinction between internal and external costs and benefits (externalities). Internal costs and benefits are borne by the consumer. Externalities are borne by third parties. Externalities occur when the actions of one individual directly affect the well being of another individual.

Policy relevant costs and benefits are costs and benefits that the consumer does not take into account. These are usually external costs and benefits but may be internal costs or benefits, for example when consumers are not fully rational or not fully informed. The focus of this paper is on the external costs and benefits.

Where a consumer does not take all costs or benefits into account, the price paid by the consumer for the good does not reflect all the costs/benefits of that consumer's consumption (social costs/benefits).¹ The usual justification for government intervention in such a case is that the failure of the consumer to consider all costs or benefits will result in market failure or non-optimal resource allocation.

The first section of this paper develops a framework that can be used to determine the role for government in the case of externalities. This section discusses when externalities cause market failure and considers institutional change, tradable property rights and regulatory and tax mechanisms as tools to address externalities. The second section of the paper applies this framework to the case of alcohol and concludes that a specific tax can be justified in the case of alcohol. The final section of the paper considers the incidence and magnitude of the externalities of alcohol consumption and uses this information to assess whether the current alcohol excise can be justified on externality grounds.

¹ The social cost (benefit) is the internal cost (benefit) + the external cost (benefit).

2 Solutions to Address Externalities

This section considers mechanisms to address externalities. The paper sets out a framework of factors that policy makers should take into account when considering externalities.

2.1 Property Rights

Some economists argue that externalities result only from a failure to specify or enforce rights to private property. Under this view external costs are failures to maintain a fully free market, rather than defects of the market.²

It is argued that externalities that do not result from unspecified or non-privately allocated property rights have no policy relevance, as they do not affect the workings of the market economy. Where property rights are fully allocated and enforced externalities are internalised, to the extent possible, through voluntary action such as trade of externalities or the charging of rental for scarce resources. In such a case only voluntary action can be expected to improve social welfare, particularly given the information constraints on government and the subjective nature of costs.³

An insight from this approach is that externalities may result from institutional structures (such as a public health system) that result in rights not being allocated privately. Thus, when addressing externalities the initial question should be whether it is desirable to reduce or eliminate the externalities through institutional change.

2.2 Trade and Transaction Costs

Coase (1988) also emphasises market solutions to the externality problem. Two aspects of Coase add to the discussion. The first is the emphasis on liability rather than property. The second is the role of transaction costs.

The Coase theorem argues that if liability rules with regard to the externality generating activity are established and agents can trade rights to generate the externality and bargaining is costless then an efficient allocation of resources will result if agents bargain rights to generate externalities, no matter which party is allocated the initial rights. The initial rights allocation affects the relative wealth of individuals. An example of this is neighbours bargaining over the use of property that affects both parties, such as the height of a house.

This implies that externalities themselves are not the cause of market failure. Where the conditions of the Coase theorem are met there is no rationale for government intervention.⁴ Where possible the government should allow the market to internalise externalities by defining liability rules to allow trade. In relation to certain externalities social norms implicitly define rules that allow a non-government solution to the externality problem. For example people generally remove their hat in church.

² Cordato (1992).

³ Brownstein (1980).

⁴ Arrow (1970) reaches a similar conclusion in a general equilibrium setting.

A qualification to the theorem is that even when bargaining is costless, bargaining does not result in an efficient allocation of resources where the parties fail to take all costs or benefits into account. For example, if there is a specific tax on the externality generating good and the parties do not take into account the change in tax revenue when consumption changes, an efficient allocation of resources does not result from bargaining. Thus imposing a tax that would be optimal in a case where bargaining does not occur, may lead to inefficiency in a case where bargaining does occur.⁵

The focus on liability, rather than property, is preferable for two reasons. First, this means a trade approach can be used even in the case of some common resources, such as air. Second, liability defines property. For example, it is debatable whether the rights to land should include the right to absence of noise from neighbours. However, if there is a legal rule establishing liability for noise pollution there is no debate over who has the right.

Even where liability rules are defined there may be no (or little) trade in externalities due to high transaction costs associated with using the market. Transaction costs affect the final allocation of resources because they reduce the gains from bargaining. Where transaction costs are present agents do not fully take into account the externalities they generate. Transaction costs are likely to be high where it is difficult to obtain the information required to make the bargain, such as where a large number of people are affected by an externality, where there is no observable value for the externality, where it is difficult to monitor whether a bargain has been fulfilled or where it is difficult to identify people with whom to bargain.

Some economists argue that market failure occurs whenever transaction costs hinder trade, as this prevents achievement of the resource allocation that would be achieved if there were no transaction costs. Others argue that transaction costs are a cost like any other and thus never result in market failure. Where transaction costs result in action not taking place, all that one can conclude is that the benefits of such action are smaller than the costs, including transaction costs.⁶

An alternative approach is a comparative institutions approach. This approach compares the institutions of the market and the government in order to assess which institutional arrangement seems best able to cope with the economic problem. Under this approach market transaction costs and the costs of government action are distinguished from other costs such as production costs, as these are the costs associated with resource allocation. When there is a form of resource allocation that can allocate resources more efficiently (in the sense of closer to the result that would be achieved in a zero transaction cost world) than the market when all costs are taken into account, then there is market failure and the alternative form of resource allocation is preferable.⁷ In order to implement this approach one must make judgements as to the size of the costs associated with each form of resource allocation. This is the approach that the remainder of this paper takes.

In summary, when considering externalities the second question policy makers should ask is whether, if liability rules were defined, transaction costs would be low enough to make a trade solution desirable. Where transaction costs are high policy makers

⁵ See page 4 for the definition of an optimal tax.

⁶ Brownstein (1980) p97.

⁷ Demsetz (1973).

should consider whether there is an alternative form of resource allocation that can improve on the market result, when all costs are taken into account.

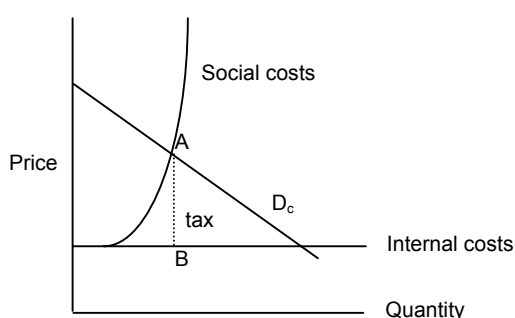
2.3 Regulation and Tax

Where institutional and trade solutions are not appropriate policy makers should consider whether specific interventions, regulation or specific taxes are appropriate to address externalities. These measures are preferable to the market solution when the net efficiency gains from the intervention are larger than the associated administrative and compliance costs. This suggests they are only likely to be desirable when externalities are reasonably large. The intervention most suited to address the externality should be used.

Regulatory and specific interventions are likely to be appropriate when they can be targeted at particular individuals/activities that are known to be more likely to generate externalities. Examples of this are law enforcement measures and restricting the purchase of a certain good to those over a certain age. Regulatory measures are also likely to be appropriate to ensure consumers are adequately informed.

Specific (Pigouvian) taxes are used to encourage the efficient use of resources. An optimal per unit Pigouvian tax is defined as a tax that would provide an incentive for each consumer to consume that consumer's socially optimal quantity of a good.⁸ For a given consumer this is the quantity at which the social marginal benefit (given by the income-compensated demand curve, D_c in figure 1) of that consumer's consumption equals the social marginal cost (represented by the social costs line below) of that consumer's consumption. This is given by point A. For a given consumer, the optimal per unit tax/subsidy is equal to the net marginal external cost of that consumer's consumption at that consumer's optimal consumption level. The length AB gives the optimal tax.⁹

Figure 1: The Optimal Pigouvian Tax



⁸ The purpose of Pigouvian taxes is to ensure that consumers take all costs into account when making consumption decisions rather than to raise revenue. Where the revenue raised means that other taxes need not be so high this revenue can be considered as redistributed back to consumers.

⁹ Using the income-compensated demand curve allows an abstraction from the revenue effects of an alcohol tax in order to focus on its role in addressing external costs. The assumption is that the revenue is returned lump sum to consumers such that only relative prices are affected.

If all consumers were identical each consumer would have the same optimal tax. However, where consumers have different demand or cost functions each consumer will have a different optimal tax. If individuals can be distinguished at low cost it will be efficient to levy different taxes on different individuals or groups of individuals. However in most cases information costs imply this will not be cost effective and the government will be constrained to applying the tax uniformly to a range of units of the good, rather than the consumer. Where a tax is imposed on units of a good there must be a clear causal relationship between consumption of the good and the externality.

Where consumers differ and cannot be distinguished at low cost one can define an optimal uniform tax.¹⁰ An optimal uniform tax, based on the Pigouvian principle, would be a weighted average of each consumer's non-uniform optimal tax. A uniform tax will result in some consumers reducing consumption too much and some consumers reducing consumption too little, relative to the case where a different tax is levied on each consumer. An optimal uniform tax must balance the efficiency gain from the reduction in the externality against the loss of consumption benefits from reduced consumption that are not regained as tax revenue.¹¹

Setting the tax rate as an average of consumers' optimal tax rates means that the tax rate depends on the magnitude of each consumer's non-uniform optimal tax and the number of consumers that produce large externalities relative to those who produce low (or no) externalities. In determining the weight to be applied to each consumer two further factors need to be considered.

First, taxation is only effective in addressing externalities if those who generate large externalities are responsive to price. However, the more price-responsive are consumers who generate low levels of externality, the larger the loss of consumption benefits. Thus the tax rate should increase as the price-responsiveness of large externality generating consumers increases relative to those who generate low levels of externality. Second, holding all other factors constant, the higher is the initial consumption of externality generating consumers, the larger is the change in their absolute consumption from a tax and the larger the proportion of the tax they pay. The lower is the initial consumption of those who do not generate externalities the less their absolute consumption will change in response to price changes, thus the less the reduction in consumer surplus due to the tax, and the less the proportion of tax they will pay. Thus the tax rate should be higher the higher the initial consumption of those who generate large externalities relative to those who generate small externalities. This suggests that tax would not be an effective tool where those who generate large externalities have lower consumption than those who generate small externalities. This may be the case in relation to activities that require skill or preparation for which a low level of participation in the activity may be more risky than a high level of participation in the activity.

These considerations suggest that the weight should measure the extent to which the consumer will change his/her absolute level of alcohol consumption in response to the tax. A measure of this is the consumer's price derivative of demand at the consumers optimal tax rate, where the weights add to one.¹² The price derivative of demand takes

¹⁰ Diamond (1973), Pogue and Sgontz (1989).

¹¹ The optimal uniform tax sums the absolute value of the gains and losses to each individual from the tax.

¹² Under the assumption that the marginal externality that each consumer, i , imposes impacts on all consumers equally, the formula for this tax rate is:

into account both the price responsiveness (uncompensated elasticity) of each consumer and the consumption level of the consumer. Standardising the price derivative of demand ensures the tax rate depends on the relative price responsiveness and relative initial consumption of consumers.

Thus the optimal uniform tax rate would weight each consumer's optimal tax by the consumer's standardised price derivative and sum these weighted externalities.¹³

The ability of the government to set an optimal uniform tax is limited by information constraints. In the first instance valuation of externalities is problematic. The value of an externality is subjective, being the value that the affected party places on it. Where there is no market transaction there will be no observable value of the externality and proxies will need to be used.

Further, in order to calculate the uniform Pigouvian tax as discussed one would need information on the optimal non-uniform tax and price-responsiveness of each individual. In most cases this information will not be available. However, an appropriate level of the tax rate may still be inferred if there is information on the total level of the externality, the incidence of the externality, the responsiveness of consumers and on patterns of consumption in the population. This is because this information would allow a conclusion to be drawn as to the relationship between the total externality and the amount of revenue that would be raised under an optimal uniform tax.

The relationship between the total externality and revenue is clear in the case of a single individual or where the marginal damage is constant.¹⁴ The relationship is complicated in the case of many consumers and where marginal damage increases with consumption. Consider figure 2 and assume that the optimal uniform tax has been imposed (dotted line). The demand curve, marginal externality curve and price line of consumers is illustrated. The consumers have the same marginal externality function but different demand curves. The revenue raised from the tax is illustrated by the black boxes. The total value of the externality is represented by the area between the marginal social cost function and the price line, up to the consumer's consumption level. For the first consumer the revenue raised exceeds the externality of this

$$\sum_i \omega_i \varepsilon_i \text{ where } \omega_i \text{ is the weight and is equal to } \frac{\frac{\partial Q_i}{\partial P_i}}{\sum_i \frac{\partial Q_i}{\partial P_i}} \text{ at } i\text{'s optimal consumption level and } \varepsilon_i \text{ is the total marginal net externality}$$

one consumer (i) imposes on the others at i's optimal consumption level.

¹³ For example assume there are two consumers. Consumer one's marginal externality at their socially optimal consumption is \$1, and consumer two's is \$10. Call the price derivative of demand PD.

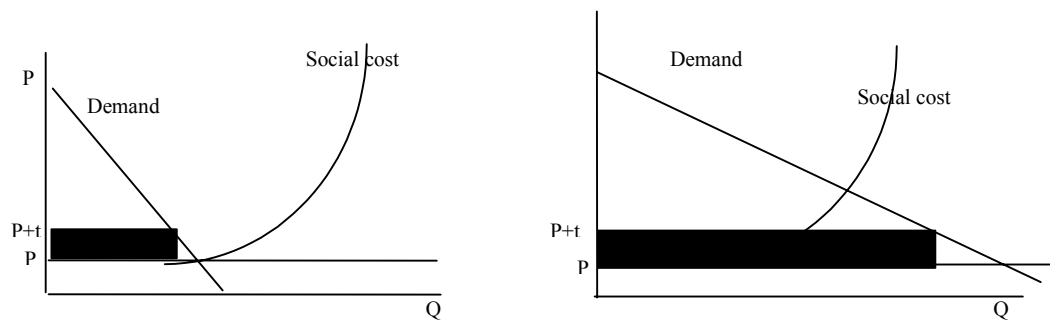
Assume for a given price change: PD consumer one = 1 unit. PD consumer two = 4 units. Standardising the PD to 1 gives the weight for consumer one of .2 and the weight for consumer two of .8. Weighting the marginal externalities by the standardised PD gives (1*.2)+(10*.8) = 8.2 as the optimal tax per unit.

Clearly if one of the consumers does not change consumption in response to a price change, that consumer would receive a weighting of 0 in the calculation of the optimal uniform excise.

¹⁴ Where marginal damage is constant the revenue raised from the tax will equal the externality.

consumer. For the second consumer the relationship is unclear. The revenue raised may or may not exceed the externality that this consumer generates. Where there are many consumers the relationship between the amount of revenue that would be raised under an optimal uniform tax and the total externality will depend on the relative number of heavy and light consumers and on the shape of the damage function from consumption. There must be sufficient information on these variables to be able to set a Pigouvian tax.

Figure 2: Revenue and Externality



The following section considers the appropriate role of government in the case of alcohol consumption.

3 Application to the Case of Alcohol

This section considers which of the mechanisms discussed in section 2 is best to address the externalities of alcohol consumption.

In the case of alcohol there is evidence that low levels of alcohol consumption by some consumers confers an external benefit, mainly because there is a reduction in expected public health expenditure due a reduction in the risk of ischaemia. Alcohol consumption also confers external costs relative to the situation of no alcohol consumption. These costs include increased use of the public health and justice systems, uncompensated damage to third parties' property due to accidents, injury to third parties and reduced productivity that affects third parties.¹⁵

3.1 Institutional Solutions

Many of the externalities of alcohol consumption are the result of institutional structure. However, the opportunities to change institutional structures to reduce the externalities of alcohol consumption are limited.

For example, one of the externalities is the additional use of the public health care system arising from alcohol related health damage. These externalities would be avoided if individuals were required to pay for health costs associated with alcohol consumption. However, wholly private funding of health care for alcohol related illnesses is unlikely to be a tenable solution.

First, if only the costs of alcohol related illnesses were required to be paid by individuals there would be information problems. For any given case it is difficult to be precise about the extent to which alcohol contributed to the illness. Second, requiring all health care costs or even alcohol related health care costs to be paid by individuals is likely to be inconsistent with the objectives of government involvement in the health system. Third, if the government were not to fund public health services a comprehensive insurance market would be needed. There are likely to be inefficiencies in this market if consumers cannot be distinguished. In such a market particular individuals may not receive cover.

Health cost recovery for particular types of damage is another option. Apart from the above concerns, this policy would draw arbitrary boundaries. For example, feasibility may allow recovery of the costs of acute alcohol consumption but not the costs of chronic alcohol consumption. However all consumers would pay any tax imposed on alcohol.

Charging for alcohol related police and justice services would have many of the same problems as discussed above. In addition, for these services it is difficult to determine the cost of use of these services in a particular case. For example alcohol breath tests only catch a proportion of drunk drivers. Thus only a proportion of the cost of breath tests could be charged to those who give rise to the need for this system.

There is an element of cost recovery associated with health and justice services presently. The above arguments imply that those who use these systems because of

¹⁵ These externalities are discussed more fully at page 12.

alcohol consumption should be required to contribute the same proportion of costs as those who use the system due to other reasons, such as undertaking dangerous activities or committing crimes.

As the ability to address alcohol externalities through institutional change is limited, alternative mechanisms need to be considered.

3.2 Trade

Even if liability rules with regard to generating alcohol externalities were defined, bargaining in rights to generate alcohol externalities would not occur because transaction costs are prohibitively high. This also means that if an optimal tax were imposed bargaining would not result in a non-optimal resource allocation.

Transaction costs of bargaining would be high largely because of information and monitoring costs and the number of people involved. In particular, a lot of information is required to identify individuals who are likely to generate externalities and to estimate the likely damage; the bargain would need to define what type of consumption the individual can/cannot undertake and it would be costly to monitor whether the consumer complies with the bargain. Further, as the cost of externalities is spread over many people, a society bargaining group would need to be established. This group would involve costs and would not be able accurately to assess the costs of externalities, as many of these costs are subjective. Further, paying individuals to reduce drinking would create an incentive for individuals to claim that they would drink large quantities in the absence of payment.

As neither an institutional nor a trade solution is likely to be successful in fully addressing alcohol externalities, consideration should be given to other mechanisms.

3.3 Targeted Measures

Targeted policies, such as education, age restrictions and alcohol dependency services are important tools to use in reducing alcohol externalities. They are also likely to be the best tools to ensure that consumers correctly assess the internal costs of consumption and will have a significant role in influencing the consumption of those who do not take all internal costs into account. These tools work best when implemented as part of an overall strategy for addressing the harms of alcohol.

Generally, education campaigns have limited impact in reducing alcohol-related externalities. Education campaigns may have some success in causing long-term changes in attitudes, making other alcohol regulatory measures more acceptable and ensuring consumers correctly take account of internal costs. Education has been successful in particular areas, such as drink driving.¹⁶

The effective enforcement of the law can also be an important tool in reducing the costs associated with alcohol, particularly costs associated with acute consumption. For example, higher penalties and better law enforcement have lowered the amount of

¹⁶ Caswell (1997).

drink driving in New Zealand.¹⁷ Third party costs, such as the costs of property damage and injury, are sometimes recovered through the court system.

Regulations such as age limits and bans on serving intoxicated people are useful in that they are able to target those most likely to generate externalities or most likely not to consider fully the internal costs of alcohol.

Judgements must be made about the costs and benefits of these policies. Costs include the direct fiscal cost, but also economic costs such as lost consumption benefits from limits on who can consume alcohol. On occasion these policies can also have perverse effects, such as making underage drinking “cool”. These policies are limited in their effectiveness and are most appropriate when they can address particular individuals or activities that are likely to generate externalities. Significant non-internalised externalities will still remain despite these policies. For this reason one should consider whether it is appropriate to apply a specific tax to alcohol to address externalities that are not adequately addressed by regulatory mechanisms.

3.4 Tax

This section assesses the case for a specific tax on alcohol by considering the factors discussed in section 2.

In the case of alcohol each consumer has a different consumption pattern and therefore generates a different level of externality. In most cases it would be prohibitively costly to distinguish *a priori* consumers who are likely to generate large externalities, as this would require information on the intended consumption pattern and level of consumption of the consumer.¹⁸ Given this the government will be constrained to applying a uniform tax over a range of consumers and units.

The lack of homogeneity in consumption patterns does not necessarily make a uniform tax undesirable. As discussed, a uniform tax seeks to balance the gains from the reduction in the externality against the loss in consumption benefits that are not gained in tax revenue. Further, there is a clear causal relationship between the consumption of alcohol and damage. For a given level and pattern of consumption the expected negative effect of alcohol is relatively homogenous across consumers. As the negative externality is related to the good, rather than only to particular characteristics of the individual, the quantity of alcohol (ethanol) consumed is an appropriate base on which to levy the tax. This is not the case with the external benefits of alcohol. As only those at immediate risk of ischaemia receive the positive health benefits associated with alcohol, individual consumer characteristics are a major driver of the different incidence of the benefits. This, combined with the fact that there are more direct ways to reduce the risk of ischaemia, suggests alcohol taxation (or subsidisation) policy is not the appropriate tool to use to reduce risks associated with ischaemia.

¹⁷ Land Transport Safety Authority web site drinking and driving statistics, www.ltsa.govt.nz/research/drink.

¹⁸ Although theoretically desirable to distinguish consumers on the basis of consumption patterns mechanisms to do this are likely to be costly and easy to avoid. For example if consumers were allowed to purchase a certain number of units of alcohol per week free of excise there will be arbitrage opportunities whereby those who do not drink much would purchase the alcohol for those who drink a lot. Further to ensure the alcohol was consumed in a way that did not generate externalities (ie in regular sittings) the pattern of consumption would need to be monitored.

In order to implement a uniform Pigouvian tax accurately one needs information on the optimal tax of each individual and the price-responsiveness of each individual. This information is not available. However, as discussed one can still infer the appropriate level of the tax if there is information available on the total level of the externality, the incidence of damage from alcohol consumption and on population consumption patterns.

There is information that can be used to estimate the tangible costs associated with the externalities of alcohol. These costs are large. Quantifying intangible costs, such as the cost of third party loss of life, is more problematic. Monetary proxies for the value of non-monetary costs are often used. However, quantification in these cases is difficult and controversial. For this reason the estimate used in this paper of the total externality focuses mainly on tangible costs. Given uncertainties as to the magnitude of the externality this paper uses an estimate of the minimum plausible bound of the externality as the base on which to assess the level of the tax against. There is sufficient information on the incidence of damage from alcohol and population consumption patterns on which to make judgments as to the appropriate level of the tax. These factors are discussed more fully in the next section.

The next section discusses the appropriate rate for a uniform tax in the case of alcohol.

4 A Uniform Tax in the Case of Alcohol

In order to advise on the appropriate rate of tax on alcohol one must derive the relationship between the externalities of alcohol consumption and the amount of revenue that would be raised from an optimal uniform tax on alcohol. Information on the shape of the damage function, the total size of the externality, responsiveness of consumers and the distribution of alcohol consumption is required.

4.1 Shape of the damage function

The externalities of alcohol consumption can be characterised as harm from acute consumption (binge drinking) and harm from long-term drinking (chronic consumption).

Acute alcohol consumption leads to externalities through adverse health and behavioural consequences. A large part of the tangible element of this externality can be proxied by the cost of additional public services. At the extreme, health effects include raised blood pressure, cardiac failure, stroke and foetal damage. Acute alcohol consumption increases the risk of falls and accidents, can lead to violent or anti social behaviour and is associated with adverse workplace outcomes. In Australia it is estimated that half of alcohol related deaths result from the short-term effects of drinking. As the incidence of casualties is greater among young adults, a high number of life years are lost from fatal casualties.¹⁹ Further, the costs of acute alcohol consumption dominate the estimates of external costs.²⁰

The risk of adverse consequences increases with the amount consumed in a single drinking session. However, even low to moderate levels of consumption increase the risk of accidents significantly and can generate significant damage.²¹ As risks increase with the frequency of consumption and the amount drunk per occasion it is reasonable to assume that these risks increase with average consumption levels.

Long-term external effects are mainly health effects, being the additional cost of use of public services.²² It is likely that the relationship between long-term alcohol consumption and health damage is J shaped for the population, with low-moderate levels of alcohol consumption conferring beneficial health effects on some consumers and higher levels of long-term alcohol consumption causing health damage.

Long-term heavy consumption of alcohol increases the risk of cancer, liver damage, pancreatitis, hypertension, cardiovascular disorders, brain damage and haemorrhagic stroke.²³ Long-term heavy consumption also results in adverse work place outcomes.²⁴ It is generally the quantity drunk rather than the drink type that is important.²⁵

¹⁹ National Health and Medical Research Council of Australia, Australian Drinking Guidelines (2000).

²⁰ See page 15.

²¹ National Health and Medical Research Council of Australia, Australian Drinking Guidelines (2000).

²² There are also long term effects on family units that are arguably not internalised.

²³ Thakker (1998), ILSI (1996) Doll et al (1994); Klatsky (1990,1995).

²⁴ Harwood and Reichman (2000).

²⁵ Doll et al (1994).

Low or moderate levels of alcohol consumption can provide some health benefits in terms of reducing the risk of ischaemic heart disease (CHD) and ischaemic stroke.²⁶ The benefits flow from a regular pattern of drinking and are not gained through binge drinking. Heavy drinking is likely to increase the risk of ischaemia relative to light drinking and abstaining.²⁷ Ischaemia is a major cause of illness in New Zealand. CHD accounted for about 6369 (23%) deaths in 1997 and strokes accounted for 2566 deaths in 1997, the majority (around 2000) of which were ischaemic.²⁸

Although the protective effect of alcohol occurs at all ages, it is of little relevance for younger age groups as these groups have little risk of ischaemia and the protective effect is probably largely gained in the short-term.²⁹ In 1997 84% of those who died from CHD were aged over 64.³⁰ The risk of ischaemia can be reduced through other less risky and more cost effective mechanisms such as diet, exercise and taking aspirin. The weight of opinion suggests that particular beverages are not more beneficial than others, as health benefits come from the alcohol component.³¹

Studies differ on the point to which marginal benefits/costs are obtained from alcohol consumption.

For those who are not at risk of ischaemia or who mainly binge drink, there is no external benefit from alcohol consumption and heavy and binge drinking will confer net external costs. Expected damage will be an increasing function of average alcohol consumption.

For those at risk of ischaemia who drink regularly, it is reasonable to assume that significant marginal benefits accrue up to an average of about 2 drinks per day and that net marginal benefits accrue up to an average of one drink per day. Consumption up to about two drinks per day is likely to incur a net external benefit. Consumption past this level is likely to incur net external costs. Past one drink per day, net external damage is likely to increase with average alcohol consumption.³²

4.2 Total Value of Externality

The externalities of alcohol consumption include tangible and intangible costs. Devlin et al (1997) have estimated the direct cost of the resource use associated with alcohol consumption. These estimates can be used as a proxy for the value of the tangible external costs. As discussed, as quantification is difficult for externalities that do not have observable monetary values this paper does not include an estimate of all possible externalities. Instead this paper uses the Devlin et al estimate as an estimate of the minimum plausible bound of the total externality, focusing on tangible costs.

²⁶ Klatsky, Doll (1997), Wald and Law (1999).

²⁷ McElduff and Dobson (1997), Kauhanan et al (1997).

²⁸ New Zealand Health Information Service (1997). CHD was the second largest cause of death.

²⁹ Klasky (1990), Doll (1997).

³⁰ New Zealand Health Information Service (1997).

³¹ Rimm et al (1996), Doll (1997), Klatsky et al (1990, 1997), Law & Wald (1999). Alcohol may also reduce the risk of non-insulin dependent diabetes and gallstones, although the evidence is unclear, Thakker (1998).

³² Verschuren (1993), Rimm et al (1991), Poikolainen (1994).

The Devlin et al (1997) estimate calculates the net social cost of alcohol consumption in New Zealand in \$1991. The external costs estimated were mainly fiscal costs, being: hospital resources, ACC, Ministry of Transport, police, penal institutions, community sentencing, periodic sentencing and court costs. The social costs of lost production were also estimated.

The health costs estimated were the health care resource use from alcohol related injury and illness. It was assumed alcohol abusers did not use more primary health care resources or require more pharmaceutical products. ACC expenditure was estimated both including (\$56 million) and excluding (\$29 million) payments for non-economic loss - compensation for impairment, pain and suffering, mental suffering, disfigurement, loss of capacity to enjoy life and other points of significance. Much of the payment for non-economic loss would accrue to the drinker and thus be internal. For this reason only 50% of this cost is included in the upper range of the estimate of external costs.

Production losses calculated arose from: excess unemployment of drinkers, reduced efficiency of drinkers, excess sick leave and absenteeism, premature death of drinkers and losses due to incarcerations. Over 85% of these costs come from excess unemployment and reduced efficiency. Assume that 5% of these costs are external and that most of the cost is borne by the individual, e.g through lower wages. A conservative assumption is used as this paper seeks to estimate the minimum plausible bound of the externality. The estimated range for external and internal production costs was \$703,583,000-\$3,389,005,000. This is large in relation to the estimated range for health care and justice service costs (\$345,194,000-\$592,858,000), thus the conservative assumption does materially alter the results.

The estimate of the external cost of use of public services will overestimate the external costs of alcohol consumption to the extent that cost recovery was not taken into account. However, as not all the costs of alcohol consumption are estimated this is a conservative estimate.

Significant external costs not included in this estimate include: the costs resulting from property damage that cannot be recouped through the court system; the cost to the government of care for victims of alcohol related incidents, such as the care of children of alcoholics; the cost of third party loss of life and injury from alcohol related incidents that were not compensated through ACC and the costs of alcohol damage to the foetus. The Land Transport Safety Authority reports that for 1999 drunk drivers were responsible for killing 40 of their own passengers and 18 other drivers, passengers, cyclists and pedestrians.³³

The following table presents the costs as estimated by Devlin et al:

³³ www.ltsa.govt.nz/research/drink

Table 1: The External Costs of Alcohol Consumption

Externality	Cost (\$000)
Hospital resources	70,243
ACC	28,970 – 42,659
Ministry of transport	10,617
Police	141,687 – 281,578
Penal institutions	34,071 – 74,845
Community sentencing	2,714 – 4,921
Periodic sentencing	12,669 – 23,376
Court costs	40,216 – 94,300
Production	35,180 – 169,450

Incorporating the above assumptions, the Devlin et al estimate puts the external tangible costs at \$376 - \$772 million per year (\$1991). The range results from using different assumptions as to the alcohol attribution factor for criminal activity (.29-.68) which was used to calculate production losses due to incarceration and the costs associated with the criminal justice system; the use of different discount rates in calculating production losses (5%-10%) from the premature death of abusers; the use of different excess unemployment rates used to calculate production losses from the excess unemployment of abusers (10%-30%) and the inclusion of non-economic costs associated with ACC.

The external costs are dominated by the costs of the police and the criminal justice system. Even under the conservative assumption of the role of alcohol in criminal offending these costs make up around 65% of costs. Further, the cost of accidental falls and road traffic fatalities make up around 47% of the cost of hospital treatment.³⁴ This suggests that acute alcohol consumption gives rise to significant costs.

The external benefits estimated by Devlin et al include the reduced risk of: coronary heart disease, cardiac dysrhythmias, heart failure, cholelithiasis and the production losses averted due to the beneficial effect of alcohol on health. The reduced use of hospital services due to these benefits was estimated to be \$27 million. As the incidence of fatal ischaemic stroke is about one third of the incidence of fatal CHD, I estimate the hospital resource savings from the reduced risk of ischaemic stroke would be around \$8 million per year. External production losses averted due to the reduced incidence of CHD, assuming 5% of the production cost is external, are between \$1.3 and \$1.9 million. Thus the estimate of the external benefit is \$36 - \$37 million per year. The external benefits of alcohol consumption are small relative to the external costs.³⁵

These estimates suggest that the net external cost of alcohol consumption is large, being significantly more than \$340 million annually (\$1991) and most likely more than \$735 million annually (\$1991). This is \$385 million - \$831 million (\$1999).

³⁴ These incidents also impose further costs on employers and on ACC.

³⁵ Devlin et al (No 9713).

4.3 Consumption Patterns

The distribution of alcohol consumption is highly skewed. A small number of people consume very large amounts of alcohol. The vast majority of drinkers consume a relatively small average volume of alcohol. The 1995 National Survey of drinking in New Zealand estimated that the top 5% of drinkers consumed 34% of the alcohol, the top 10% of drinkers consumed 49% of the alcohol, the top 25% of drinkers consumed 74% of the alcohol and the top 50% of drinkers consumed 93% of the alcohol.

This distribution of alcohol consumption implies that a small percentage of consumers generate externalities related to adverse long-term health effects. However the costs of binge drinking, rather than the costs resulting from long-term alcohol use, make up the major portion of external costs. The National Survey indicated that a significant portion of alcohol is consumed in single sittings. The survey asked males how frequently they consumed six or more 15 ml drinks in a drinking session and females how often they consumed four or more 15ml drinks in a drinking session.³⁶ For males, 41% said at least monthly and 21% at least weekly. For females, 22% said at least monthly and 8% at least weekly. This implies that a large number of consumers consume alcohol in a way that carries a significant risk of generating external costs.

4.4 The Rate of the Uniform Excise

We can use information on the incidence of damage from alcohol and the distribution of alcohol consumption to make inferences about the relationship between the total externality and the amount of revenue that would be raised by an optimal uniform tax in the case of alcohol.

Consider figure 3 in the case of alcohol. As illustrated, the expected external costs of alcohol increase with the average level of consumption for both long term and acute consumption.³⁷ The optimal uniform tax has been imposed on units of alcohol (dotted line). Assuming elasticities are roughly equal across consumers at different consumption levels³⁸, heavy drinkers will have a higher weighting in the optimal uniform tax.³⁹ This will increase the tax relative to the situation of equal weighting. Consumers have the same marginal externality function but different demand curves.

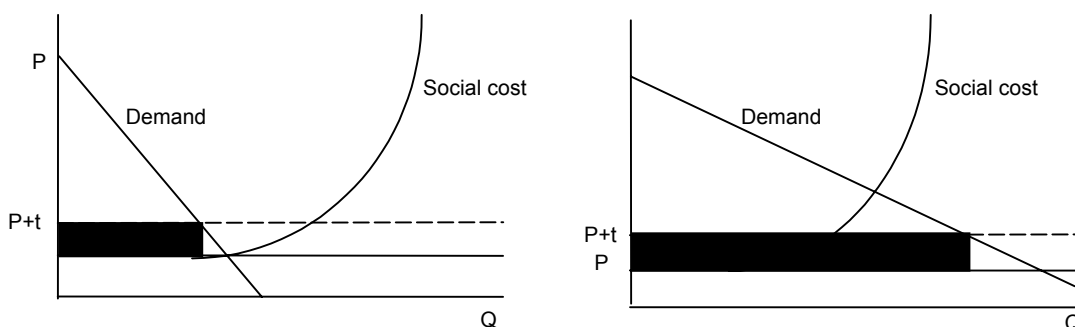
³⁶ A 750 ml bottle of wine that is 10% alcohol by volume would contain 5 15 ml drinks.

³⁷ I have assumed that the expected external damage from acute consumption increases with the amount per sitting and frequency of consumption, thus for a given individual expected externalities increase with average consumption levels. This assumption will not hold in all cases, as moderate levels of consumption can cause significant damage in particular cases (such as road crashes).

³⁸ Edwards (1994) p119 suggests this is a conservative assumption as there is evidence that heavy drinkers are more responsive to price. This means the absolute change in consumption in response to a price change increases with consumption levels.

³⁹ As heavy drinkers have a higher initial consumption. This is appropriate as the absolute consumption of heavy drinkers will change more than the absolute consumption of lighter drinkers if they have the same elasticity.

Figure 3: Revenue and Externality Alcohol



For heavy drinkers the revenue gained from their consumption is likely to be less than their externality. The number of heavy consumers is relatively small, given the skewed nature of the distribution of alcohol consumption. However the externality they generate and the revenue they pay is relatively large. For a number of binge drinkers the revenue raised from their consumption will also be lower than the externality they generate. The majority of consumers consume low average levels of alcohol. Thus for most consumers the revenue collected will exceed the externality they impose. The lower weighting of lighter consumers in the calculation of the optimal excise, all else equal, will increase the excess of revenue over externality for lighter consumers and decreases the excess of externality over revenue for heavy consumers.

Given that for the vast majority of consumers under an optimal uniform tax the revenue collected from them will exceed the externality they generate it is reasonable to assume that the revenue from the tax should be at least as much as the total externality. If the revenue is around the same value as the externality consumers will pay the social costs of their consumption “on average”. A small number of heavy consumers will pay the highest tax per person but this will not be enough to cover the externalities they create. Similarly a small number of acute drinkers will pay less in tax than they generate as externalities. Lighter consumers will pay tax in excess of their externality. However, this cost will be spread over a large number of people. The lack of information makes it difficult to be more precise than this.

In 1999/00 the amount of revenue collected from the tax on alcohol was \$580 million (\$1999/00 including GST on the excise and the duty collected on imported alcohol).⁴⁰ This is near the mid-point of the estimated bound of the external tangible costs of alcohol (\$608 million). Thus the current rate of excise tax can be justified on externality grounds. As total external costs include a number of other intangible costs the total external costs are likely to be significantly more than the revenue collected. A case to increase the excise would need to show that these costs are significant and that tax was the best tool to address these costs.

⁴⁰ Budget Economic and Fiscal Update (2000)

Conclusion

This paper has considered the case for government intervention in the case of externalities and, in particular, in the case of alcohol externalities.

The paper assesses various mechanisms to address externalities. These mechanisms are institutional solutions, trade in rights to generate externalities, regulatory measures and Pigouvian taxes. The paper assesses these tools in the case of alcohol and concludes that institutional, trade and regulatory solutions are limited in their ability to address the externalities of alcohol.

A specific tax can be justified in the case of alcohol. The externalities are large and there is sufficient information on which to base a tax. Given the information constraints the specific tax must be applied uniformly across a range of units of consumption, rather than to particular individuals. Where an optimal uniform tax is imposed it is reasonable to assume that the amount of revenue collected by the government would be at least as large as the total externality.

In 1999/00 the amount of revenue collected from the tax on alcohol was \$580 million. This is near the mid-point of the estimated bound of the external tangible costs of alcohol (\$608 million). Thus the current rate of excise tax can be justified on externality grounds. As total external costs include a number of other intangible costs the total external costs are likely to be significantly more than the revenue collected. A case to increase the excise would need to show that these costs are significant and that tax was the best tool to address these costs.

References

Theory References

Baumol, William and Oates. (1988). 'The Theory of Environmental Polciy'.

Boettke PJ. (1994). 'The Elgar Companion to Austrian Economics'.

Brownstein B. (1980). 'Pareto Optimality, External Benefits and Public goods: A Subjectivist Approach', The Journal of Libertarian Studies, Vol IV No 1 Winter.

Budget of the New Zealand Government 2000.

Casswell S. (1997). 'Population Level Policies on Alcohol: are they still appropriate given that 'alcohol is good for the heart'?' Addiction Vol 92 (Supplement 1) S81-S90.

Casswell S. (1994). 'Moderate Drinking and Population-based Alcohol Policy' Contemporary Drug Problems.

Coase RH. (1988). 'The Firm, the Market and the Law', University of Chicago Press.

Cordato, R. (1989). 'Welfare Economics and Externalities in an Open Ended Universe, A Modern Austrian Perspective', Kluwer Academic Publishers.

Cordato, R. (1989). 'Subjective Value, Time Passage, and the Economics of Harmful Effects', Hamline Law Review Vol 12 (2).

Demsetz, H: "Contracting Costs and Public Policy", in "Externalities: theoretical dimensions of political economy" edited by Staaf R, Tannian, F (1973).

Demsetz H. (1998). 'Toward a Theory of Property Rights' p104 Demsetz: 'The Organisation of Economic Activity'.

Devlin N, Schuffham P and Bunt L. (1996). 'The Social Costs of Alcohol Abuse in New Zealand', Economics Department, University of Otago, Dunedin no.9603.

Devlin N, Schuffham P and Bunt L. (1997). 'The Social Costs of Alcohol Abuse in New Zealand', Addiction 92(11), 1491-1505.

Devlin N, Schuffman P. (1997). 'The Value of the Physiological Benefits of Alcohol and The Social Costs of Alcohol Abuse by Illness and Injury', Economics Department, University of Otago, Dunedin no.9713.

Diamond P. (1973). 'Consumption Externalities and Imperfect Corrective Pricing', Bell Journal of Economics 4(2), 526-538.

Edwards G et al. (1994). 'Alcohol Policy and the Public Good', Oxford Medical Publications.

Edwards G and Holder H. (1995). 'Alcohol and Public Policy Evidence and Issues', Oxford Medical Publications.

Farell, J. (1987). 'Information and the Coase Theorem', *Economic Perspectives*, Vol 1, Fall p113.

Hagen K. (1978). 'Consumption Externalities and Direct Versus Indirect Corrective Pricing', *European Economic Review* Vol 11, p59-73.

Hall T. (1996). 'The Alcohol Excise', *The New Zealand Treasury*.

Holm P and Suoniemi I. (1992). 'Empirical Application of Optimal Commodity Tax Theory to Taxation of Alcoholic Beverages', *Scand J of Economics* p85.

Ironfield, Diewert and Lawrence. (1999). 'The Alcohol Excise: A Review', *Tasman Asia Pacific Economic, Management and Policy Consultants*.

Land Transport Safety Authority Web Site, <http://www.ltsa.govt.nz>.

Papandreou A. (1994). 'Externality and Institutions', *Oxford University Press*.

Pogue T and Sgontz L. (1989). 'Taxation to Control Social Costs: The Case of Alcohol', *AER March* Vol 79(1).

Richardson J and Crowley S. (1992). 'Taxation to Minimise the Social and Economic Costs of Alcohol Consumption', *Centre for Health Program Evaluation*.

Sandmo A. (1976). 'Direct Versus Indirect Pigouvian Taxation', *European Economic Review* Vol 7, 337-49.

Sandmo A. (1975). 'Optimal Taxation in the Presence of Externalities', *Swed J of Economics*, p86.

Terrell, TD. (1999). 'Property Rights and Externality: The Ethics of the Austrian School', *The Journal of Markets and Morality* Vol 2 No 2 Fall.

Final Report of the New Zealand Tax Review. (2001). <http://www.treasury.govt.nz/taxreview2001/>.

Empirical References

Anderson P, Cremona A, Paton A, Turner C, Wallace P. (1993). 'The Risk of Alcohol', *Addiction* (88), Vol 11, 1493-1508.

Australian Drinking Guidelines Consultation Draft. (2000). National Health and Medical Research Council.

Berger M & Leigh P. (1988). 'The Effect of Alcohol Use on Wages', *Applied Economics*, Vol 20, 1343-1351.

Barrett G. (2000). 'The Effect of Alcohol Consumption on Earnings', Department of Economics, University of New South Wales, Sydney.

Doll R, Peto R, Hall E, Wheatley K, Gray R. (1994). 'Mortality in Relation to Consumption of Alcohol: 13 years' observations on male British doctors', *BMJ* 309; 911-918.

Doll R. (1997). 'One for the Heart', *BMJ* 315: 1664-1668 (20 December).

Edwards G. (1996). 'Sensible Drinking', *BMJ* 312:1 (6 Jan).

Gill J, Shipley M, Tsementzis S, Hornby R, Gill S, Hitchcock E, Beevers G. (1991). 'Alcohol Consumption – A Risk Factor for Hemorrhagic and Non-hemorrhagic Stroke' *The American Journal of Medicine* Vol 90 p489.

Gronbaek M, Deis A, Sorensen T, Becker U, Schnohr P, Jensen G. (1995). 'Mortality Associated with Moderate Intakes of Wine, Beer, or Sprints', *BMJ* 310; 1165-1169.

Gronbaek M, Becker U, Johansen D, Tonnesen H, Jensen G, Sorensen T. (1998). 'Population Based Cohort Study of the Association Between Alcohol Intake and Cancer of the Upper Digestive Tract'; *BMJ* 317: 844.

Hamilton V & Hamilton B. (1997). 'Alcohol and Earnings: does drinking yield a wage premium', *Canadian Journal of Economics*, 30(1) p135.

Hart C, Davey Smith G, Hole D & Hawthorne V. (1999). 'Alcohol Consumption and Mortality from all Causes, Coronary Heart Disease, and Stroke: results from a prospective cohort study of Scottish men with 21 years of follow up', *BMJ* Vol 318, p1725.

Harwood H and Reichman M. (2000). 'The Cost to Employers of Employee Alcohol Misuse: A Review of the US Literature'.

ILSI. (1996). 'Alcohol: Health Issues Related to Alcohol Consumption', International Life Science Institute.

Kauhanen J, Kaplan G, Goldberg D, Salonen J. (1997). 'Beer Binging and Mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study', *BMJ* 315; 846-815.

Klatsky A. (1995). 'Cardiovascular Effects of Alcohol', Scientific American Science & Medicine March/April.

Klatsky A. 'The Epidemiology of Alcohol and Cardiovascular Diseases', <http://www.kaiserpermanente.org/medicine/permjournal/sum97pj/epidemiology.html>.

Klatsky A, Armstrong M, Friedman G. (1997). 'Red Wine, White Wine, Liquor, Beer, and the Risk for Coronary Artery Disease Hospitalisation', The American Journal of Cardiology Vol 80; 416-420.

Klatsky A, Armstrong M, Friedman G. (1990). 'Risk of Cardiovascular Mortality in Alcohol Drinkers, Ex-drinkers and Non-drinkers', The American Journal of Cardiology, p1237.

Law M and Wald N. (1999). 'Why Heart Disease Mortality is Low in France: the time lag explanation', BMJ Vol 318, p1471.

Manning, W.G, Blumberg L and Moulton LH. (1995). 'The Demand for Alcohol: the differential response to price', Journal of Health Economics 14, 123-48.

McElduff P, Dobson A. (1997). 'How Much Alcohol and how Often? Population based case-control study of alcohol consumption and risk of major coronary event', BMJ 314:1159 (19 April).

New Zealand Health Information Service. (1997). 'Mortality and Demographic Data'.

Poikolainen K. (1995). Alcohol and Mortality: A review', J Clin Epidemiology Vol 48 No 4 p455-65.

Rehm J, Bondy S, Sempos C & Vuong C. (1997). 'Alcohol Consumption and Coronary Heart Disease Morbidity and Mortality', American Journal of Epidemiology Vol 146 No 6.

Rimm E, Williams P, Fosher K, Criqui M & Stamper M. (1999). 'Moderate Alcohol Intake and Lower Risk of Coronary Heart Disease: meta-analysis of effects in lipids and haemostatic factors', BMJ 319; 1523-1528 (11 Dec).

Rimm E, Klatsky A, Grobbee D & Stampfer M. (1996). 'Review of Moderate Alcohol Consumption and Reduced Risk of Coronary Heart Disease: is the effect due to beer, wine, or spirits', BMJ 312; 731-36.

Scragg R. (1995). 'A Quantification of Alcohol-Related Mortality in New Zealand', Australia New Zealand Medical Journal Vol 25, p5.

Single E, Rehm J, Robson L, Van Truong. (2000). 'The Relative Risks and Etiologic Fractions of Different Causes of Death and Disease Attributable to Alcohol, Tobacco and Illicit Drug Use in Canada', Canadian Medical Association Journal 162 (12).

Single E, Plant M and Stockwell T. (1997). 'Alcohol, Minimising the Harm. What Works?'

Stampfer M, Rimm E, Chapman Walsh D. (1993). 'Commentary: Alcohol, the Heart, and Public Policy', American Journal of Public Health, Vol 83, No 6, p801.

Thakker KD. (1998). 'An Overview of Health Risks and Benefits of Alcohol Consumption', Alcoholism: Clinical and Experimental Research Vol 22 No 7, p285S-298S.

Tobgy E. (1998). 'Coronary Heart Disease and Alcohol: Can you Drink for the Heart', medsch.

Verschuren. (1993). 'Health Issues Related to Alcohol Consumption', ILSI Press.

White I. (1996). 'The Cardio-protective Effects of Moderate Alcohol Consumption', BMJ 312; 1179-1180 (11 May).

Wyllie A, Millard M & Zhang J. (1995). 'Drinking in New Zealand, A National Survey'.