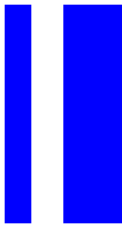

TASMAN ASIA PACIFIC

Economic, Management
and Policy Consultants

The Alcohol Excise: A Review

Report prepared for

Beer Wine & Spirits Council of New Zealand, Wine Institute of New Zealand Inc. and Distilled Spirits Association of New Zealand

by

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SUMMARY

A 1996 report by The Treasury to the Working Party on the Alcohol Excise included a paper by Tom Hall (1996) in Annex 4 titled *The Alcohol Excise*. The paper argues that the consumption of alcoholic beverages by most New Zealanders leads to net damages being imposed on the wider community. The paper considered that damage included 'alcohol–related' costs such as health care, loss of life and injury caused in motor vehicle accidents and assaults, as well as costs of police, penal institutions, etc and 'alcohol–related' payments by the Accident Compensation Commission.

Hall (1996) in essence treats 'alcohol–related' unsocial behaviour as costs of consuming alcohol. However, in his discussion of 'net damage', Hall only recognises the benefit associated with a reduction in the incidence of coronary heart disease (CHD) for that segment of the population who would otherwise suffer from CHD and do not drink abusively. For the rest of the community, the paper suggests that the consumption of alcoholic beverages has no positive or negative externality up to around half a glass, but at higher levels alcohol consumption leads to increasingly high negative externalities.

Hall (1996) also argues that, in the presence of these net negative externalities, a uniform excise tax will maximise aggregate welfare if the tax rate is determined with reference to the weighted–average across drinkers of their marginal net externalities. After estimating the value of this net externality the paper suggests that 'the current rate of excise is too low and current consumption is too high to maximise society's welfare' (Hall 1996, p.2). Like all analysis relying on economic theory, the paper's findings rely heavily on a range of assumptions. Tasman Asia Pacific was commissioned by the Beer Wine and Spirits Council of New Zealand, the Wine Institute of New Zealand Inc. and the Distilled Spirits Association of New Zealand to review the appropriateness of these assumptions and to consider whether the paper's conclusions are sensitive to them.

Our review of the positive and negative effects associated with consuming alcoholic beverages raises considerable doubt about the assessment of the 'net damage' and the level of consumption associated with 'net damage' presented in Hall (1996). There are significant questions about the appropriateness of the analytical framework used and of Hall's concept of what constitutes an externality. In addition, we question a number of the technical assumptions used in the application of Hall's analytical framework. Even if one accepts Hall's analytical framework, our review indicates that the paper has used very conservative

assumptions about the benefits of alcohol consumption and overly pessimistic assumptions about the costs.

The problem Hall (1996) attempts to address

Before addressing these issues it is necessary to first examine the basic rationale behind Hall's approach and the problem he is trying to solve. In the case where an individual's consumption of a particular product imposes external costs on others, the government may impose a tax on the consumption of that product by that individual. This is intended to raise the cost of consumption to that individual to the point where his consumption falls back to the level it would be at if he was bearing all the costs of consumption (ie. the external costs he imposes on others as well as his own costs). In other words, the tax attempts to 'internalise the externalities' and so correct the market failure. Conversely, if consumption of a product by an individual was the source of external benefits, then the government may attempt to subsidise his consumption to increase it to the same point it would be at if he received all the benefits from consuming it.

This approach to fine tuning taxes (and subsidies) to internalise externalities is known as 'optimal taxation'. However, the government faces numerous difficulties in doing this with any degree of accuracy. It is extremely information intensive — the government would need to know the exact extent of external costs or benefits, which individuals are causing the externality and the responsiveness of their demand for the product to price changes. Even if this information was available, optimal tax calculations implicitly assume the absence of other sources of market failure.

In the case of alcohol consumption there are widely differing views on the extent of externalities present and, consequently, on what the appropriate role for government is. From the review of the available evidence presented in section 3, it is likely that any significant external costs would be confined to the small proportion of drinkers who consume excessive amounts of alcohol. If the government attempts to use taxes to reduce the consumption of abusive drinkers causing external costs, they would need to be targeted on those problem drinkers. Typically, the government does not have access to sufficient information to be able to target taxes in this way and/or the costs of ensuring those drinkers do not obtain alcohol from individuals not incurring the tax are too high.

To overcome this problem, Hall (1996) advocates imposing a uniform tax on drinkers to correct the problem 'on average'. However, this reduces the consumption of all alcohol consumers, not just the problem drinkers. In this instance, a uniform tax is far too blunt an instrument to improve social welfare. Rather, it is likely to have an adverse impact on social

welfare as all alcohol consumers are 'fined', not just those causing external costs. Even in the case of the problem drinkers it is not clear to what extent a uniform tax will modify their behaviour. Society is likely to receive a better pay–off from the government targeting other instruments at these problem drinkers to encourage them to reduce their consumption. These instruments include public education campaigns, better enforcement of legal sanctions to punish criminal behaviour and ensuring that market failures or government interventions in other markets which impact on problem alcohol consumers (such as under recovery of health care costs) are addressed directly.

The appropriateness of the Hall (1996) framework

A number of more fundamental questions need to be addressed regarding application of the Hall (1996) analytical framework. After reviewing the literature on the benefits and costs associated with the consumption of alcoholic beverages it is clear that there are substantial benefits associated with light to moderate consumption. The evidence suggests that for most people moderate consumption of one, two and three or even four drinks a day will produce positive benefits in terms of health, reduced risk of dying from all causes and improved productivity. While most of these benefits will be internalised by the consumer, there may be some residual spill–over benefits for society. On the other hand, the majority of medical costs associated with the consumption of alcoholic beverages are associated with a small minority of New Zealanders who drink very heavily and, as a consequence, contract a disease such as cirrhosis. The majority of the costs will be internal to the consumer. A large part of those costs that are identified by Hall as being external arise from government interventions and market failures in other markets such as mis-pricing of health care services.

Many external costs, which are commonly treated as 'alcohol–related', such as injury to third parties or property, are generally not associated with the consumption of alcohol per se. Rather, these costs are generated by anti–social and criminal behaviour such as fatalities and injury to third parties as a result of drunken driving and domestic violence. Research into factors contributing to one of these externality generators — fatalities related to drink driving — found that many of these drivers had blood alcohol levels substantially higher than the legal limit and many had levels which corresponded to fifteen 300ml glasses of beer (Bailey and Bailey 1998). Many of these so–called 'hard–core' drinkers where found to be persistent offenders displaying very different characteristics to the rest of the population. The most effective policy response in this instance is likely to be better policing and enforcement of legal sanctions combined with public education campaigns.

Many of the 'externalities' identified by Hall are open to dispute and generally better addressed by more targeted policy instruments than a blunt instrument like a uniform excise.

Indeed, the information requirements associated with trying to set an 'optimal' excise level are overwhelming. Such across–the–board approaches are likely to reduce rather than improve welfare, as many of the beneficial affects of alcohol consumption on light to medium drinkers are foregone for an uncertain impact on the consumption of heavy and abusive drinkers. Consequently, important reservations have to be expressed about the appropriateness of the Hall (1996) analytical framework.

Validity of technical assumptions used in Hall (1996)

Even if one adopts Hall's analytical framework, we conclude that:

- the evidence on the benefits and costs of consuming alcoholic beverages suggests that the net externality function is not a convex increasing function over the entire alcohol consumption range. For most consumers, the positive benefits are likely to be maximised somewhere between two or three, or even four drinks per day. At some higher consumption level the net externalities associated with heavy and abusive drinking turn negative. Over some range these net externalities may be increasingly negative;
- the evidence to hand indicates that the net externality function does not have the convex increasing functional form assumed by Hall. Thus, Hall's conclusion that the excise is too low cannot be substantiated. In fact, if the net marginal externality function is piecewise quadratic and linear then the 'optimal' excise could be zero, positive or, in some instances, a subsidy could even be potentially justifiable on economic efficiency grounds. Much more information and analysis would be required before any firm conclusions could be drawn;
- the majority of studies examining consumers' responsiveness to a change in the price of alcoholic beverages have not examined differences in the elasticity of demand for light, moderate and heavy drinkers. These studies have in the main estimated that the demand for alcoholic beverages is relatively inelastic, which suggests that a 10 per cent increase in the price of alcohol would lead to a reduction in consumers' demand of less than 10 per cent. The one study, which has examined the responsiveness of different types of consumers to a change in price, found a substantial variation in drinkers' responsiveness. Moderate drinkers were found to be more than twice as responsive to a change in price as both heavy and lighter drinkers. The results indicate that if the price of alcoholic beverages increased by 10 per cent moderate drinkers would decrease their demand by more than 10 per cent. On the other hand, heavy drinkers faced with the same price increase would reduce their demand by less than 10 per cent. If this study's findings are

correct, there would be a substantial cost to the community from taxing moderate drinkers who, in all likelihood, are generating positive externalities; and

- There is evidence in virtually all studies that examined the elasticity of demand suggesting that an increase in the price of alcohol would lead to some reduction in the consumption of heavy drinkers. However, it is not clear that their response will be sufficient to have any significant impact on any negative externalities they may generate from drinking. It is unlikely that the external benefits generated by the relatively small reduction in the consumption of these heavy drinkers would outweigh the costs imposed on the wider community.

There is a strong probability that the net damage (externality) estimates of $432 to $713 million presented in *The Alcohol Excise* paper are too high. In fact, it is difficult to accept that estimates of the net damage are even in the 'ball park'.

In summary, Hall (1996) provides an interesting analytical contribution to the debate on the taxation of alcoholic beverages. However, we find that the key assumptions on which the paper's conclusions are based are not supported by available evidence. For example, the paper underestimates the benefits to society from moderate levels of alcohol consumption and over estimates the external costs. We find little support for many of the papers key theoretical assumptions. Consequently, the paper's findings on the appropriate level of the alcohol excise have to be questioned.

1. INTRODUCTION

This report by Tasman Asia Pacific ('Tasman') is in response to a request by the Beer Wine and Spirits Council of New Zealand, the Wine Institute of New Zealand Inc. and the Distilled Spirits Association of New Zealand to review a June 1996 report to the Working Party on the Alcohol Excise. Of particular interest is the paper in Annex 4 of the report titled *The Alcohol Excise* by Tom Hall of The Treasury (Hall 1996).

The rationale driving the analysis in Hall (1996) is a concern that there are significant negative net externalities associated with the consumption of alcoholic beverages and that the current level of these externalities is reducing the aggregate utility of New Zealanders. Given these concerns the paper provides an interesting analytical contribution to the debate on the taxation of alcoholic beverages. However, like all papers relying on economic theory it relies heavily on a range of assumptions to support its finding that 'the current rate of excise is too low and current consumption is too high to maximise society's welfare' (Hall 1996, p.2). This report reviews the appropriateness of those assumptions and how sensitive the paper's conclusions are to them.

A review of the alcohol excise is timely as the New Zealand Government has previously announced its intention to reduce its reliance on excises, but the alcohol excise remains firmly in place. For instance, at the time of the introduction of the GST the Minister of Finance stated that 'GST will eventually replace almost all indirect taxes' (Douglas 1985, p.11). This was reiterated by the Prime Minister in 1992 with regard to alcohol taxation: 'Over time, and as the fiscal position permits, the Government believes GST will come to be regarded as the primary instrument of indirect taxation, with excise reducing as a source of Government revenue' (Treasury 1996).

After briefly examining New Zealanders' current level of consumption of alcoholic beverages, this report reviews the methodology, assumptions and evidence Hall uses to derive his conclusions. In particular, this report examines:

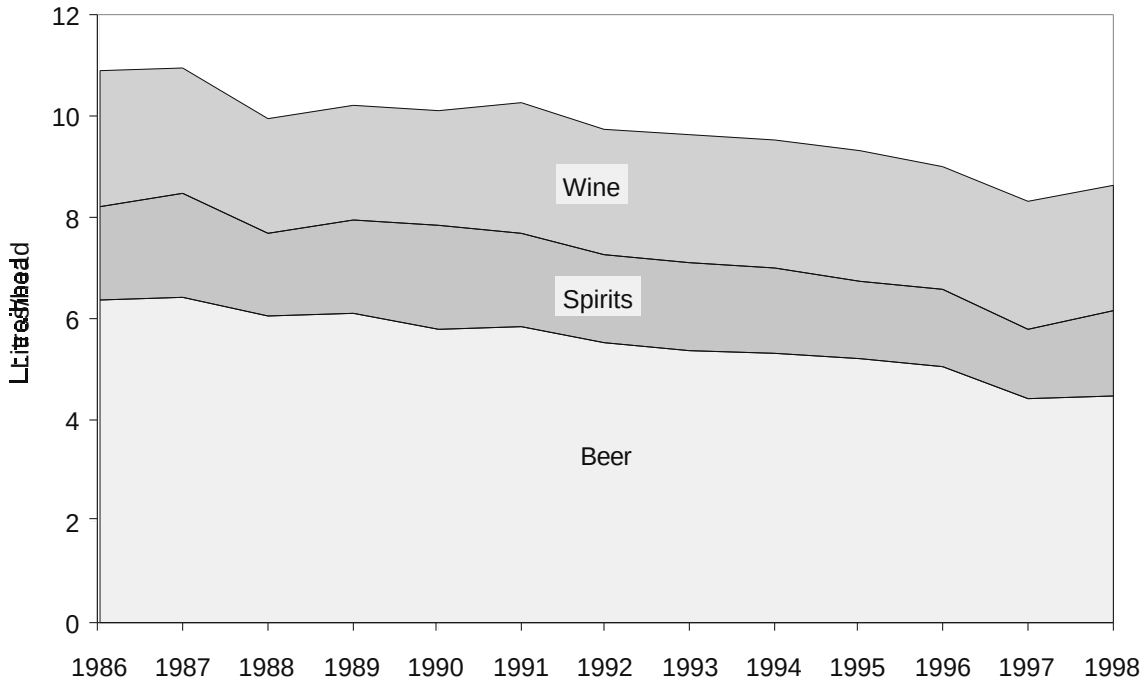
- the benefits and costs associated with alcohol consumption (section 3);
- what constitutes an externality with regard to consuming alcoholic beverages and alternative options for dealing with 'alcohol-related' costs (section 4);
- Hall's (1996) estimate of the value of the net external costs of alcohol consumption (section 5); and
- the taxation of externalities generated by consuming alcohol and a number of key assumptions behind Hall's conclusions (section 6).

2. ALCOHOL CONSUMPTION IN NEW ZEALAND

New Zealanders, as a whole, are relatively moderate consumers of alcoholic beverages. A review of 53 countries shows that New Zealand ranked twenty-third in per capita 1995 alcohol consumption (see Appendix 1).

Average alcohol consumption has also been falling steadily in New Zealand in recent years. Between 1986 and 1998 average alcohol consumption by New Zealanders aged 15 years and over declined by 21 per cent from 10.9 litres per head to 8.6 litres per head (Figure 1). This resulted from a 30 per cent fall in per capita consumption of alcohol from beer, a 10 per cent fall in alcohol consumption from spirits and a 7 per cent fall in alcohol consumption from wine.

Figure 1: **Average New Zealand alcohol consumption per person 15 years and over, 1986 to 1998**

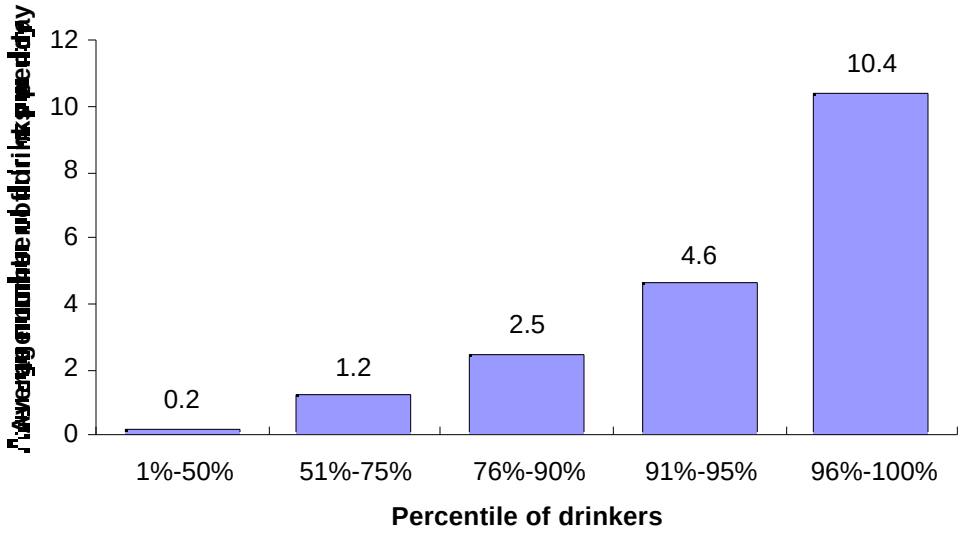


Source: EconData (1999).

The level of alcohol consumption in New Zealand is not uniform across the drinking age population. Estimates presented in Hall (1996) indicate that average daily alcohol consumption in New Zealand is heavily skewed to the top 90 to 100 percentile of drinkers (Figure 2).

The figure highlights that around half of those New Zealanders who consume alcoholic beverages drink, on average, much less than one glass per day. Hall (1996) does not provide details of the number of drinking age New Zealanders who totally abstain from drinking alcoholic beverages. If these people were included, the average daily consumption in the bottom half of the drinking age population would be considerably lower and approaching zero.

Figure 2: **New Zealand drinkers' per capita alcohol consumption** [a]



(a) These estimates are based on data from the Alcohol and Public Health Research Unit, School of Medicine, University of Auckland. The Unit pointed out that its estimates may be affected by under reporting of consumption. Hall upwardly adjusted the estimates proportionately across consumption levels to take account of this factor.

Source: Hall (1996).

Hall (1996) also reports that drinking levels of young people increase rapidly with age but tend to peak at around 20 to 24 years of age and then gradually decline. Abusive drinking tends to be a young rather than a middle age or elderly phenomenon.

Drinking patterns also appear to vary considerably with income level. For example, a telephone survey undertaken in Auckland indicated that in 1996 just over 30 per cent of the population in the lower income group consumed no alcohol in the previous twelve months ¾ up from around 20 per cent in 1991 (APHRU 1998). By contrast more than 20 per cent of those surveyed in the middle income group and less than 10 per cent of respondents in the higher income group had consumed no alcoholic drink in the previous twelve months. The survey also found a marked increase, from around 18 per cent in 1990 to 34 per cent in 1996, in the proportion of young people in the 14 to 19 year age group who had not consumed any alcoholic beverages in the twelve months prior to the survey.

3. ALCOHOL CONSUMPTION: ITS BENEFITS AND COSTS

There are benefits and costs associated with the consumption of all goods and services and alcoholic beverages are no exception. This section considers the evidence regarding these benefits and costs.

3.1 BENEFITS OF ALCOHOL CONSUMPTION

People, like all other creatures, need a minimum quantity of food to survive. However, in affluent societies like New Zealand we can enjoy a range of food products which are not strictly required to survive but improve the quality of our lives. For many people their utility (benefit) from consuming food will be maximised if their diet includes a wide variety of foods and beverages. For example, some people enjoy consuming water, bread and cereal, milk, apples and cherries, cheese, roast chicken and vegetables, tea, chocolate bars, alcoholic beverages etc.

In many households around the world the consumption of alcoholic beverages with meals or at important occasions is a traditional or cultural activity. Alcohol, like music and well-cooked food, can be a means of enlivening people's enjoyment of life. This phenomenon is not new. There is archaeological evidence that shows that alcohol has been a part of Western and Eastern civilisations over the millennia. For example, beer was brewed in ancient Egypt.

In addition to the enjoyment people derive from consuming alcohol, there are a range of other benefits from drinking alcohol. Numerous studies have found that light to moderate consumption of alcohol has positive effects on health and well-being. However, in his discussion of 'net damage' Hall (1996) only recognises the benefit associated with a reduction in the incidence of coronary heart disease (CHD). As the following discussion highlights, there is a large body of evidence that the health benefits extend well beyond those included in Hall's analysis.

Coronary heart disease

CHD is a major cause of morbidity and death in developed countries, including New Zealand. Heart disease is the second most common cause of death facing New Zealanders, being responsible for 24 per cent of all deaths. Men have a higher mortality rate for heart disease than women. For example in 1995 the male age standardised mortality rate for heart disease

was 157.7 deaths per 100,000 of population. By comparison, the heart disease death rate for females was 71.6 per 100,000 of population (NZIS 1998). Unfortunately, the main risk factors for CHD — high blood cholesterol and high blood pressure — have no symptoms in the early stages.

Consumption of alcoholic beverages has been shown to have a significant impact on reducing the incidence of coronary heart disease in men and women. Clinical research has identified a "U" or "J" shaped relationship between the consumption of alcohol and mortality from coronary heart disease. This shape reflects the evidence that moderate drinkers have a lower risk of coronary heart disease than non-drinkers and heavy drinkers (see Stockley 1998). Studies have also shown that former drinkers as well as those who have never consumed alcohol have a higher risk of coronary heart disease than moderate drinkers (for example, see Jackson, Scragg and Beaglehole (1991) and Klatsky, Armstrong and Friedman (1990)).

Hall (1996, p.16) argues that the CHD benefit of consuming alcohol increases the more is drunk, up to an average of one drink per day. The paper argues there is no substantial benefit beyond one drink per day, but acknowledges the benefit accrues even at heavy drinking levels. However, the paper's graphical description of the marginal benefits and costs associated with alcohol consumption suggests that the CHD benefits fall off sharply after one drink per day. This seems at odds with the Hall's own finding that CHD benefits accrue at higher levels than one drink per day.[1]

Hall (1996) is correct in his observation that some CHD benefits can be achieved with fairly low levels of alcohol consumption. However, many CHD studies suggest that greater benefits may be available at higher levels of consumption. Results of CHD studies reviewed by Anderson, Cremona, Paton, Turner and Wallace (1993) and reproduced in Figure 3 show that some coronary benefits can be achieved with very low levels of alcohol consumption. For example, studies by Jackson, Scragg and Beaglehole (1991) and Scragg, Stewart, Jackson and Beaglehole (1987) reported in the Anderson review show a substantial reduction in the risk of CHD with consumption levels of less than 10 grams of alcohol per day (which is roughly equivalent to one standard drink). However, Figure 3 highlights that these two studies as well as a number of other studies show that even at very high consumption levels the risk of coronary heart disease is reduced. Indeed, the study by Jackson, Scragg and Beaglehole (1991) found that the risk of CHD was lowest at consumption levels of over 50 grams (five standard drinks) per day. On the other hand, a study by Hennekens, Rosner and Cole (1978), which is

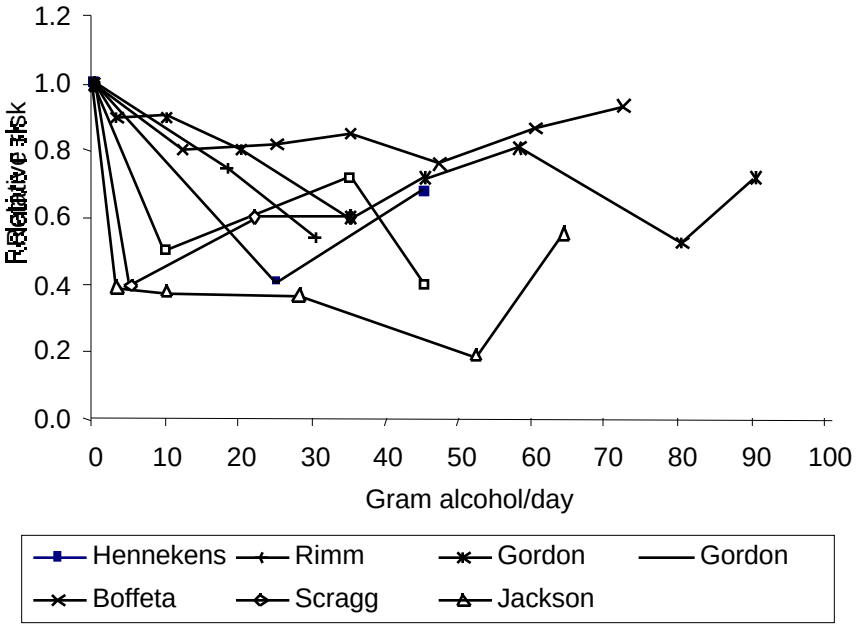
[1] See Hall (1996), Diagram 1: Marginal Costs and Benefits of Alcohol Consumption, page 16, and

also reported by the Anderson study and detailed in Figure 3, found the lowest risk was at consumption levels of just over 20 grams per day or approximately two standard drinks.

Jackson and Beaglehole (1993), after reviewing a range of studies, also concluded that the weight of evidence of the beneficial effects of alcohol consumption on CHD is now beyond reasonable doubt. They point to a study by Bofetta and Garfinkel (1990) which suggests that *the coronary heart disease benefits of consuming alcoholic beverages generally increase until around four drinks a day*.

These results indicate that Hall's assumption that increasing benefits for CHD are only achieved up to an average of one drink per day is extremely conservative. Increasing benefits extend to at least two or three drinks per day and many studies indicate that CHD benefits at some positive level extend to much higher levels of daily consumption.

Figure 3: **Coronary heart disease in men**



Source: Anderson, Cremona, Paton, Turner and Wallace (1993)

Hall (1996, p.20) also assumes that:

> … the young do not generate health benefits in their young years from drinking alcohol, since they do not suffer from CHD when young.

However, although death from CHD is commonly associated with people in the middle to older age groups it is not restricted to these groups. For example, the NZIS (1998) reports that 15 people below the age of 35 years died from ischaemic heart diseases or CHD in 1995. Importantly, CHD sufferers display no symptoms when the disease is in its early stages.

Bonita and Beaglehole (1998) point out there is good evidence that risk factors for cardiovascular disease are the same at all ages. However, the prevalence of the risk factors increases with age, placing older people at a greater risk than younger people. Thus, the benefits of a reduced incidence of CHD are not strictly limited to older New Zealanders.

The CHD benefits gained by New Zealanders drinking moderate levels of alcohol are considerable and should not be discounted. Scragg (1995) estimates that if all New Zealanders did not drink alcohol then 1,732 additional deaths from CHD would have occurred in 1987.

As noted in section 2, the majority of New Zealand's drinking age population currently consume zero or very low levels of alcohol per day. On the basis of the evidence presented above, we must conclude that many of these people are not drinking sufficient levels of alcohol to reduce their risk of CHD. As a consequence, many New Zealanders are unnecessarily dying from CHD.

Other Benefits

There is substantial evidence to suggest that daily moderate consumption of alcohol produces a range of other benefits including: a reduced risk of certain types of stroke, a major cause of chronic and serious morbidity in the population; improved psychological outcomes; a reduced overall risk of dying from all causes; and productivity benefits.

Ischaemic stroke and psychological benefits

Harding (1996) reports on a number of studies (including a United Kingdom joint study by the Royal Colleges of Physicians, Psychiatrists and General Practitioners in 1995) which consistently suggest that compared to non–drinkers, moderate consumption of alcoholic beverages has a protective effect against ischaemic stroke.[2] These studies suggest that the relative risk of ischaemic stroke is reduced by approximately 50 per cent. For men the protective effect is obtained by consuming between two and five standard drinks per day. A lower level of consumption of between two to four standard drinks per day achieves the same protective effect for women. Regular, rather than irregular, moderate consumption appears to be important in achieving the protective effect. On the other hand, the risk of stroke appears to increase for heavy drinkers with hypertension (Puddey, Beilin and Rakick 1996).

Baum–Baicker (1985) identified psychological benefits from low to moderate consumption of alcohol. These benefits included reductions in stress levels and improved cognitive

[2] Ischaemic stoke covers both thrombotic and embolic stroke. Thrombotic stoke is the most common type

performance including problem–solving and short–term memory. Abstainers as well as heavy drinkers were found to have higher rates of clinical depression than moderate drinkers. The low to moderate consumption of alcohol was also found to be effective in treating geropsychiatric problems.

Reduced risk of morbidity and mortality from all causes

The best way to judge the net effect of alcohol consumption on a variety of causes of death is to examine all cause mortality in follow–up studies, where data on alcohol use was collected prior to the onset of disease or death. Ellison (1995) documents the findings of ten follow–up studies in a range of countries. These studies examined the relative risk of dying from all causes and related this risk to the level of alcohol consumed (see Appendix 1). All ten studies show that overall mortality (the relative risk of dying from any cause) is lower for individuals who consume alcohol than for individuals who do not consume alcohol. Ellison points out that although the studies varied in the statistical significance of each alcohol consumption category, they all confirmed that the people with the lowest risk of death were those classified as being either moderate drinkers or those consuming one to two drinks per day.

The positive relationship between alcohol consumption and longevity has been highlighted by an Australian study by Simons, McCallum, Friedlander and Simons (1996). The authors undertook a longitudinal study of the mortality of over 3,000 people over the age of 60 years and found that men consuming more than three standard drinks per day had a 63 per cent lower mortality rate than men who abstained from drinking alcohol. Although the majority of women did not consume alcohol or consumed less than one standard drink per day, the results suggest there is a U–shaped relationship, with the relative risk of death decreasing to 0.61 for consumption up to two standard drinks per day. However, consumption at higher levels lead to the risks of death increasing to 1.12.

Similarly, a Household Health Survey undertaken jointly by Statistics New Zealand and the Ministry of Health also supports the hypothesis that consumption of alcoholic beverages has a positive impact on the health of consumers. The study found that non–drinkers visited the GP more often and filled more prescriptions than respondents to the survey who drank alcoholic beverages (Statistics New Zealand 1993).

There is also evidence, particularly *in vitro* evidence, that some forms of alcohol, particularly red wine, contain antioxidants which have additional beneficial health effects (Stockley 1998). Antioxidants neutralise free radicals in the body and appear to be beneficial in boosting the immune system, combating ageing and some cancers.

Jackson and Beaglehole (1993) also confirm that from a public health perspective the effect of alcohol on overall morbidity and mortality should be the central focus of any debate. They reviewed a range of studies on alcohol consumption and various aspects of health (including the risk of accidents). They conclude that if men drink above approximately three drinks a day and women drink more than about two drinks a day then the adverse health effects of alcohol consumption are likely to outweigh the related benefits.

These studies indicate the overall outcome of moderate drinking is better health and longer life.

Improved productivity

In a relatively unrestricted labour market, higher (lower) productivity of particular workers could be expected to show up as higher (lower) wages. There is increasing evidence to suggest that low to moderate consumption of alcohol is associated with a higher income earning potential and consequently higher productivity for the economy. Studies based on samples of workers have found a positive relationship between moderate consumption of alcohol and higher wages. For example, French and Zarkin (1995), after controlling for a range of other variables, found that employees with moderate alcohol consumption levels earned higher wages. They estimated that those workers consuming 1.5 to 2.5 alcoholic drinks per day earned higher wages than their fellow workers who abstained as well as fellow workers who drank heavily.

Another United States study examined income levels of prime–age workers responding to the 1991 and 1992 National Household Survey of Drug Abuse and identified a wage premium in the order of seven per cent for male workers who drink alcoholic beverages (Zarkin, French, Mroz and Bray 1998). The study found no evidence of the 'U' shaped relationship identified in the earlier French and Zarkin (1995) study. The positive relationship between income and alcohol consumption was evident over a wide range of consumption levels. A four per cent wage premium was identified for women workers who drank alcoholic beverages. However, this relationship was not found to be statistically significant.

One concern with these studies is that they did not isolate the impact of earnings on alcohol consumption. Hence, if people on higher incomes tend to consume more alcoholic beverages, rather than more expensive alcoholic beverages, the findings may merely reflect the fact that consumption of alcohol rises with income. However, the following three studies have addressed this potential problem in their modelling and continued to find that a wage premium exists for drinkers compared to non–drinkers.

The first of these studies by Berger and Leigh (1988) identified a beneficial relationship between alcohol consumption and wages in their sample of United States workers who responded to a quality of employment survey. They found that males who drink alcoholic beverages earn significantly more than those who had always abstained. However, in reaching this conclusion they note that their analysis could not indicate whether those who drink alcoholic beverages earn current wages at the expense of future wages.

Similarly, Hamilton and Hamilton (1997) used Canadian national survey data to examine the wages earned by non–drinkers, moderate and heavy drinkers. They found that moderate drinkers earned a wage premium in the order of 7 per cent over non–drinkers. However, heavy drinkers' wages were lower than those of non–drinkers.

A recently released study by Barrett (1999) used the 1989 Australian National Health Survey to examine the effect of alcohol consumption on the earnings of full–time male workers over the age of 24 years. The study, after adjusting for any reverse causation which might arise from people with higher incomes consuming more alcohol, found that the wage premium for people who drink moderately could be as high as 20 per cent. Barrett (1999, p.4) concluded that the finding is 'consistent with the hypothesis that moderate alcohol consumption has beneficial health and hence labour market productivity effects'.

These results suggest that the moderate consumption of alcoholic beverages has a positive impact on the productivity of workers. The more productive a workforce, the more significant the beneficial impact on the economy as a whole. Increased productivity from an increase in the number of New Zealanders who drink moderately would flow through to more competitive industries, increased exports and increased gross domestic product.

Summary

These studies suggest that the benefits of consuming low to moderate amounts of alcohol on a regular basis are not restricted to a reduced incidence of CHD. Other benefits, such as reductions in overall mortality risks, lower stress levels, reduced incidence of stroke and improved productivity, are available to virtually the whole of the adult population. While blanket recommendations should be avoided, there are public benefit grounds to argue that it would be beneficial for a large proportion of adult New Zealanders, rather than only those predisposed to CHD, to consume moderate amounts of alcoholic beverages on a regular basis.[3]

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[3] On the basis of current evidence, it may be advisable that some high risk groups including pregnant

3.2 COSTS OF ALCOHOL CONSUMPTION

Hall (1996) identifies a wide range of costs associated with the consumption of alcohol including:

- Productivity:
  - Lost production from absenteeism and reduced efficiency;
- Personal and property damage:
  - Death and injury including assault, suicide and manslaughter;
  - Policing, judicial, court costs, etc; and
  - Damage to property including that caused by motor vehicle accidents;
- Health:
  - Cirrhosis — which Hall argues to be an exponentially increasing function of average chronic alcohol consumption;
  - Cancer — argued to be a linear relationship with upward curvature at higher drinking levels; and
  - Related medical costs.

Costs associated with each of these three broad areas are discussed briefly below.

Productivity

Many studies and reports on the negative impact of alcohol consumption often link alcohol consumption to low productivity in the workforce. Hall cites a paper by Devlin, Scuffham and Bunt (1996) which, on the basis of a 1979 report by the United States General Accounting Office, assumes that annual working efficiency is reduced by 25 per cent if workers abuse alcohol.[4] However, the more recent literature on the relationship between alcohol and wages suggests that the 1979 United States estimate may be excessive.

Jones, Casswell and Zhang (1995) undertook a computer–assisted telephone survey of 2,638 drinkers in Auckland to examine 'alcohol–related' absenteeism and productivity/efficiency reductions in New Zealand. The sample reported a total of 273 absences related to the consumption of alcohol with the heaviest drinkers having by far the largest number of

[4] Tasman has not been able to obtain a copy of this study. However, Jones, Casswell and Zhang (1995) in discussing the US General Accounting Office report, note that the estimate related to reduced efficiency was measured as a reduction in annual salary per employee. The estimate was not based on empirical analysis but rather on several experts' opinions and, at the time, was considered conservative. No details of what constituted

alcohol–related absences. On average each heavy drinker was absent from work for alcohol–related reasons on 0.43 working days per year. Similarly, the heaviest drinkers (people who drank approximately 6 drinks per occasion) were much more likely to report reduced efficiency at work. On average these people estimated that their performance when attending work was reduced on 3.93 working days per year (see Table 1). These estimates of alcohol absenteeism and reduced productivity are in aggregate considerably lower than the estimate by the United States General Accounting Office.

Table 1: **Absentee days and reduced efficiency days in relation to annual alcohol consumption for the previous year**

	Drinkers groups					
	Top 10% (a)	Top 10–25%	Top 25–50%	Bottom 25–50%	Bottom 10–25%	Bottom 10% (b)
	Absenteeism					
Sample size (c)	265	395	660	657	398	263
Percentage of people who had taken at least one absentee day	16.60	6.10	2.10	1.80	0.80	0.40
Average number of absentee days per year (days/person)	0.43	0.27	0.04	0.03	0.02	0.004
Estimated average production loss ($/person)	54.8	27.5	3.20	4.30	2.00	0.40
	Reduced Efficiency					
Sample size (d)	126	188	314	314	189	124
Percentage of people who felt that work performance was reduced	30.20	22.90	12.70	8.00	3.20	0.00
Average number of days when work performance was reduced (days/person)	3.93	1.84	0.33	0.59	0.05	0.00
Estimated average production loss ($/person)	112.00	72.30	13.70	12.60	1.30	0.0

(a) 6 drinks per drinking occasion on average. (b) 1 drink per drinking occasion on average.
(c) Data based on total drinkers who had full- or part-time paid job (***n*** = 2,638).
(d) Data based on total drinkers who had full- or part-time paid job (***n*** = 1,255).
Source: Jones, Casswell and Zhang (1995)

The Jones, Casswell and Zhang (1995) study found that people who drank one drink per drinking occasion (the bottom 10 per cent of drinkers) had an average of 0.004 days absent per year due to alcohol and estimated no detrimental effect from alcohol on their productivity. Moderate drinkers, indicated by drinkers in the bottom 25 to 50 per cent, constituted around 30 per cent of respondents. These people also had minimal alcohol–related absences — only 1.8 per cent of people in this group had taken an absentee day due to their consumption of alcohol. Similarly, 92 per cent of people in the bottom 25 to

50 per cent group of drinkers estimated that alcohol consumption had not reduced their productivity (see Table 1).

The Jones, Casswell and Zhang (1995) analysis only focused on the relationship between alcohol and reduced performance and absenteeism. However, as discussed in section 3.1, recent studies have shown a positive relationship between alcohol consumption and workers' wage rates. For example, studies by French and Zarkin (1995), Berger and Leigh (1988), Zarkin, French, Mroz and Bray (1998) and Barrett (1999) found a positive relationship between alcohol consumption and wages.

However, these studies may include some bias as they do not include persons who may have been forced to leave the workforce due to abusive drinking. For example, Mullahy and Sindelar (1993) identified a negative relationship between alcoholism and income. In a latter study the same authors (Mullahy and Sindelar 1996) found that problem drinking reduces employment and increases unemployment.

Given that the majority of New Zealand's drinking population are very moderate in their consumption of alcohol and given there appears to be a positive relationship between non–abusive drinking and productivity, it is likely that the net income and productivity effects of alcohol consumption are positive.

Personal and property damage

Hall (1996) outlines a range of 'alcohol–related' damage to persons and property. He suggests that damage from consuming alcohol includes loss of life and injury caused in motor vehicle accidents, assaults, etc, as well as 'alcohol–related' costs of police, penal institutions, etc, and payments by the Accident Compensation Commission.

Hall, in essence, treats 'alcohol–related' unsocial behaviour as costs of consuming alcohol. There can be no doubt that some people associated with causing personal and property damage were under the influence of alcohol at the time the damage occurred. The evidence on this relationship is clear from data prepared by the Land Transport Safety Authority (LTSA) and from police reports. For example, 469 fatal motor vehicle accidents occurred in 1997. The LTSA (1998a) reports that alcohol consumed by the driver was probably a contributing factor in 127 of these fatalities. However, it is common for most accidents to have more than one contributing factor. For example, in 1997 there were 9,482 motor vehicle accidents and 15,553 factors identified in accident reports as probable contributors.

A recent study of factors contributing to New Zealand's road fatalities concludes that sub–standard highways and bad weather are key factors behind a large proportion of the

fatalities (Bailey and Bailey 1998). The study also found that heavy (hard–core) drinkers driving with blood alcohol consumption levels (BACs) well over the legal limit were the main cause of many of the fatalities where alcohol was identified as a major contributor. For example, the study found that accidents on rural roads were the most likely to result in a fatality. Approximately one third of these rural road fatalities involved a driver whose drink driving was suspected as a contributing factor. Virtually all of these drink drivers were found to have 'exceptionally high BACs' which corresponded to fifteen 300ml glasses of beer. A number of significant findings emerged about the hard–core drink drivers involved in fatalities including that many:

- are persistent offenders displaying very different characteristics to the rest of the population; and
- drive old vehicles with mechanical defects.

An earlier study by Bailey (1995) also supports these findings. The study found that in the majority of fatal motor vehicle accidents driver fault was a factor. In 1991, there were 533 fatal road accidents with driver fault. Of these, 166 drivers were identified as being over the legal blood alcohol limit. Over a third of these drunk drivers had previous convictions for drink driving. However, many drunk drivers who were at fault in accidents had a tendency to engage in criminal activity other than drink driving (Figure 4). Bailey's analysis suggests that recalcitrant drivers, rather than people who drink alcoholic beverages per se, are the cause of many of the so called 'alcohol–related' road accident fatalities.

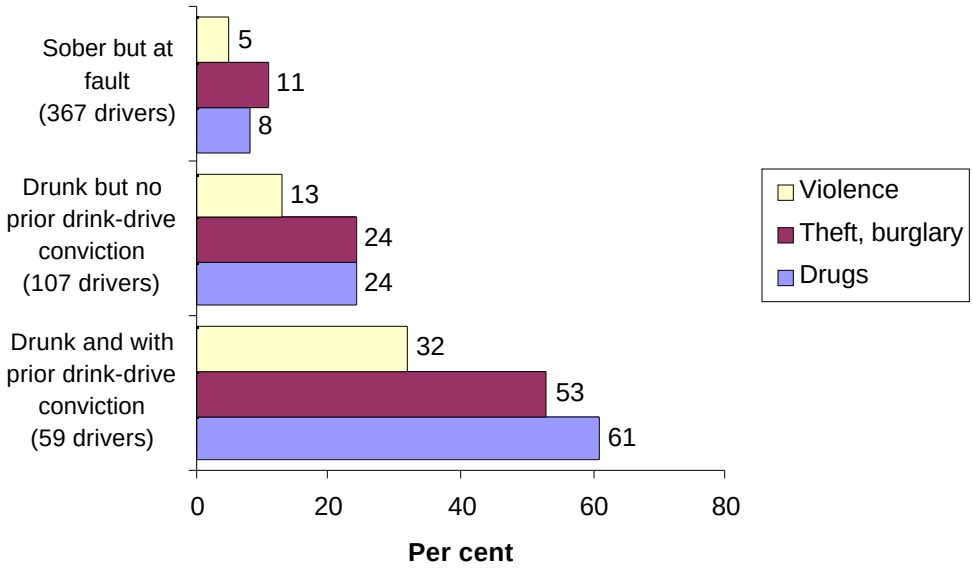
Alcohol is also claimed to be an important contributor to violence, particularly domestic violence. However, research presented in Australia at a National Symposium on Alcohol Misuse and Violence found that alcohol had no role in 50 per cent of all domestic violence incidents (NSAMV 1994). The results of a survey of women who had been subject to domestic violence were reported at the symposium. Only 10 per cent of the women surveyed stated that domestic violence only occurred when the perpetrator had consumed alcohol. The symposium identified key strategies to deal with domestic violence including:

- violent men should take personal responsibility for violence against their partners and children — they should not be permitted to avoid personal responsibility by blaming the 'drink'; and
- Government and other agencies should give out consistent messages that violent behaviour is a criminal offence that is socially unacceptable.

These studies create considerable uncertainty about the importance of the role of alcohol in many so–called 'alcohol–related' incidents. The cause and effect relationship is not clear. For

instance, do people who are having domestic problems resort to drinking heavily or does excessive drinking lead to domestic trouble? It is difficult to justify an argument that the consumption of alcohol is the root of the problem. On the other hand, it is easy to support an argument that the problem is people undertaking socially–unacceptable criminal activity.

Figure 4: **Prior convictions of at-fault drivers**
1991 fatal accidents — 533 drivers in total



Source: Bailey (1995).

In the case of motor vehicle accidents where the primary fault was drink–driving, the problem is not that people consume alcoholic beverages but rather that they commit a criminal offence and drive with high levels of alcohol in their systems. Drunken driving, not consuming alcohol *per se* is the problem that can generate costs. As with domestic violence, Government and other agencies should give out consistent messages that driving over the legal limit is a criminal offence that leads to large sanctions for the offender. People can drink to excess without generating damage to third parties. If they do choose to drink excessively they should not drive. Education and strict enforcement of hefty penalties can reinforce this message.

Health costs

A range of health costs associated with the consumption of alcohol are outlined in Hall (1996). The following discussion highlights that the health costs identified are generally associated with heavy or abusive drinking. Given that most New Zealanders drink less (for many, much less) than 2 drinks a day, this suggests that the health costs of 'alcohol–related' diseases such as cirrhosis and certain cancers are generated by the very few who are alcoholic

or heavy drinkers and actually suffer from these diseases. It is important to note that not all heavy drinkers will generate these costs. These health costs also need to be considered in the context of the wider health benefits of low to moderate alcohol consumption. As noted earlier, there is a strong link between moderate daily alcohol consumption and lower mortality risks.

Cirrhosis

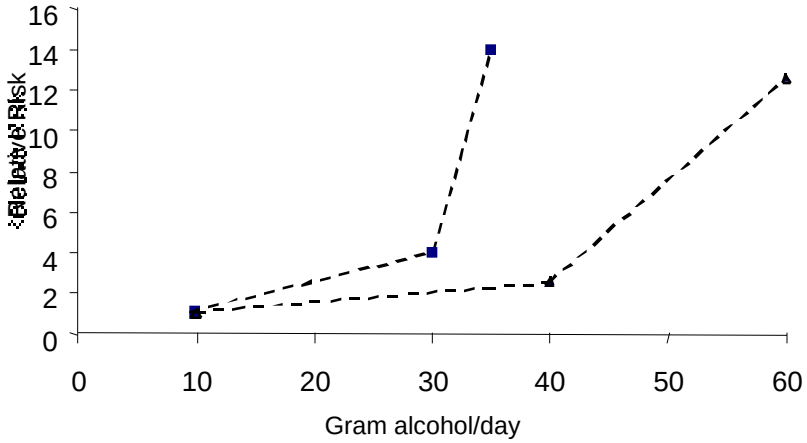
Cirrhosis is a relatively rare cause of death among New Zealanders. In 1995 chronic liver disease and cirrhosis accounted for 113 deaths or 0.4 per cent of the total number of New Zealanders who passed away in that year. Cirrhosis of the liver is typically, but not only, associated with the consumption of alcohol.

There is currently little consensus on the threshold number of drinks at which the risk of cirrhosis is increased substantially above the risk to abstainers. However, research from a range of sources suggests that the risk of cirrhosis increases when consumption is consistently at high levels. Anderson, Cremona, Paton, Turner and Wallace (1993) in a review of studies into the incidence of liver cirrhosis found that the link between moderately high alcohol consumption and higher cirrhosis risk appears greater for women[5] (see Box 1). Most studies reviewed suggest that the risks of cirrhosis in men increased substantially at drinking levels higher than 30 to 40 grams of alcohol (approximately three to four standard drinks) per day. Interestingly, in some studies reviewed, the relative risk for men declined slightly at lower levels of alcohol consumption (Box 1).

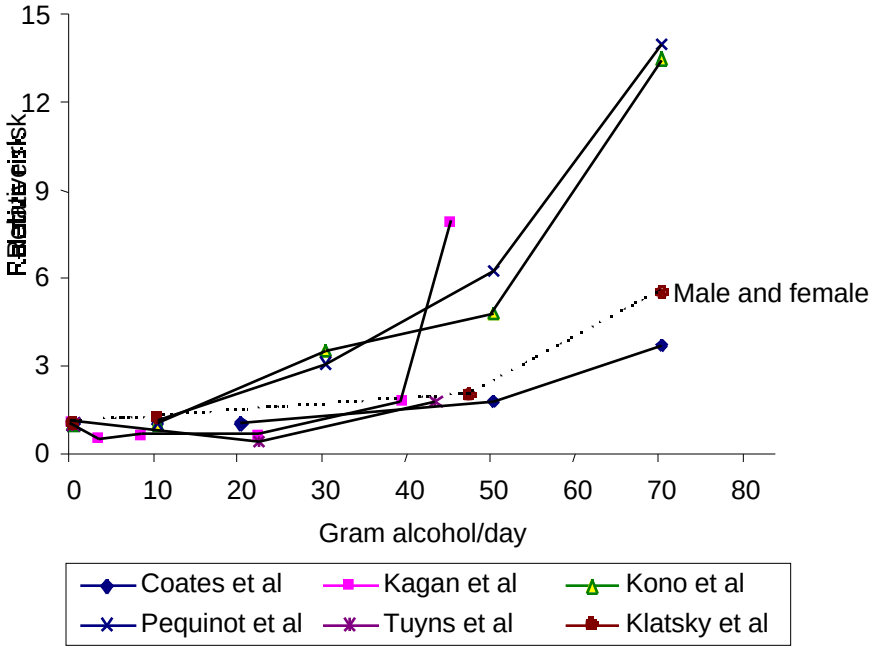
Box 1: **Alcohol and liver cirrhosis incidence in men & women**

Liver cirrhosis incidence in women

5 There are very few studies on the relationship between drinking alcoholic beverages and cirrhosis in



Liver cirrhosis incidence in men



Note: The authors truncated the data at 70g a day. The data reproduced here have been estimated from Figure 1 in Anderson, Cremona, Paton, Turner and Wallace (1993).

Source: Anderson, Cremona, Paton, Turner and Wallace (1993).

The positive relationship between cirrhosis of the liver and relatively moderate alcohol consumption levels may be spurious. Ellison (1995) notes that physiological studies have shown that healthy individuals only show liver abnormalities when they consume fairly large amounts of alcohol. But some epidemiological studies show the risks to increase with even small levels of alcohol consumption. This inconsistency, he suggests, can be explained by a commonly suggested phenomena in this area of research — that is, that heavy drinkers under

data on alcohol consumption is recorded before the onset of disease the risk of death in moderate drinkers from 'alcohol–related" diseases such as cirrhosis have generally not increased.

More recent studies than those reviewed by Anderson, Cremona, Paton, Turner and Wallace (1993) suggest that the likelihood of developing cirrhosis, relative to abstainers, is very small for low to moderate drinkers of alcohol (see, for example, Harding 1996 and Ellison 1995). On the other hand, 8 to 30 per cent of long–term heavy drinkers are likely to develop cirrhosis.

Cancer

While there is fairly clear evidence that high levels of alcohol consumption are associated with cirrhosis, the evidence is much less clear for cancer. Certainly it can be stated that alcohol is not a primary cause of most cancers in the community. That said, a number of studies have linked certain types of cancer — cancers of the oral cavity, pharynx, larynx, oesophagus, and liver — to alcohol. In total, these upper aero–digestive tract cancers accounted for just over one per cent of all deaths in New Zealand. For example, Duffy and Sharples (1992) reviewed a range of studies of the relationship between these cancers and alcohol consumption and found a causal relationship. However, closer examination of the studies shows that many did not adjust findings for the risks associated with smoking.

Also, most of the studies reviewed by Duffy and Sharples report that the risks of these relatively rare cancers increased significantly with alcoholism or a consistently high level of alcohol consumption. This suggests that moderate consumption of alcohol is not associated with risks greater than those in the non–drinking community.

Duffy and Sharples (1992) also raised concerns about the link between breast cancer and alcohol. However, Ellison (1995) points out that the link between breast cancer and alcohol consumption is yet to be determined as the studies to date vary considerably in their findings. He also pointed out that age–standardised death rates for female breast cancer in 1987 were lowest in those countries where total alcohol consumption is highest (namely France, Italy and Spain) and highest in developed countries with relatively lower alcohol consumption (namely, United States, Great Britain and Ireland). Ellison notes that this cross–cultural evidence is not sufficient to conclude one way or another as other factors could ameliorate the effect of the higher intake of alcohol.

The United Kingdom Committee on Carcinogencity examined studies published from 1988 to June 1995 on the link between cancer and alcohol. It concluded that there is evidence that the risk of cancers of the upper aero–digestive tract, including cancers of the oral cavity, pharynx,

larynx and oesophagus, increases at consumption levels of above 40 grams (approximately four drinks) per day. The Committee also concluded that the risks of liver cancer are much greater for those who drink heavily and that most tumours occur in people who already have cirrhosis or who have previously contracted hepatitis (Harding 1996). The Committee also noted that the evidence on a relationship between drinking alcohol and breast cancer was unclear but should be kept under review.

Overall there does appear to be evidence which suggests that there is a link between drinking large quantities of alcohol and some rare forms of cancer. However, for low to moderate consumption of up to four drinks a day, the risks do not appear to be greater than those experienced by the public at large. However, at very high levels of consumption, the risks increase dramatically for liver cancer and some rare cancers of the upper aero–digestive tract. The link between breast cancer and alcohol consumption is yet to be resolved.

3.3 SUMMARY

This chapter has identified a range of benefits and costs associated with alcohol consumption. Leaving aside benefits such as enjoyment of taste, quenching of thirst and enrichment of daily life, there appears to be significant positive health and productivity benefits associated with drinking moderately (see Table 2). These include a reduced risk of coronary heart disease, a reduced risk of ischaemic stroke, reduced risk of morbidity and mortality from all causes and higher wages reflecting higher productivity.

In the main, the health, personal and property damage, and productivity costs associated with drinking alcohol are not apparent at these moderate levels of consumption. These costs tend to show themselves at much higher, some may call abusive, levels of consumption. In many instances the health costs are associated with a greater risk of rare cancers and other diseases such as cirrhosis (Table 2). Many of the personal and property damage costs such as drunken driving and domestic violence arise from the criminal actions of a small proportion of problem drinkers. Similarly, productivity costs associated with absenteeism mainly arise from the small proportion of abusive drinkers and/or alcoholics.

On the basis of the wide range of available evidence reviewed in this chapter, Hall (1996) is extremely conservative in his estimates of the health and other benefits arising from moderate alcohol consumption while being relatively pessimistic in his estimates of the health and other costs arising from alcohol consumption. The next issue to be examined is the potential role for government intervention in the market for alcoholic beverages. The appropriate framework in which to assess government interventions such as the alcohol excise is addressed in the

following chapter. Generally, there will only be a potential role for government if the identified benefits and costs are external to the drinker.

Table 2: **The benefits and costs of consuming alcoholic beverages**

	Benefits	*Costs*
CHD	Increasing benefits at least up to **two and perhaps up to four drinks per day**. Benefits level off at higher levels but remain positive.	
Cirrhosis		Much greater risk of cirrhosis when alcohol consumption is at consistently high levels. Risk increases substantially for men at consumption levels **greater than three to four drinks per day**. Women appear to have a much lower consumption threshold than men.
Ischaemic Stroke	Benefits from moderate consumption of **between two and four to five drinks** per day	Higher risk of stroke for **heavy drinkers**
Cancer		Risks of the relatively rare aero-digestive cancers increase above those in the non-drinking community at levels above approximately **four drinks per day** and increase significantly among very heavy drinkers and alcoholics. Risk of liver cancer greater among **heavy drinkers** and those with cirrhosis of the liver.
Overall mortality	Lower risk of death for people who drink moderately — say **one to two drinks** per day.	
Productivity	Benefits in terms of higher wages (and hence national productivity) from **moderate non-abusive drinking**. One study found the optimal drinking level to be **1.5 to 2.5 per day**.	**Problem/abusive drinking** reduces the potential for a person to be employed and increases their risk of unemployment.
Personal and property damage		There is some risk associated with damage to person or property associated with drinking excessively. Violence and other criminal activity **not alcohol consumption per se** is the contributor to the costs associated with 'alcohol-related' domestic violence and motor vehicle accidents.

4. THE APPROPRIATE FRAMEWORK OF ANALYSIS

The discussion above identifies numerous benefits and, for heavy and abusive drinkers, some health, damage and productivity costs associated with consuming alcoholic beverages. From an economic perspective, resources will be efficiently allocated (and society's welfare maximised) when the price paid by a consumer (which equates to the consumers' marginal benefit) equals the marginal social cost of consuming the product or service.

The marginal costs and benefits will equate with the marginal social benefits and the marginal social costs, if the benefits and costs associated with a transaction are internal to the transacting parties. However, in certain cases some of the benefits and/or costs associated with a transaction are external to the transacting parties. This creates what is known as an 'externality'. Where there are externalities, the person who initiates an action may not have to bear the full costs of that action or, alternatively, receive all the benefits from that action. This creates a mismatch between the benefits and costs of the action to the individual and those to society. This has the potential to present the individual with a set of incentives that leads him to act in a way that is not in the best interests of society. This is known as a case of 'market failure' and distinguishes this situation from normal market operation where all benefits and costs are internalised to the transacting parties and individual and social interests coincide.

In many instances the external benefits or costs associated with consumption are exhausted before the last (marginal) unit is consumed. In others, the disparity between internal and external costs and benefits is not sufficiently large to justify government intervention. However, in some cases the magnitude of the externality and its importance to the community is so great at the margin, that government intervention may be warranted to bring consumption closer to a level that will maximise community welfare.

In the case where an individual's consumption of a particular product imposes external costs on others, the government may impose a tax on the consumption of that product by that individual. This is intended to raise the cost of consumption to that individual to the point where his consumption falls back to the level it would be at if he was bearing all the costs of consumption (ie. the external costs he imposes on others as well as his own costs). In other words, the tax attempts to 'internalise the externalities' and so correct the market failure. Conversely, if consumption of a product by an individual was the source of external benefits, then the government may attempt to subsidise his consumption to increase it to the same point it would be at if he received all the benefits from consuming it.

This approach to fine tuning taxes (and subsidies) to internalise externalities is known as 'optimal taxation'. However, the government faces numerous difficulties in doing this with any degree of accuracy. It is extremely information intensive – the government would need to know the exact extent of external costs or costs, which individuals are causing the externality and the responsiveness of their demand for the product to price changes. Even if this information was available, optimal tax calculations implicitly assume the absence of other sources of market failure.

In the case of alcohol consumption there are widely differing views on the extent of externalities present and, consequently, on what the appropriate role for government is. From the review of the available evidence presented in section 3, it is likely that any significant external costs are confined to the small proportion of drinkers who consume excessive amounts of alcohol. If the government attempts to use taxes to reduce the consumption of abusive drinkers causing external costs, they would need to be targeted on those problem drinkers. Typically, the government does not have access to sufficient information to be able to target taxes in this way and/or the costs of ensuring those drinkers do not obtain alcohol from individuals not incurring the tax are too high.

To overcome this problem, Hall (1996) advocates imposing a uniform tax on drinkers to correct the problem 'on average'. However, this reduces the consumption of all alcohol consumers, not just the problem drinkers. In this instance, a uniform tax is far too blunt an instrument to improve social welfare. Rather, it is likely to have an adverse impact on social welfare as all alcohol consumers are 'fined', not just those causing external costs. Even in the case of the problem drinkers it is not clear to what extent a uniform tax will modify their behaviour. Society is likely to receive a better pay–off from the government targeting other instruments at these problem drinkers to encourage them to reduce their consumption. These instruments include public education campaigns, better enforcement of legal sanctions to punish criminal behaviour and ensuring that market failures or government interventions in other markets which impact on problem alcohol consumers (such as under recovery of health care costs) are addressed directly.

4.1 WHAT CONSTITUTES AN ALCOHOL–RELATED EXTERNALITY?

Hall (1996) recognises that the relationship between alcohol consumption and externalities is complex and cannot be precisely specified. However, despite the inherent difficulties, Hall (1996, p.14) argues that alcohol consumption at the individual level leads to net damages — some of which are internal and others external — and that:

Increasing net damage is likely to be associated with roughly–proportionally increasing net externalities (ie. external monetary costs). For example, the greater the net damage:

- the greater the health costs paid for by others;
- the greater the emotional costs imposed on others; and
- the greater the loss of productivity paid for by employers and work–colleagues.

Certainly many of the benefits and costs associated with consuming alcohol are internal to the person who drinks rather than external costs that impact on the community as a whole. Many of the benefits identified in section 3 associated with moderate alcohol consumption such as improved longevity, reduced chance of coronary heart disease and ischaemic stroke, and improved productivity clearly have substantial internalised benefits for the consumer. Similarly, many of the health and other costs identified for heavy or abusive drinkers such as cirrhosis of the liver, increased risk of some rare forms of cancer, personal and property damage, and absenteeism also impose significant costs on the individual. While there are also undeniably some external costs imposed on society by these individuals (and broader–based external benefits from moderate alcohol consumers), it is not clear that the three sources identified above by Hall should automatically be classed as 'alcohol–related externalities'.

In the case of health care, for instance, many of the problems arise from the moral hazard that results from failing to charge appropriate prices for health care and public insurance (through Accident Compensation Commission contributions). Failure to impose cost recovering user charges in the supply of hospital services will cause many distortions. For instance, it could also be interpreted as a subsidy to those who are obese, those who do not eat healthy food and those who do not pursue healthy lifestyles just as much as a subsidy to abusive drinkers. But additional taxes are not imposed on food to compensate for this because most people can handle food without abusing it, just as most people can handle alcohol without abusing it. Clearly the benefits of subsidised medical services are not going to be distributed equally and will inevitably induce some moral hazard. As with any distortion, it is better to tackle the problem at its source rather than trying to arbitrarily compensate for its impact in some markets but not others.

Similarly, failure of the legal market can result in not all of the costs of personal and property damage being internalised. This can be the case for damage caused by drunken drivers, but also for damage caused by others who break the law.

In other words, many of the 'external' costs and benefits of alcohol consumption result, in part, from the failure of other markets. Is it then appropriate to use a tax on alcohol to compensate for market failure in the health, education and legal areas?

4.2 MATCHING TARGETS AND INSTRUMENTS

The previous sections have highlighted that the range of externalities associated with alcohol consumption is likely to be narrower than that assumed by Hall (1996). In particular, a uniform excise is a very blunt instrument for dealing with any negative externalities associated with alcohol consumption as true external costs are confined to a small proportion of problem drinkers. Alternative policy options, such as education, regulation and better assignment of property rights may be more efficient measures for dealing with any negative externality problem.

The need to use better targeted instruments to address alcohol–related externalities has been succinctly noted by the New Zealand Business Roundtable (1996, p.3):

> Policies that target the misuse of liquor rather than responsible consumption are required to address anti-social behaviour. This approach is similar to that taken in respect of motor vehicle accidents. Greater mobility is rightly seen as a benefit of higher living standards and strategies to reduce accidents are targeted at their specific causes. The problem does not relate to people who drive, or even to those who drive a lot, but to those who cause accidents. A similar approach in respect of liquor requires policies directly targeted at its misuse.

The following discussion briefly examines some alternative policies and considers whether they can produce the desired outcome — a reduction in negative net externalities.

4.2.1 Education

Education can be a powerful tool in changing the behaviour of heavy or abusive anti-social drinkers. It can also be an important tool in highlighting the benefits of moderate alcohol consumption.

Successful mass education programs have generally been found to:

- include specific detailed recommendations about the behaviour in question and indicate how the behaviour can be modified;
- be perceived as coming from a credible source;
- balance pros and cons of an argument rather than being purely one sided;
- draw conclusions clearly; and
- be combined with the enforcement of effective laws (Hamilton and Hamilton 1997).

The New Zealand Police and the Land Transport Safety Authority have run an intensive road safety enforcement and publicity campaign since 1995. Vivid depiction of the physical and

emotional costs of road accidents caused by drunken driving has aimed to jolt awareness and change attitudes. The campaign was modelled on the successful combination of 'shock' advertisements and tightly–enforced legislation and penalties implemented in the Australian State of Victoria which succeeded in halving Victoria's road toll in the first half of the 1990s. Road deaths in New Zealand fell by 18 per cent in the first year of the program and were still 8 per cent lower in 1997 than the year before the campaign started (LTSA 1998b). The number of fatal or serious injury crashes involving a drunk driver has fallen 24 per cent from 780 to 590.

Providing alternatives to drink driving can also be an important focus of the education program. These might include nominating one member of a group as the non–drinking driver or taking a taxi to and from a party or a restaurant. An education campaign might also run in tandem with a free or subsidised late night bus servicing hotel districts to encourage people not to drink and drive.

Education can also focus on the servers of alcohol in hotels and restaurants. In some states in the United States server training is mandatory. Server training education aims to alter servers' practices, particularly their practices for young drinkers and those drinkers who are showing obvious signs of intoxication.

The Alcohol Advisory Council of New Zealand (ALAC) has also been set up by the Government to promote moderation in the use of alcohol and to develop and promote strategies that will reduce alcohol–related problems. Its mission is to help people make healthy choices about alcohol. ALAC (1998) identifies its objectives as:

- providing expert advice to policymakers and others on how best to reduce alcohol problems;
- educating the general public on responsible alcohol use via television and other media;
- organising training opportunities for people working to reduce alcohol problems; and
- helping all consumers to discriminate between the beneficial and harmful uses of alcohol.

The United Kingdom government, after assessing the benefits and costs of drinking alcoholic beverages, also developed a *Sensible Drinking Message* for the community. The message is couched in terms of advising those drinking at heavy levels to cut down. However, it does not try to get every one to reduce their consumption. As well as defining benchmarks for sensible drinking for men and women the *Sensible Drinking Message* aims to reduce episodes of excessive or binge drinking and emphasises the need for individuals to take personal

responsibility and control. The message also includes information for particular groups. For example, it provides advice such as not drinking in situations where drinkers might be a danger to themselves or others. It also draws attention to the health benefits that moderate alcohol consumption can bring to certain groups who currently do not drink (Harding 1996).

4.2.2 Regulation

The effective enforcement of the law can be an important tool in reducing the costs associated with many 'alcohol-related' criminal offences such as driving with high BACs and violence. Penalties are currently imposed under the Transport and Crimes Acts for undertaking this anti–social and unacceptable behaviour. These penalties should give a consistent message that all violent and other criminal behaviour is socially unacceptable.

Ideally the penalties imposed under the Transport and Crimes Acts should be linked more closely to the costs imposed. Numerous studies (for example, Becker (1968), Stigler (1974) and Ehrlich (1974)) have shown that there is a strong link between the decision to commit a crime and the punishment that the perpetrator expects to be imposed. Raising the perpetrator's expected cost of committing an 'alcohol–related' offence is not simply a matter of increasing the fine. It also involves effective policing and enforcement to increase the risk of being caught and being fined.

In some instances, it may be that persistent offenders require other measures. In the case of repeat drink driving offenders one option is to require that vehicles driven by the offender be fitted with a breath alcohol ignition interlock system. This device aims to prevent a repeat offender from starting the motor vehicle and driving away if a breath test identifies BACs above the legal limit. This device is used in many states in the USA. Its popularity is due to its ability to selectively target persistent drink drivers. Tasman understands that the alcohol ignition interlock system is currently being trialed in New South Wales for repeat drink driving offenders.

4.2.3 Re-Assigning property rights

Many of the community wide costs associated with 'alcohol–related' crimes and alcohol abuse are 'external' because of the current assignment of property rights in New Zealand. Hall (1996) draws attention to analyses by Cameron (1989) and Dwyer (1992). These commentators advocate consideration of a change in the current property rights assignment as a method for reducing these external costs. Hall states that these commentators advocate 'assigning all the costs of consuming alcohol to the drinker'. Strictly speaking, the property

rights approaches advocated by Cameron and Dwyer do not require a full assignment of costs. Their concern is that currently no consideration is given to alternative property rights assignments. They advocate that a closer consideration of these alternatives may lead to more efficient, and perhaps even more equitable, outcomes than those that presently occur.

Interestingly, two areas for change covered in the Cameron and Dwyer analyses relate to a move towards more market driven outcomes. These relate to the provision of public health care and insurance. Currently, the New Zealand Government has a heavy involvement in the health care and accident insurance markets. This involvement stems from a concern for social welfare extending much further than any externalities associated with 'alcohol-related' anti-social behaviour. However, there appears to be considerable merit in the arguments presented by Cameron and Dwyer. Indeed, it is noteworthy that private competition for the provision of insurance for workplace accidents has recently been introduced. This should lead to a better pricing of risk.

Hall's brief review of the Cameron and Dwyer arguments concludes that 'no likely New Zealand government will accept them, at least *in toto*'. However, the recent developments in the market for workplace accident insurance indicate that this view may have been overly pessimistic. A thorough review of New Zealand's health care arrangements may find that the Government's wider social and economic objectives for health care can be achieved via less restrictive, more market oriented arrangements which involve a change in the assignment of property rights. These less restrictive arrangements may also create a greater incentive for the minimisation of 'alcohol–related' crimes and alcohol abuse (and hence reduced costs to the general community and third parties).

Even if other considerations limit the Government's willingness to introduce widespread health care reforms, it may be appropriate to require an element of cost recovery for hospital services provided to anyone with repeated convictions for drunkenness. Precedents include the ability of insurance companies to refuse to pay out on a car insurance policy if the driver was over the blood alcohol limit at the time of the accident. Targeted policies such as this are likely to produce better outcomes for society than blunt instruments such as a uniform tax which does not discriminate between the few causing external costs and the many who do not.

4.3 HALL'S (1996) FRAMEWORK OF ANALYSIS

The Alcohol Excise paper's findings on externalities relies on the assumption that:

- the relationship between alcohol and net damage is a plausible proxy for that between alcohol consumption and net externalities (ie. the net external costs associated with net damage); and
- alcohol consumption externalities are an increasing convex function, though less than exponential function of combined chronic alcohol consumption and binge drinking.

Unfortunately, there is little direct evidence about the shape of the alcohol consumption net externality function. Hall suggests that the net externality associated with alcohol consumption is only positive up to around one drink a day and that this positive externality is only associated with the consumption of alcohol by those at risk of CHD. For the rest of the community, Hall suggests that the consumption of alcoholic beverages has no positive or negative externality up to around half a glass, but at larger levels alcohol consumption leads to increasingly high negative externalities. This is a very conservative view of the benefits of alcohol consumption and an overly pessimistic view of the costs. The evidence, which is summarised in Table 2, suggests that for most people moderate consumption of one, two and even three or four drinks a day will maximise positive benefits in terms of health, reduced risk of dying and even increased productivity.

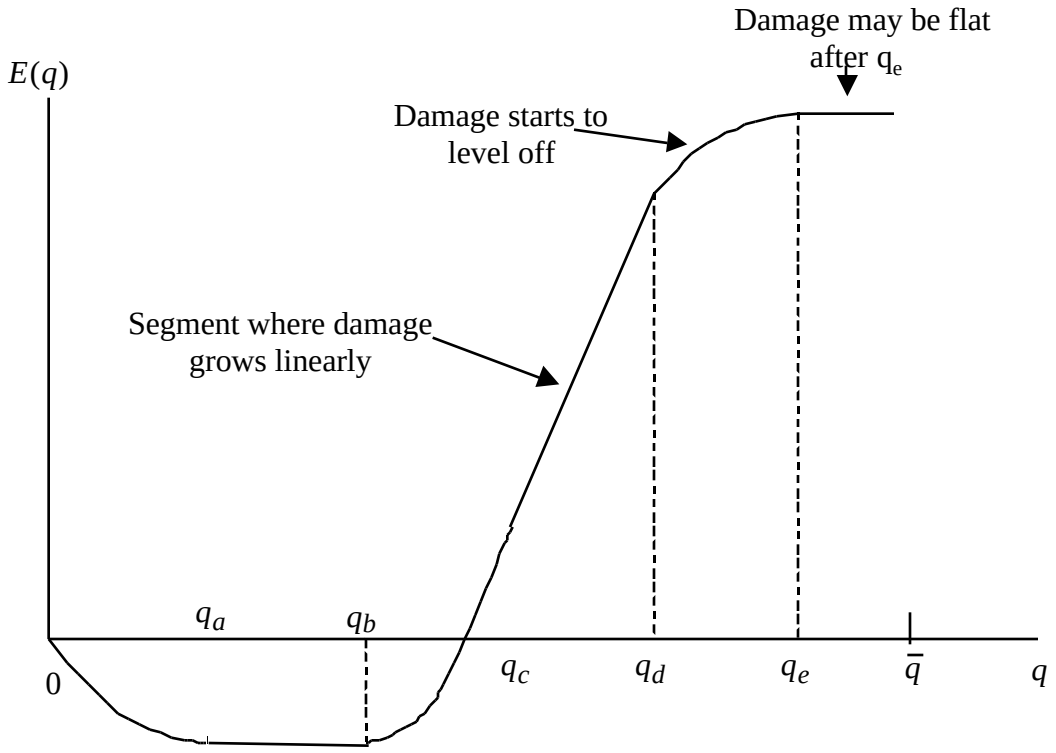
Hall's conclusion is based on the assumption that the relationship between alcohol consumption and 'net damage' is a suitable proxy to infer the net externality function. We are not aware of any empirical analysis that has estimated the net externality function or the relationship between alcohol consumption, 'net damage' and the net externality function. However, on the basis of the health and productivity evidence to hand, this assumption seems hard to justify for at least the law abiding, low to moderate consumers of alcoholic beverages which comprise the majority of the community. Even at higher levels of consumption, many of the costs, such as health costs, will be internal to the consumer.

Consequently, there is much doubt about the appropriateness of Hall's framework as well as of his estimates of benefits and costs and to what extent they are internal or external. Many of the 'externalities' Hall refers to are the result of government interventions and market failure in other markets which are likely to be better addressed at their source. Many of the costs identified by Hall as being associated with negative externalities are associated with heavy drinking in combination with criminal behaviour rather than consuming alcohol per se. Better policing and enforcement of legal sanctions would best address these costs.

While the use of a framework of analysis which attempts to better match instruments to targets would be more appropriate, for the remainder of this report we use Hall's framework of analysis to gauge its sensitivity to the assumptions made. Consequently, in what follows we adopt Hall's definition of 'externalities'.

Hall (1996) assumes that the net externality function is an increasing convex function (Appendix 2 explains the implications of this assumption). However, the evidence on benefits and costs presented in section 3, indicates that the function is more likely to be decreasing over a range greater than zero to at least two, and for some drinkers, up to three or even four drinks per day (it is possible that the positive externalities generated by many law abiding male drinkers out–weighs any negative externality at consumption levels as high as four drinks a day.) Figure 5 illustrates a more likely shape of the net externality function using Hall's concept of externalities.

Figure 5: **The net externality function of alcohol consumption**



Section 6 and Appendix 2 explains why the shape of the net externality function has important implications for any policy prescription which involves imposing a tax on alcohol in the framework Hall (1996) uses. However, before we discuss this issue, section 5 considers the estimates of the value of the net external costs which are presented in Hall's paper.

5. THE MONETARY ESTIMATE OF NET EXTERNAL COSTS OF ALCOHOL

Hall (1996) presents estimates of the net externality associated with the consumption of alcoholic beverages. The estimates, which are heavily based on estimates presented in a study of the social costs of alcohol abuse in New Zealand by Devlin, Scuffham and Bunt (1996), suggest the net external costs, in March quarter 1996 dollars, are in the range of $432 million to $713 million. By contrast, the alcohol excise and the duty equivalent on imported alcoholic beverages raised around $570 million in 1996.

Devlin, Scuffham and Bunt (1996) estimated that the social cost of alcohol abuse in New Zealand was in the order of $1,544 million, in 1991 prices. Abuse was defined as any situation where the consumption of alcohol had produced adverse consequences to the consumer and/or negative external effects upon other individuals. Thus, this cost estimate covers gross costs which were internal as well as those considered to be external to the consumer.

Table 3 reports cost generators identified by Devlin, Scuffham and Bunt (1996) as well as their most 'conservative' cost estimates. These estimates formed the basis of the Hall (1996) paper's lower limit on external costs.

Table 3: **Cost generators identified by Devlin, Scuffham and Bunt (1996)**

Cost Category	*1991 — $,000*
· Production losses through:	
(a) excess unemployment;	369,258
(b) reduced efficiency of those abusers in employment;	739,440
(c) temporary removal from employment through sickness;	22,087
(d) alcohol-related absenteeism	14,034
(e) premature death	38,125
(f) alcohol-related incarceration	15,779
· Health care costs:	
(a) Hospital costs;	74,250
(b) Primary health care and pharmaceuticals;	0
· Other direct social costs:	
(a) Accident Compensation Corporation expenditures;	28,970
(b) Ministry of Transport;	10,617
(c) Police costs; and	141,687
(d) Justice costs.	89,670
Total estimated direct costs	1,544,000

Source: Devlin, Scuffham and Bunt (1996).

Hall (1996) did not include the total costs estimated by Devlin Scuffham and Bunt on the grounds that the majority (assumed to be 95 per cent) of the costs associated with lost production are internalised. However, additional costs associated with death and injury to third parties, not estimated by Devlin, Scuffham and Bunt, were also included. As discussed in section 3.2, the costs associated with death and injury to third parties are not strictly speaking costs of consuming alcoholic beverages – they are costs associated with criminal activity such as driving over the legal alcohol limit and violence.

We have several concerns about the data that form the basis of the net externality cost estimates reported in Hall (1996).

Firstly, as reported in section 3.1, there is a strong chance that there is a positive effect on productivity. This positive effect manifests itself as a wages premium for workers who consume low to moderate amounts of alcohol. Given that most people who consume alcohol are not 'abusers' it is highly probable that this positive effect out–weights any negative effect from 'abusers' who work inefficiently or have alcohol–related absenteeism which are included in the Hall's cost estimate. However, as noted in the preceding section, it is likely that most of these productivity effects are internalised in any case.

Secondly, the majority of the monetary cost estimates (for example, utilisation of hospital services, Ministry of Transport costs and Police costs) are based on Alcohol Aetiological Fractions (AAF). Aetiological fractions or risks are estimates of the damage to health which can be attributed to a specified factor such as drinking alcohol-or smoking. These fractions, which are derived from case studies, apportion a share of the cause of death or disability to the factor in question.

Aetiological fractions studies have at least two sources of bias. The first derives from any bias which might be implicit in the original studies. For example, a study of the impact of alcohol consumption on longevity may have included ex–drinkers in the non–drinkers category and, hence, overestimate the impact of alcohol on the relative risk of mortality among moderate drinkers. Similarly, studies included in the analysis of aetiological fractions may not sufficiently demonstrate a link between alcohol consumption and morbidity or death. This situation appears to have occurred in the New Zealand AAF study by Scragg (1995) which is a major information source for the Devlin, Scuffham and Bunt (1996) analysis. For example, using AAFs Scragg estimates there were 110 deaths from breast cancer in women in New Zealand in 1987. However, the link between the consumption of alcohol and breast cancer has not been satisfactorily demonstrated. As discussed in section 3.2, while a number of studies have suggested there is a link, others have raised doubts about any significant link.

Another major problem with the aetiological fraction methodology is that it will overstate each of the various factors which cause the disease because there is virtually always more than one cause. The approach can systematically overstate a single cause because of the cross relationship between causes. This point is illustrated by the number of factors which possibly contributed to the cause of fatal road accidents in New Zealand. The LTSA (1998a) reports that in 1997 the consumption of alcohol was probably a contributing factor in 27 per cent (127) of fatal accidents. Similarly, speed was probably a contributing factor in 29.3 per cent (137) of fatalities. However, in 10.9 per cent (51) of all fatalities speed and alcohol were both identified as potentially contributing. Details of other causes of these 'alcohol-related' fatalities have not been reported separately by the LTSA. However, recent analysis by Bailey and Bailey (1998) into the causes of New Zealand's fatal road accidents indicates that many fatal accidents have multiple causal factors. Thus, it is highly likely that there were other contributing factors in a significant number of the 'alcohol–related' accidents reported in 1997. Thus, if a study such as the Devlin, Scuffham and Bunt (1996) study only focused on the alcohol aetiological fraction associated with illness, death or injury it would over–estimate the contribution of alcohol.

In addition, there is strong evidence that many AAFs are declining over time as people become more aware of the dangers of abusive consumption and the dangers of driving over the legal blood alcohol limit etc. For example, the number of road accidents where alcohol was identified as a potential contributing factor has declined since the Devlin, Scuffham and Bunt study. In 1991, 41 per cent of fatal accidents were reported as probably being 'alcohol–related (Devlin, Scuffham and Bunt used an AAF of 0.41). However, by 1996 the proportion had fallen to 28 per cent. Similarly, over the same period the number of road accidents where alcohol was identified as a potential factor contributing to injury declined from 21 per cent (the AAF used by Devlin, Scuffham and Bunt) to 16 per cent (LTSA 1998a). Thus, even if the AAFs for road accidents did not overestimate the probable contribution of alcohol in 1991, it would still be overestimating the external costs for 1996 included in the estimates presented in Hall (1996) because the number of 'alcohol–related' road accidents has declined substantially.

As a consequence of these factors, it is highly likely that a number of the AAFs, in addition to road fatalities and road injuries, used to estimate costs in the Devlin, Scuffham and Bunt (1996) analysis and consequently the net externality estimates presented in Hall (1996) are too high.

Even if one were to accept that AAFs gave an accurate representation of the alcohol consumption risks, it is hard to accept that all of the so called 'alcohol related' costs

identified as being externalities would be totally avoided if all New Zealanders abstained from consuming alcohol. Numerous studies (for example, Peltzman (1975) and Viscusi and O'Connor (1987)) have shown that people respond rationally to risk and indeed choose a certain level of risk or danger in their lives that maximises their utility. Changes in risk factors, for example regulations specifying mandatory wearing of seat belts or speed limits, will often lead to other changes in behaviour to maintain an individual's utility maximising level of risk. Thus, it is likely that the policing and justice costs would not change substantially. This point is also reinforced by the Bailey and Bailey (1998) study which found that many drivers involved in fatal road accidents are persistent offenders displaying very different characteristics to the rest of the population. As noted in the preceding section, these offenders are most effectively dealt with through policing and enforcing legal sanctions rather than through the tax system.

Another major concern with the net damage estimate is that the external health benefits associated with drinking alcohol are not included. Scragg (1995) using the aetiological fractions methodology estimated that by consuming alcohol New Zealanders in 1987 had 'caused' 1,464 deaths but prevented 1,880 deaths from CHD. Scuffam and Devlin (1997) using the Scragg (1995) data estimate that the hospital treatment costs avoided by the prevention of CHD were in the order of $27.3 million in 1991 prices. Other health benefits, which are likely to be primarily internal, totalled $38.8 million in 1991 prices (Scuffam and Devlin 1997).

Finally, Hall's paper includes 'alcohol–related' payments of $29 million in 1991 prices by the Accident Compensation Corporation (ACC) in his estimate of the net external cost. The inclusion of these payments as an externality is questionable given that the ACC collects a premium, admittedly not a fully risk–rated premium, for motor accident insurance and workers compensation insurance. As a consequence, the payments by the ACC should be treated as a transfer rather than an externality.

On the basis of these concerns there is a strong probability that the net damage externality estimate is too high. In fact, it is difficult to accept that estimates of the net damage associated with the consumption of alcohol presented in Hall (1996) are even in the 'ball park'.

6. TAXATION AND ALCOHOL–RELATED EXTERNALITIES

Taxing negative externalities and subsidising positive externalities are two of a number of policy options governments can utilise to resolve an externality problem.

Hall (1996) correctly points out that the first best taxation option for externalities is to perfectly price discriminate so that the tax or subsidy on each alcohol consumer would equalise the marginal social benefits and costs of consuming alcohol. However, given that governments do not have perfect information, this is not feasible. An excise, subsidy or tax which is uniform across drinks and drinkers is put forward as a second best option. Drawing on Diamond (1973), Hall (1996) points out that the excise, subsidy or tax under this second best option will maximise aggregate welfare if it is equal to the weighted average across alcohol consumers of their marginal net externalities from consuming alcohol at the socially optimal consumption level. The appropriate weights to apply to each consumer's marginal net externality of alcohol consumption in this situation would be equal to their price derivatives of demand.

Again the information requirements for achieving this uniform tax are considerable and Hall correctly concludes that an optimal rate of excise cannot be calculated. However, he argues that there is sufficient information to determine whether a tax based on the socially optimal weighted–average marginal net externality will be higher or lower than the amount currently collected by the excise.

It should also be borne in mind, however, that the excise is only one of a number of taxes which create a wedge between the actual cost of alcoholic beverages and the price paid by consumers. Alcoholic beverages are also subject to a 12.5 per cent GST and an Alcohol Advisory Council levy. In 1998 the levy raised $6.4 million. An analysis commissioned by the industry suggested that the GST levied on beer, wine and spirits amounted to around $300 million in 1992. These additional taxes will also have an impact on the level of consumption and hence any externalities generated. The revenue generated by these taxes should also be included in any analysis of the optimal level of taxation necessary to reduce negative externalities to socially optimal levels. Unfortunately, the revenue generated by these taxes was not included in the analysis which led Hall to conclude that the current excise is too low and consumption is too high. These taxes should be taken into account in any analysis of the appropriateness of the current rate of excise. Consequently, even if one accepted Hall's broad analysis, there can be no certainty that an increase in the current excise would improve aggregate welfare by equating marginal benefits and marginal costs.

Leaving aside the impact of other taxes on the level of consumption, Hall's conclusion relies heavily on the following assumptions:

- the only significant influence on weighted–average marginal net externalities is the distribution of marginal negative externalities from consuming alcohol;
- marginal net (and assumed negative) externalities are a convex increasing function of alcohol consumption; and
- all drinkers — light, moderate and heavy — have similar price elasticities of demand for alcohol.

As the following discussion highlights each of these assumptions is unrealistic given the evidence at hand.

6.1 WEIGHTED AVERAGE NET EXTERNALITIES AND POSITIVE EXTERNALITIES

Hall (1996) presents the argument that the distribution of marginal negative externalities from consuming alcohol has a much higher weighting in New Zealand's net alcohol externality function than positive externalities. This conclusion is based on the argument that positive externalities are only generated by New Zealanders who drink less than about one alcoholic drink per day and would otherwise suffer from CHD. Our review of the evidence on the benefits of consuming alcoholic beverages indicates that this is an overly conservative view of the positive benefits from consuming alcohol.

As outlined in section 3, many studies have demonstrated that increasing CHD benefits extend to two or three drinks per day. Studies also indicate that CHD benefits at some positive level extend to much higher levels of daily consumption. In addition, the health benefits from drinking alcohol are not, as Hall argues, restricted to the 35 per cent of New Zealanders who would otherwise be afflicted by CHD. Numerous studies which have examined the relative risk of dying from all causes and related this risk to the level of alcohol consumed have shown that health benefits from consuming alcohol in moderation extend to the whole community. Jackson and Beaglehole (1993, p.25), after examining a wide range of studies of the protective effect of alcohol on CHD and overall health, concluded:

> The hypothesis that light–to–moderate consumption of alcohol reduces the risk of coronary disease meets most of the epidemiological criteria for causality. … From a public health perspective, however, the effect of alcohol on overall morbidity and mortality is more important than the effect on coronary disease alone. **The adverse effects of alcohol consumption outweigh the benefits above approximately three drinks a day in men; for women, the safe level is about two drinks a day.** [emphasis added]

Certainly some of these health benefits from consuming alcohol will be internal to the consumer. However, others will be external including a smaller drain on publicly provided health and hospital services than would be the case if light to moderate consumers abstained from drinking (adopting Hall's proposition that mis-pricing of health care constitutes an externality). In addition, there is evidence that moderate (not abusive) consumption of alcoholic beverages has a positive impact on the productivity of workers which flows through to more competitive industries, increased exports and increased gross domestic product.

This evidence suggests that, using Hall's externality concepts, there are positive net externalities associated with drinking alcohol in moderation and that these benefits are maximised at consumption levels of about two alcoholic drinks per day for women and three per day for men. These levels are substantially above those currently consumed by the majority of the population. Currently only those drinkers in the 76th to 90th percentile and mostly likely consumers in the 91st to 93rd percentiles drink, on average, at levels close to those which will maximise the net health benefits. Following Hall's assumption that the relationship between net damage (or in this case net benefits) and alcohol consumption can be used as a proxy for the relationship between net externalities and alcohol consumption we can infer that the majority of New Zealand drinkers generate positive externalities from consuming alcohol. The evidence also suggests that the positive benefits are currently not being maximised as many New Zealanders are drinking much less per day than would maximise their well being as well as the community's aggregate welfare.

Therefore, it is by no means clear that in Hall's framework the only significant influence on the weighted–average marginal net externalities is the distribution of marginal negative externalities. At current consumption levels it is likely that positive net externalities are generated by the majority of New Zealanders who choose to drink alcoholic beverages. If a uniform tax (subsidy) is the only policy option available to address this externality issue the weighting for positive externalities should be very significant in determining the level of the excise (see Table 4).

In addition, Hall does not consider the ramifications of the excise on the segment of the population who are currently not drinking at all, but who might have chosen to drink moderately if the price of alcoholic beverages were lower. If the alcohol excise tax is set high enough, some consumers will curtail their consumption of alcohol all together (see Appendix 2). It is probable that some current non–drinkers fall into this category. In the absence of the excise, many of these potential drinkers would generate positive benefits that are currently foregone by them and the community as a whole.

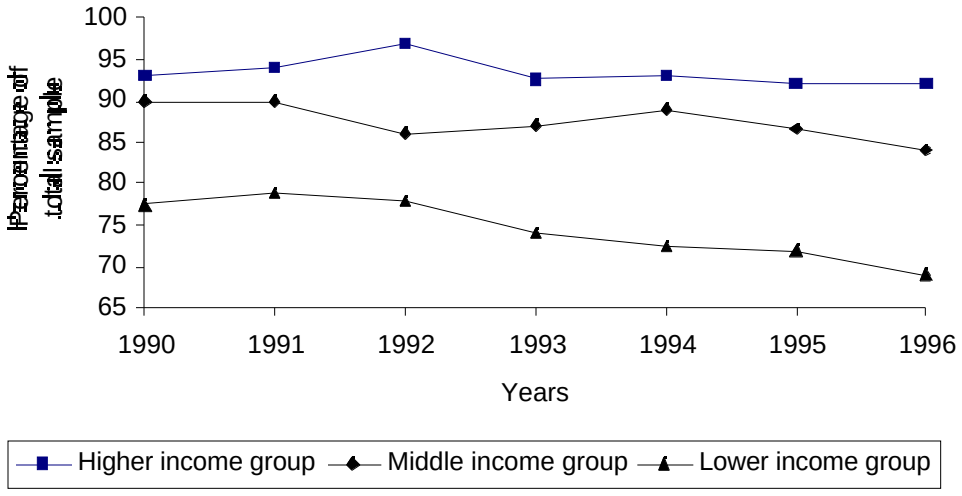
Table 4: **Weighting of Current Drinkers of Alcoholic Beverages**

Percentile of Drinkers	*Proportion of total drinkers*	*Average number of drinks*	*Ratio of drinks per day (weights) 1% to 50% = 1*	*Weight of each range (=3* 1)*	*Normalised weight range =4/7.625*
	1	*2*	*3*	*4*	*5*
96%–100%	0.05	10.4	52	2.6	0.341
94%–95%	0.02	7	35	0.7	0.092
Subtotal negative weight					***0.433***
91%–93%	0.03	3	15	0.45	0.059
76%–90%	0.15	2.5	12.5	1.875	0.246
51%–75%	0.25	1.2	6	1.5	0.197
1% to 50%	0.5	0.2	1	0.5	0.066
Subtotal positive weight					***0.567***
Total	1			7.625	1.000

Note: As no detail is available on consumption at the individual percentiles levels, we have assumed that the 91st to 93rd percentiles consumed an average of three drinks and that the 94th to 95th consumed at a higher level to reflect an average consumption of 4.6 drinks in the 91st to 95th percentile as reported by Hall (1996).

There is evidence which suggests that some drinkers have been priced out of the alcohol market creating a deadweight loss for the economy as a whole. An annual APHRU survey of trends in drinking patterns in Auckland supports this. A significant proportion of respondents indicated that they had changed their drinking habits because alcohol was too expensive. The survey results also show that over the last few years there has been a significant decrease in the proportion of respondents who consumed any alcohol in the previous twelve months. The decrease in alcohol consumption since 1992 was particularly prominent for respondents in the lower income group (Figure 6).

Figure 6: **Proportion of drinkers by income groups**



Source: APHRU (1998).

The price and income responsiveness of different types of drinkers is discussed below.

6.2 THE SHAPE OF THE EXTERNALITY FUNCTION

The assumption that the marginal net externality function is negative and a convex increasing function of alcohol consumption measured in absolute dollars is also critical to the conclusions reached by Hall (1996). A mathematical consequence of this assumption is that an 'efficient' tax in response to the externality will be likely to generate total revenue much larger than the average marginal externality. This is because it reflects the high costs imposed by the heavy drinkers which have a greater weight than the externality 'costs' of light to moderate drinkers (see Diamond (1973) and Pogue and Sgontz (1989)). This situation is explained in Figure 7 and outlined in more detail in Appendix 2. For simplicity, the analysis is presented from the perspective of a single consumer.

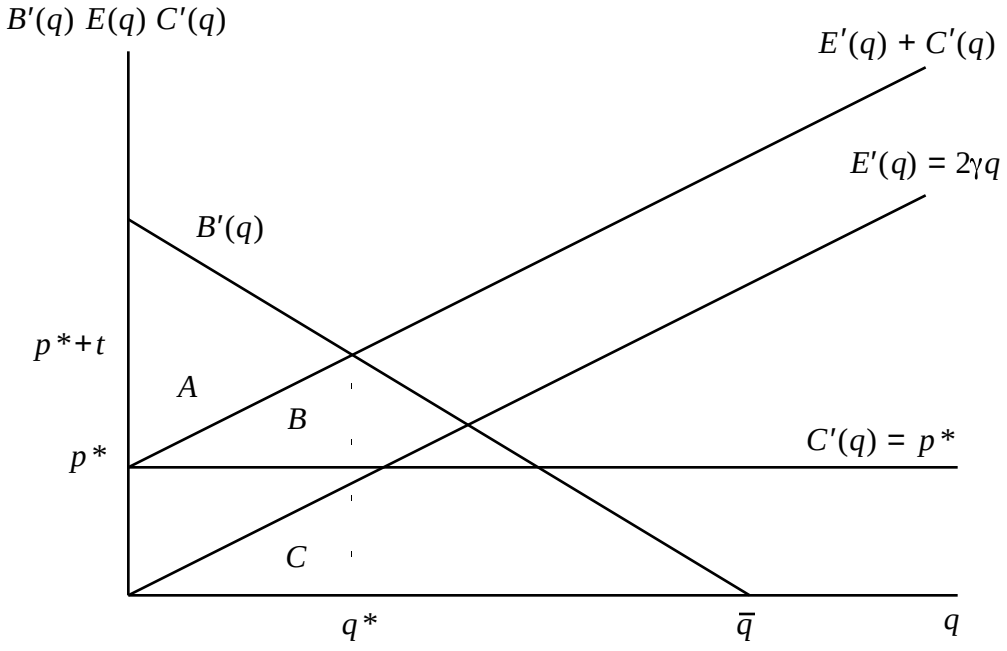
As outlined in Appendix 2, if negative net externalities are quadratic then the marginal net externality function $E(q)$ will be linear. Figure 7 shows that in this instance the government can maximise community welfare by imposing a uniform tax per alcoholic drink of:

(1) $t^* \quad E'(q^*)$.

The net external cost associated with the optimal level of drinking is:

(2) $E(q^*) = \int_0^{q^*} E'(q)dq = area\ C$.

Figure 7: **The optimal tax when externalities are a convex increasing function**



It is easy to see that:

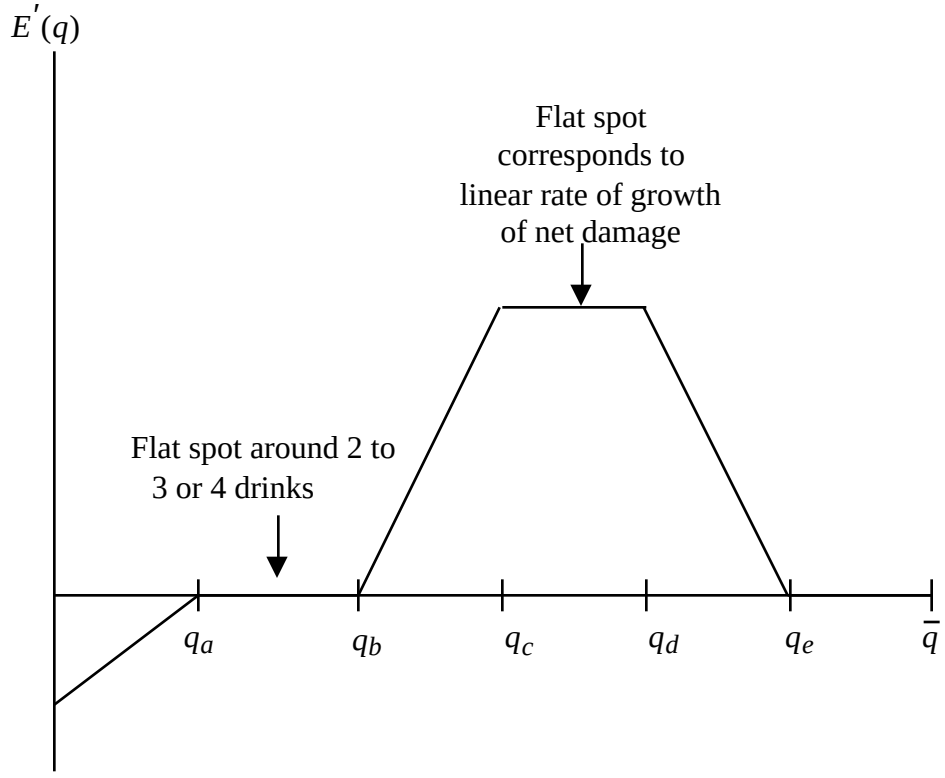
(3) $area\ C = area\ B$

and the total tax revenue collected from this 'optimal' tax is:

(4) $t^* q^* = area\ A + area\ B$.

Hence, if the convex assumption holds, the 'optimal tax' is substantially greater than the cost of the externality from consuming alcoholic beverages. As discussed above and illustrated in Figure 5, we believe that the assumption is doubtful because the evidence suggests that the net externality function is decreasing (that is, there are net positive externalities) associated with light to moderate consumption of alcoholic beverages (again using the concept of an externality outlined in Hall (1996)). Further, many of the costs outlined by Hall as being associated with the consumption of alcohol — such as 'alcohol–related' road fatalities — are associated with criminal anti–social behaviour rather than the consumption of alcoholic beverages per se. In this situation the net marginal externality function will not take on the linear form of $E'(q)$ appearing in Figure 7, but is more likely to be non–linear and resemble the net marginal externality function $E'(q)$ presented in Figure 8. The flat segments of the marginal externality function correspond to those quantities consumed where there is a linear rate of growth in positive or negative externalities.

Figure 8: **Net marginal externality with positive marginal net externality associated with light to moderate alcohol consumption**



Replacing this marginal elasticity function with the linear function presented in Figure 7 leads to a very different outcome to that envisaged in the analysis presented in Hall (1996). As shown in Figure 9, the demand curve $B'(q)$ could intersect $E'(q) + C'(q)$ at any one of 6 regions:

Region 1: $0 \le q \le q_a$; $t^* < 0$ ♦ *subsidy*

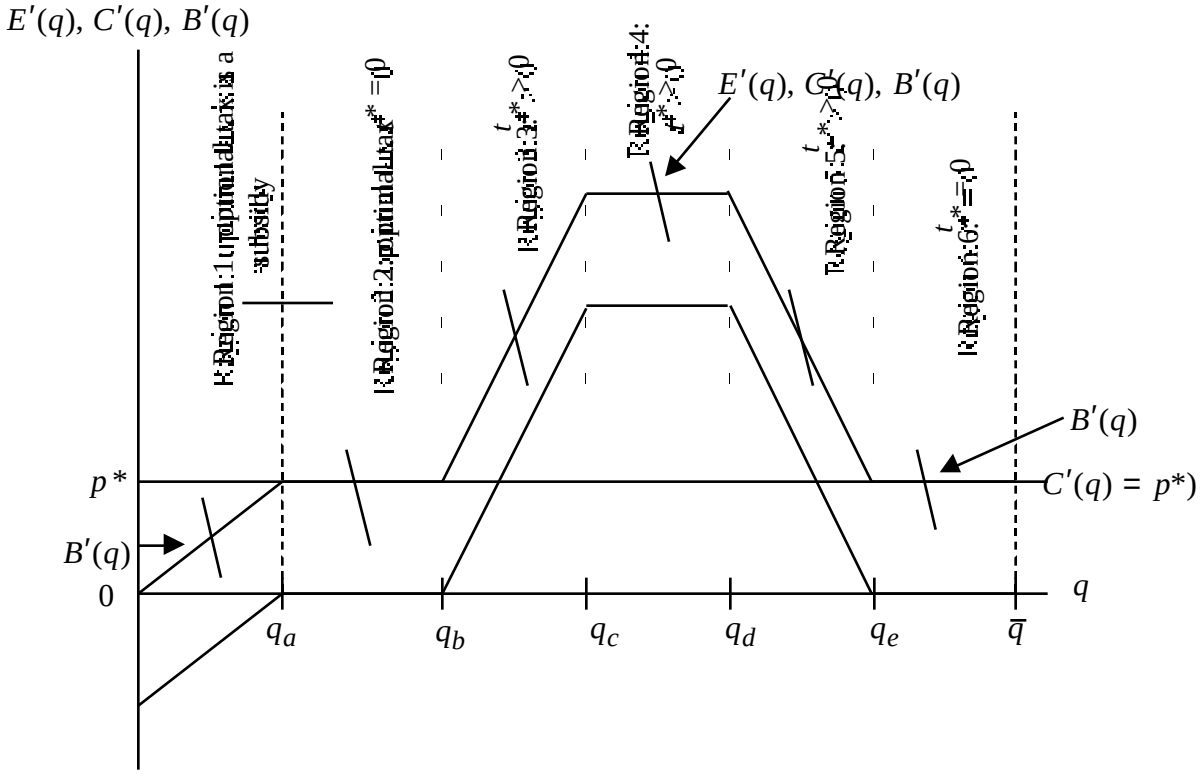
Region 2: $q_a \le q \le q_b$; $t^* = 0$ ♦ *optimal tax* = 0

Regions 3, 4, 5: $q_b \le t \le q_e$; $t^* > 0$ ♦ *optimal tax positive*

Region 6: $q_e \le q \le \bar{q}$; $t^* = 0$ ♦ *optimal tax* = 0

It should be noted that while the conclusion that a subsidy is appropriate in region 1 can be drawn from this model, a thorough cost/benefit test would need to be applied before such a policy prescription could be derived. Also, the policy prescription for region 6 would be dependent on the assumption that there is a levelling off of net damage at very high levels. If net marginal damage continues to grow right up to the point of satiation then a positive tax would be justified in region 6.

Figure 9: **Optimal tax rates if externalities are not increasingly convex across the consumption range**



Clearly, even using Hall's framework of analysis, the possibility of a non–convex net externality function raises substantial doubt about his paper's findings on the current excise level and the validity of a uniform excise for all consumers.

However, even if there were no evidence suggesting there are positive net marginal externalities from light to moderate consumption of alcohol, there is evidence which suggests that the imposition of a uniform excise will not necessarily have the expected response. There is no certainty that:

- heavy drinkers will reduce their consumption by an amount substantial enough to significantly reduce the negative net externality, Hall (1996) argues they cause; and
- other drinkers will not substantially change their drinking patterns.

These issues are discussed in the following section.

6.3 ALCOHOL CONSUMERS' PRICE ELASTICITY OF DEMAND

In the analytical framework Hall (1996) uses, society gains from an optimal uniform excise on alcohol externalities if the consumption of the individuals which generate the negative externality falls to, or closer to, the socially optimal level. However, if there are other consumers of alcohol who generate no externalities (or positive externalities) their consumption level will be below its optimal level. Society will gain if the number of 'abusers' and the level of the negative externality they create is large and if they are sensitive to a change in the price of alcohol — the greater the price sensitivity the greater the gain. On the other hand, the magnitude of the net gain to society will be reduced, potentially by a significant amount, if the consumers who generate no externalities (or, even worse, positive externalities) reduce their consumption substantially.

The analysis presented in Hall (1996) is based on the assumption that the own price elasticity of demand is roughly constant for consumers with different levels of average consumption.[6] Hall (1996) points to a range of studies, primarily based on research from the United States, which show that heavy drinkers are responsive to price. For example, Richardson and Crowley (1995) and Edwards et al (1994) refer to a number of studies that

[6] Alcohol price elasticities estimate how a change in price will affect demand for alcohol while income elasticities estimate how a change in income level will impact on demand. Own price elasticities estimate how a change in the price of alcohol will impact on the demand for alcohol. They can be defined as the percentage change in a commodity's consumption divided by the percentage change in the commodity's price. Own price elasticities are normally negative. An own price elasticity of –0.8 for a commodity would mean that a 10 per cent increase in the price of that commodity would lead to an 8 per cent decrease in demand for the commodity. In this instance demand is said to be inelastic. Own price elasticities greater than one indicate that the change in

show that even heavy drinkers will reduce their consumption in the face of price rises. However, many of the studies reviewed in these papers used proxies for changes in heavy drinkers' consumption. One paper reviewed used decreased death rates, or a slowing in the number of deaths, from cirrhosis (a disease which only manifests itself after many years of heavy drinking) in the year after a rise in the price of alcohol. Another study examined the response of light and heavy drinkers to happy hour and non–happy hour experimental conditions in a hospital setting.

There have been relatively few studies of the elasticity of demand for alcohol in New Zealand. In one of the more recent studies, Wette, Zhang, Berg and Casswell (1993) examined New Zealand consumers' average response to a change in the price of alcohol over the period 1983–1991. The study found that, on average, consumers are very responsive to a change in the price of beer and wine. The study, which used highly aggregated quarterly data for the economy as a whole and ordinary least squares multiple regression analysis, estimated that the elasticity for beer, wine, spirits and total alcohol consumption were –1.1, –1.1, 0 and –2.0, respectively. Cross price elasticities, which estimate whether products are substitutes or complements, were found to be insignificant except for the cross price elasticity of beer and wine. Income levels were not found to determine the level of alcohol consumed.

Unfortunately, the highly aggregated data used in this study means its usefulness in determining particular types of consumers' responsiveness to a change in the price of alcohol is doubtful. In addition, no account was taken of changes in alcohol availability, advertising or anti–drink drive mass–media campaigns. The authors note that while the analysis explains 80–90 per cent of the change in alcohol consumption over the period it does not mean that consumption at the level of the individual drinker can be explained in the same manner. In addition, the authors note that a number of variables which could have important impacts on the level of consumption were excluded from the analysis because of a lack of adequate data.

An earlier New Zealand study of alcohol consumption in the period 1960 to 1982 reported by Ashton and Casswell (1987) estimated the price and income elasticities for absolute alcohol consumption at –0.81 and 0.49, respectively. An alternative methodology also reported by Ashton and Casswell (1987) examined individual price elasticities for New Zealanders' beer, wine and spirits demand and estimated elasticities of –0.45, –1.37 and –1.25, respectively. On the other hand, a study by Easton and Kay (1982), found that a ten per cent increase in the price of alcoholic beverages would lead to a 3.5 per cent fall in the demand for beer but a 10 per cent decline in the demand for wine and spirits.

Selvanathan and Clements (1995) estimated Australian demand elasticities for alcoholic beverages over the period 1956 to 1986 and reported own price elasticities for beer, wine and

spirits of –0.2, –0.3 and –0.6, respectively. Their analysis of the demand equation for alcohol as a whole revealed income and own price elasticities of 1.0 and –0.6, respectively. Clements and Selvanathan (1995) also examined the consumption of alcohol against changes in the relative price of alcohol in Australia, the United States and the United Kingdom. They concluded that the own price elasticity of demand was very similar in all three countries.

Unfortunately, many of the studies reported above were also based on fairly aggregated data and none considered the responsiveness of different types of drinkers to a change in price. As far as we can ascertain, only one study has rigorously estimated the elasticity of demand of drinkers with different consumption levels. A United States study used data from the 1983 national interview survey and found that the drinker's response to a price change varies and depends on whether they are heavy, moderate or light drinkers (Manning, Blumbery and Moulton 1995). The study found that light and heavy drinker's demand for alcohol is substantially less price–elastic than the demand of moderate drinkers. The median drinker had a price elasticity of –1.19 whereas light and heavy drinkers' price elasticities were around –0.5. However, the price elasticity of 'very light drinkers was not significantly different from those embedded in the decision to be a drinker' (Table 5).

The price elasticity for heavy drinkers in the 90th quintile was –0.495. However, the price elasticity for the heaviest drinkers (those in the 95th quintile) was found to not significantly differ from zero — that is, the research could not disprove the hypothesis that these very

Table 5: **Price and income elasticity estimates across quintiles**

Quintiles		*Price*		*Income*	
Among drinkers	*All adults*	*Elasticity*	*t*	*Elasticity*	*t*
0.00	0.396	–0.5550 (b)	–5.52	0.1912 (b)	16.71
..					
..					
0.05	0.426	–0.5561 (b)	–2.23	0.1917 (b)	6.77
0.10	0.457	–0.5312 (b)	–2.51	0.2247 (a)	9.39
0.20	0.517	–0.7557	–3.39	0.2768	10.97
0.30	0.577	–0.8981	–3.70	0.2664	9.71
0.40	0.638	–0.9799	–4.02	0.2668	9.67
0.50	0.698	–1.1916	–4.80	0.2756	9.81
0.60	0.759	–1.1497	–5.17	0.2943	11.69
0.70	0.819	–0.9561	–3.97	0.2968	10.87
0.80	0.879	–0.7379 (b)	–3.33	0.3021	12.02
0.90	0.940	–0.4940 (b)	–1.91	0.2623	8.94
0.95	0.970	0.1213 (b)	0.40	0.2365	6.95

(a) Significantly different from the 50th percentile of drinkers at the 10 per cent level.

(b) Significantly different from the 50th percentile of drinkers a the 5 per cent level.

Note: The survey used in this study defined a current drinker as a person who drinks more than 12 drinks in any year and drank at least one drink in the twelve months prior to the survey.

Source: Manning, Blumbery and Moulton (1995)

heavy drinkers have perfectly price inelastic demands for alcohol (see Table 5). However, the researchers note that the tendency for drinkers, particularly very heavy drinkers, to under report their alcohol consumption could bias the results, particularly the results for the drinkers in and above the 95th percentile. They estimate that the overall price elasticity for the population was appreciably lower than the moderate drinker's elasticity and was estimated to be –0.42. The study, as might be expected, also found that the demand for alcohol was affected by the level of income and the income response varied with the type of drinker (Table 5).

Overall, the findings of Manning, Blumbery and Moulton (1995) indicate that the Hall paper is correct in stating that drinkers, even heavy drinkers, are likely to respond to an increase in the price of alcohol. However, the Manning, Blumbery and Moulton (1995) estimates suggest that the magnitude of the response is likely to be substantially greater for New Zealand's moderate drinkers who are currently generating the largest positive externalities from the decision to drink between two and three drinks a day.

A higher excise could also push some very light drinkers out of the market and consequently reduce the positive (albeit smaller) benefits these drinkers are currently generating. Importantly, a rise in excise would have a detrimental impact on the decision of these very light drinkers to increase their consumption and generate higher benefits from drinking moderately.

Certainly, the responsiveness of heavy drinkers, in terms of the absolute amount of alcohol they consume, will lead to a fall in consumption if prices rise. However, whether this response will be sufficient to have any significant impact on the negative externality these heavy drinkers create is uncertain. For example, assuming a price elasticity of demand for alcoholic beverages of –0.5, a 10 per cent increase in the price would only reduce the consumption of the very heavy New Zealand drinkers (those in the 95th to 100th percentile group) from an average of 10.4 drinks per day to 9.9 drinks per day. A 30 per cent increase in the price would only see these very heavy drinkers reduce their consumption to just under nine drinks per day. Medical evidence suggests that the risks of cirrhosis and cancers are still very high even at these 'excise–reduced' levels of alcohol consumption (see Box 1). It is unlikely that the benefits generated by such small reductions in the consumption of these heavy drinkers would outweigh the costs associated with a reduction in the positive externalities and the internalised benefits that are generated by the majority of New Zealanders who consume alcoholic beverages in moderation. Consequently, any attempt to increase the excise by the magnitude necessary to have a worthwhile impact on the

consumption of abusive drinkers would have a very high cost in terms of foregone positive benefits for light to moderate drinkers.

6.4 CONCLUDING COMMENTS

Hall concludes that the current excise is too low and consumption is too high and that an increase in the current excise towards the weighted average marginal net externality at the optimal consumption level will improve aggregate welfare. From our analysis of the benefits and costs of alcohol consumption and adopting Hall's analytical framework and concept of externalities, we conclude that:

- the evidence on the benefits and costs of consuming alcoholic beverages suggests that the net externality function is not a convex increasing function over the entire alcohol consumption range. For most consumers, the positive benefits are likely to be maximised somewhere between two and three or even four drinks per day. At some higher consumption level the net externalities associated with heavy and abusive drinking turn negative. Over some range these net externalities may be increasingly negative;
- the evidence to hand indicates that the net externality function does not have the convex increasing functional form outlined in Hall (1996). Thus, the Hall paper's conclusion that the excise is too low cannot be substantiated. In fact, if the net marginal externality function is piecewise quadratic and linear then the 'optimal' excise could be zero, positive or, in some instances, a subsidy could even be potentially justifiable on economic efficiency grounds. Much more information and analysis would be required before any firm conclusions could be drawn.
- the majority of studies examining consumers' responsiveness to a change in the price of alcoholic beverages have not examined differences in the elasticity of demand for light, moderate and heavy drinkers. These studies have in the main estimated that the demand for alcoholic beverages is relatively inelastic, which suggests that a 10 per cent increase in the price of alcohol would lead to a reduction in consumers' demand of less than 10 per cent. The one study which has examined the responsiveness of different types of consumers to a change in price found a substantial variation in drinkers' responsiveness. Moderate drinkers were found to be more than twice as responsive to a change in price as both heavy and lighter drinkers. The results indicate that if the price of alcoholic beverages increased by 10 per cent moderate drinkers would decrease their demand by more than 10 per cent. On the other hand, heavy drinkers faced with the same price increase would reduce their demand by less than 10 per cent. If this study's findings are

correct, there would be a substantial cost to the community from taxing moderate drinkers who, in all likelihood, are generating positive externalities.

- There is evidence in virtually all studies of the elasticity of demand which suggests that an increase in the price of alcohol would lead to some reduction in the consumption of heavy drinkers. However, it is not clear that their response will be sufficient to have any significant impact on the negative externalities they generate. It is unlikely that the external benefits generated by the relatively small reduction in the consumption of these heavy drinkers would outweigh the costs imposed on the wider community.

As well as these more technical reservations about the application of the Hall (1996) analytical framework, a number of more fundamental questions also need to be addressed. After reviewing the literature on the benefits and costs associated with the consumption of alcoholic beverages it is clear that there are substantial benefits associated with light to moderate consumption. The evidence suggests that for most people moderate consumption of one, two and even three or four drinks a day will produce positive benefits in terms of health, reduced risk of dying and even improved productivity. While most of these benefits will be internalised by the consumer, there may be some residual spill–over benefits for society. On the other hand, the majority of medical costs associated with the consumption of alcoholic beverages are associated with a small minority of New Zealanders who drink very heavily and, as a consequence, contract a disease such as cirrhosis. The majority of the costs will be internal to the consumer. A large part of those costs that are identified by Hall as being external arise from government interventions and market failures in other markets such as mis-pricing of health care services.

Many external costs, which are commonly treated as 'alcohol–related', such as injury to third parties or property, are generally not associated with the consumption of alcohol per se. Rather, these costs are generated by anti–social and criminal behaviour such as fatalities and injury to third parties as a result of drunken driving and domestic violence. Research into factors contributing to one of these externality generators — fatalities related to drink driving — found that many of these drivers had blood alcohol levels substantially higher than the legal limit and many had levels which corresponded to fifteen 300ml glasses of beer (Bailey and Bailey 1998). Many of these so–called 'hard–core' drinkers where found to be persistent offenders displaying very different characteristics to the rest of the population. The most effective policy response in this instance is likely to be better policing and enforcement of legal sanctions combined with public education campaigns.

As noted in section 4, many of the 'externalities' identified by Hall are open to dispute and generally better addressed by more targeted policy instruments than a blunt instrument like a

uniform excise. Indeed, the information requirements associated with trying to set an 'optimal' excise level are overwhelming. Such across–the–board approaches are likely to reduce rather than improve welfare as many of the beneficial affects of alcohol consumption on light to medium drinkers are foregone for an uncertain impact on the consumption of heavy and abusive drinkers. Consequently, important reservations have to be expressed about the appropriateness of the Hall (1996) analytical framework and conclusions.

APPENDIX 1: STATISTICAL EVIDENCE

Table A1.1:Pure alcohol consumption by country (litres per capita): 1995

Rank	*Country*	*Reliability*	*1995*
1	Luxembourg	**	11.6
2	France	***	11.5
3	Portugal	**	11.0
4	Hungary	**	10.2
5	Spain	***	10.2
6	Czech Republic	**	10.1
7	Denmark	***	10.0
8	Germany	***	9.9
9	Austria	***	9.8
10	Switzerland	***	9.4
11	Republic of Ireland	**	9.2
12	Belgium	**	9.1
13	Greece	*	9.0
14	Romania	*	9.0
15	Italy	***	8.8
16	Bulgaria	*	8.1
17	Netherlands	***	8.0
18	Cyprus	***	7.9
19	Slovak Republic	*	7.8
20	Australia	**	7.6
21	United Kingdom	***	7.3
22	Argentina	***	7.3
23	**New Zealand**	*******	**7.0**
24	USA	***	6.8
25	Japan	**	6.6
26	Finland	**	6.6
27	Poland	**	6.4
28	Canada	***	6.2
29	Uruguay	*	6.1
30	Russia	*	5.8
31	Venezuela [1]	*	5.3
32	Sweden	*	5.3
33	Chile	*	5.3
34	South Africa	*	4.9
35	Colombia [2]	*	4.6
36	China [4]	*	4.4
37	Norway	*	4.1
38	Cuba	*	3.8
39	Brazil	*	3.6
40	Iceland	***	3.5
41	Mexico	*	3.3
42	Paraguay [1]	*	2.0
43	Singapore	**	1.7
44	Ukraine	**	1.6
45	Peru [1]	**	1.2

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Table A1.1: **Pure alcohol consumption by country: 1995** (continued)

Rank	*Country*	*Reliability*	*1995*

46	Turkey	**	0.9
47	Israel [1]	*	0.8
48	Thailand	**	0.6
49	Malaysia [3]	**	0.6
50	Tunisia [1]	*	0.5
51	Algeria [1]	*	0.3
52	Morocco [1]	*	0.3
53	Vietnam [2]	*	0.2

Notes:*** = Very reliable; ** = reliable; * = Less reliable.
1 Data are for beer and wine only; 2 Data are for beer only;
3 Data are for beer and spirits only; 4 1994 consumption level.
Source: http://www.alcoweb.com/english/gen_info/alcohol_health.

Table A1.2: **Relative Risk of Dying (All Causes) ***

Study	*Follow Up*	*Year*	*Alcohol Category (# Drinks)*	*Relative Risk*
Japanese Physician's Study (Kono, et al.)	19 yr	1986	None	1.00
			Occasional	0.86
			1–4 /day	0.91
			5+ /day	1.28
			Ex-drinker	1.38
British Regional Heart Study (Shaper, et al.)	7.5 yr	1988	Occasional	1.0
			0.1–2/day	0.7
			2–6 /day	0.7
			>6 /day	0.9
American Cancer Society (Boffetta & Garfinkel)	12 yr	1990	Non-drinker	1.00
			Occasional	0.88
			1/day	0.84
			2/day	0.93
			3/day	1.02
			4/day	1.08
			5/day	1.22
			>6/day	1.38
			Irregular	1.01
Kaiser Permanente Study (Klatsky, et al.)	<7 yr	1990	Abstainers	1.0
			<1/mth	1.0
			>1/mth, <1/day	0.9
			1–2/day	0.9
			3–5/day	1.0
			>6/day	1.4
			Ex-Drinkers	1.1

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Table A1.2: **Relative Risk of Dying (All Causes) *** (continued)

Study	*Follow Up*	*Year*	*Alcohol Category (# Drinks)*		*Relative Risk*
Busselton Study (Cullen)	23 yr	1991	Men	None	1.00
				Mild	0.90
				Moderate	0.69
				Ex-drinkers	1.13
			Women	None	1.00
				Mild	1.01
				Moderate	0.35
				Ex-drinkers	2.47
			Combined	None	1.00
				Mild	0.92
				Moderate	0.66
				Ex-drinkers	1.26
British Doctor's Study*** (Doll)	12 yr	1991		0	1.00
				0.1–1.3/day	0.64
				1.4–2.7/day	0.78
				2.8–4.1/day	0.72
				4.2–5.6/day	0.73
				>5.7/day	1.03
Normative Aging Study (De Labry, et al.)	12 yr	1992	<49 yrs	None	1.00
				Moderate	0.76
				Heavier	1.35
			50–64 yrs	None	1.00
				Moderate	0.80
				Heavier	1.36
			>65 yrs	None	1.00
				Moderate	0.60
				Heavier	0.88
Studies in Elderly (Scherr, et al.)	5 yr	1992	East Boston	0 in year	1.0
				Some in yr, 0 in month	1.1
				Some in mth, <1oz./day	0.6
				>1oz./day	0.6
			Iowa	0 in year	1.0
				Some in yr, 0 in month	1.4
				Some in mth, <1oz./day	1.0
			New Haven	>1oz./day	1.6
				0 in year	1.0
				Some in yr, 0 in month	0.5
				Some in mth, <1oz./day	0.5
				>1oz./day	0.6

(continued next page)

Table A1.2: **Relative Risk of Dying (All Causes) *** (continued)

Study	*Follow Up*	*Year*	*Alcohol Category (# Drinks)*	*Relative Risk*	
				White	Black
Kaiser Permanente Study (Klatsky, et al.)	<10 yr	1992	Abstainers	1.0	1.0
			<1/mth	1.0	0.9
			>1/mth, <1/day	0.8	0.9
			1–2/day	0.9	0.9
			3–5/day	1.0	1.1
			>6/day	1.2	1.3
			Ex-Drinkers	1.2	1.0

* According to Level of Reported Usual Alcohol Intake (with referent group being non-drinkers, given a value of 1.0) and adjusted for smoking and other risk factors.

** values estimated from graph in publication.

*** men with no history of cardiovascular disease at baseline.

**** for this study, an ounce of alcohol was calculated to be the equivalent of approximately one mixed drink or cocktail, 1.5 4- ounce glasses of wine, and 1.7 12-ounce bottles of beer.

APPENDIX 2 CONSUMPTION EXTERNALITIES AND TAXES

Taxation and subsidies are often put forward as a solution to the problem of externalities. When demand is determined only by price, taxes (subsidies) on a product which generates externalities in consumption will raise (lower) its price of above (below) marginal production costs and change the level of consumption. If the tax (subsidy) is set at an appropriate rate the price on the last unit consumed is equal to its net marginal (internal and external) cost. At this point consumption is at a socially optimal level and welfare is maximised.

Commentators on public health and safety issues frequently suggest that consumption of alcohol generates costs (negative externalities) which reduce community welfare. In these situations, an individual by maximising his utility from consuming alcohol consumes up to a point where the private (internal) benefits he obtains from consumption are exceed by the external costs his consumption generates. Consider first a single consumer's partial equilibrium utility of alcohol maximisation problem:

(1) $\max_q B(q) - p^* q$

where:

q = number of drinks per day

p^* = cost of a single drink

$B(q)$ = private utility of benefit of consuming q drinks per day.

As outlined in Figure A2.1 we assume that an individual's private utility of benefit of consuming a quantity of alcoholic drinks per day, $B(q)$, is an increasing concave function up to the level of satiation $\bar{q}$. We also assume that if the individual consumes no alcoholic beverages per day, he or she obtains zero benefit, that is $B(0) = 0$. If $B(q)$ is quadratic for $0 \leq q \leq \bar{q}$, then the slope function of $B(q)$, $B'(q)$ is linear (Figure A2.2).

The first order necessary condition for an interior solution for (1) are:

(2) $B'(q^*) = p^*$

In this instance $B'(q)$ is an inverse demand function — that is, it is the demand curve which measures price as a function of quantity. For each level of quantity demanded the function tells us the price an alcoholic drink would need to be in order for our consumer to choose to consume that particular quantity.

Figure A2.1: **Private Utility Alcohol Consumption Function**

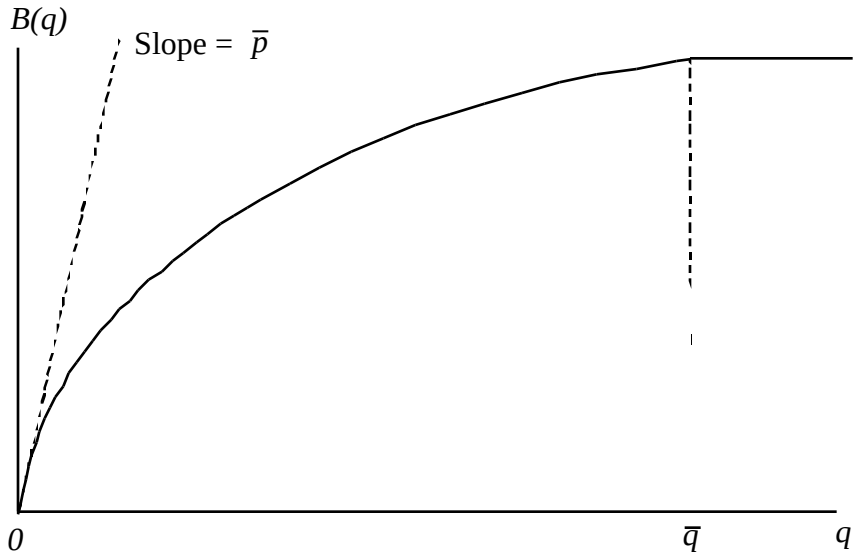
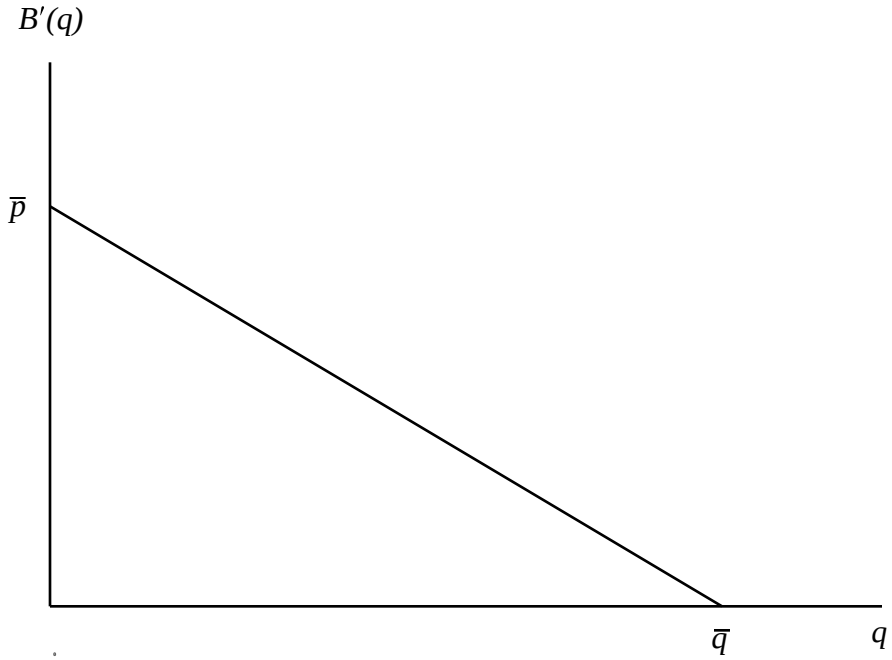
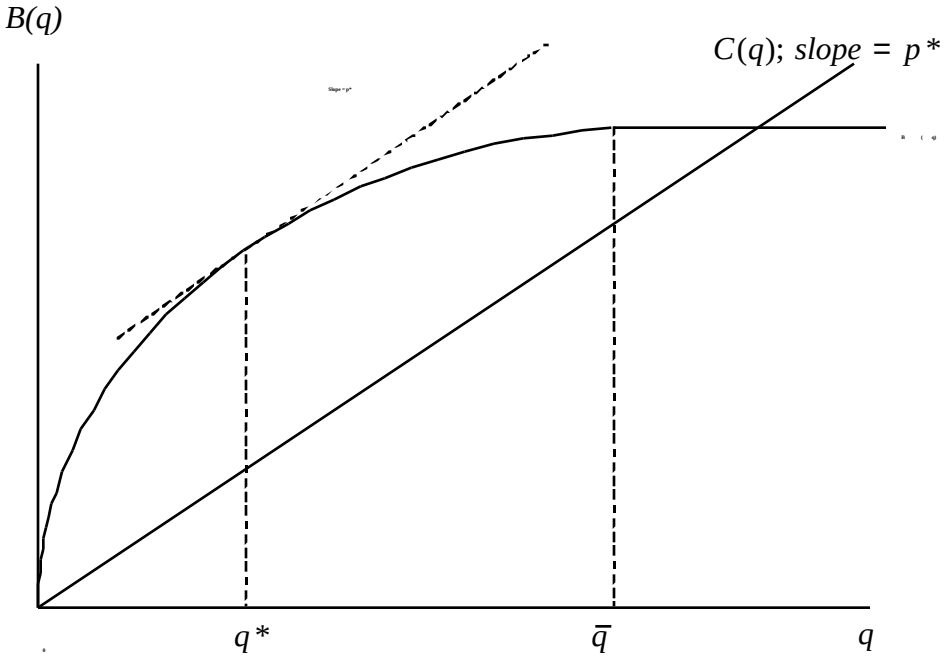


Figure A2.2: **Demand for Alcoholic drinks per day**



As shown in Figure A2.3, the quantity q^* is the optimal level of alcoholic drinks per day. Consumption at this level which will maximise the utility of our consumer. In the absence of taxes and externalities this level of consumption will also maximise the welfare of the community as a whole.

Figure A2.3: **Utility maximising consumption level**



At the consumers' optimal consumption level q^* in Figure A2.3 our consumer will maximise the distance between his private utility function $B(q)$ and his the private cost function $C(q)$ which we define as:

(3) $C(q) \quad p^* q$

We can also examine the optimal consumption level in terms of partial equilibrium demand and supply curves which are the derivatives of $B(q)$ and $C(q)$ [note $C'(q) = p^*$].

From elementary calculus, the total utility benefits of drinking q^* drinks per day is

(4) $$\int_0^{q^*} B'(q)\,dq = B(q^*) - B(0)$$
$$= B(q^*)$$

since we assumed $B(0) = 0$.

Thus $B(q^*)$ can be represented by the sum of the areas A and B in Figure A2.4. However, these are the gross private benefits of consuming q^* drinks per day. To derive the net private benefits, we need to subtract cost:

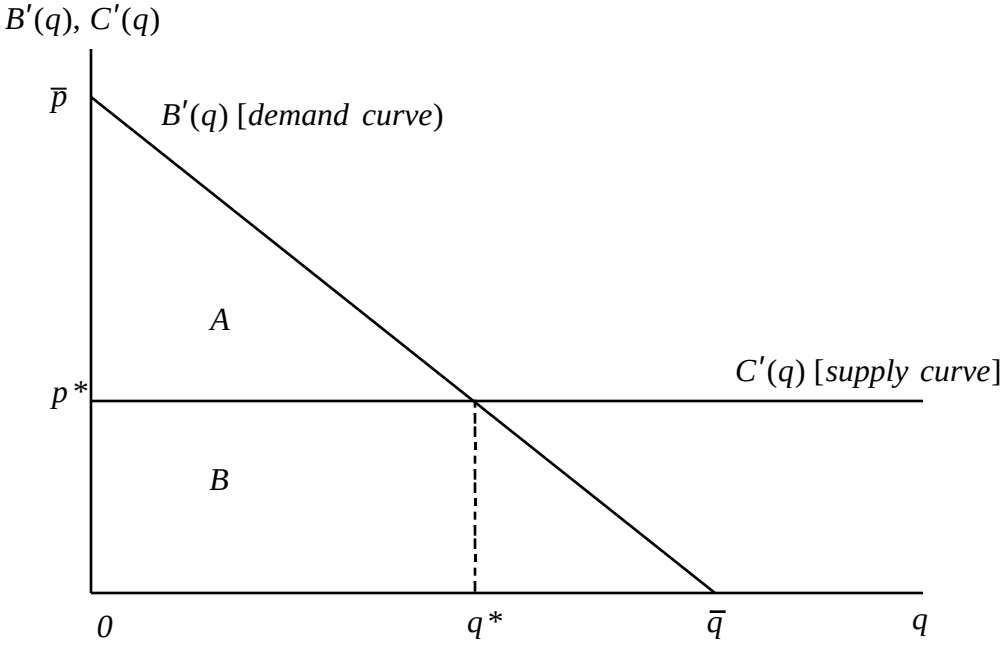
(5) $$\int_0^{q^*} C'(q)\,dq = \int_0^{q^*} p^*\,dq = p^* q^* = \text{area } B$$

Therefore net private welfare defined by

(6) $N(q) = B(q) - C(q)$

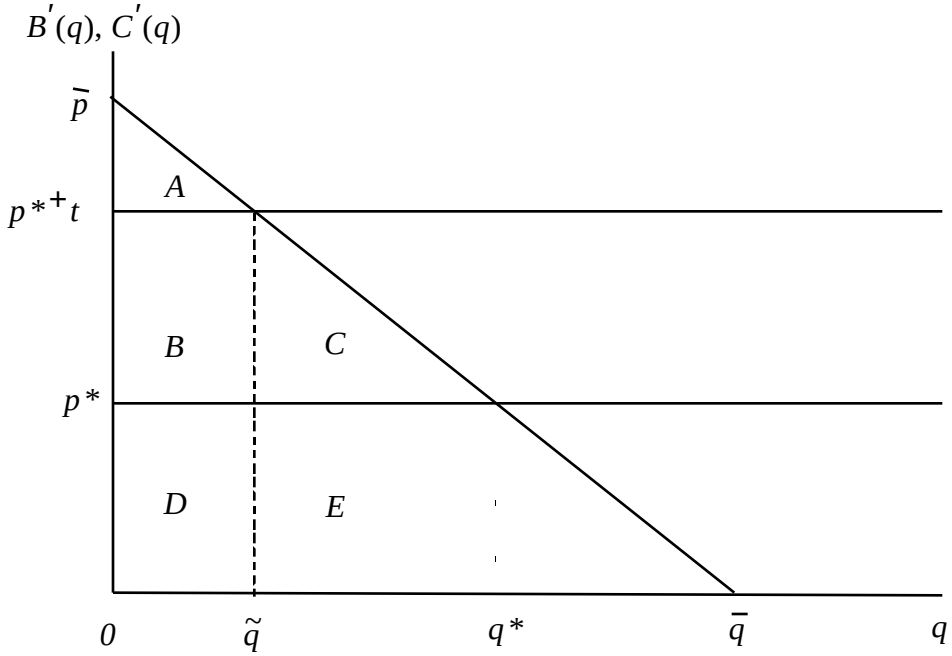
is maximised at q^* and the consumer's net benefit or consumer surplus is represented by the area *A* in Figure A2.4.

Figure A2.4: **Demand and Supply of Alcoholic Drinks per day**



Let us now assume that the government decides to impose an excise tax of *t* on each alcoholic drink consumed. The consumer is now faced with a higher price per alcoholic drink and he reduces his consumption to $\tilde{q}$ (see Figure A2.5).

Figure A2.5: **A Uniform Excise tax and the Consumption of Alcoholic Drink**



The total benefit of drinking is now reduced to the areas $A+B+D$. However, much of the benefit of drinking this reduced quantity is attributable to the private cost D and the tax cost B. Thus the net private welfare (utility) gain due to taxing drink at the tax rate t is:

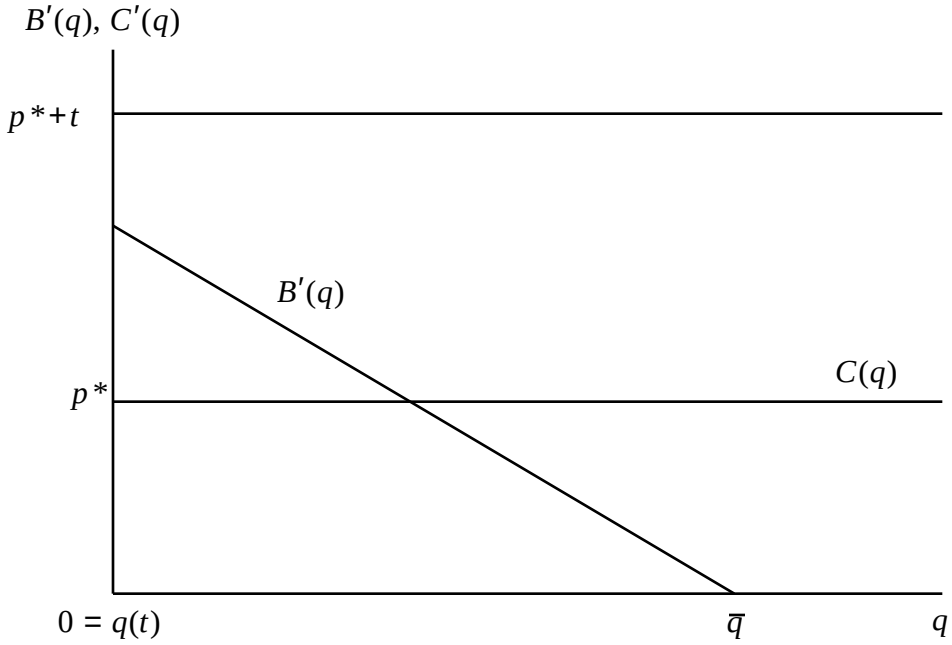
$$N(q(t)) \quad B(q(t)) - C(q(t)) - tq(t) = \int_0^{q(t)} B'(x)dx - p^* q(t) - tq(t) \tag{7}$$

where $q(t) = \tilde{q}$ is the solution to the private utility maximisation problem

$$\max_q \; B(q) - [p^* + t]q \; . \tag{8}$$

If the alcohol excise tax t is set high enough (or if the cost of production p^* is sufficiently high), some consumers will curtail their consumption of alcohol to zero as shown in Figure A2.6.

Figure A2.6: **Alcoholic drink consumption with a prohibitive tax**



If the government were to lower the tax rate, the above non-drinker would choose to drink a small amount and obtain some positive consumption benefits which are unavailable to him or her in the presence of the tax. However, to digress for a moment, the consumer's net welfare gain presented in equation (7) above omits any increase in welfare generated by the tax revenue raised by the tax on alcoholic drink. This wider issue of optimal taxes is briefly discussed in Box A2.1

Box A2.1: **Optimal taxes**

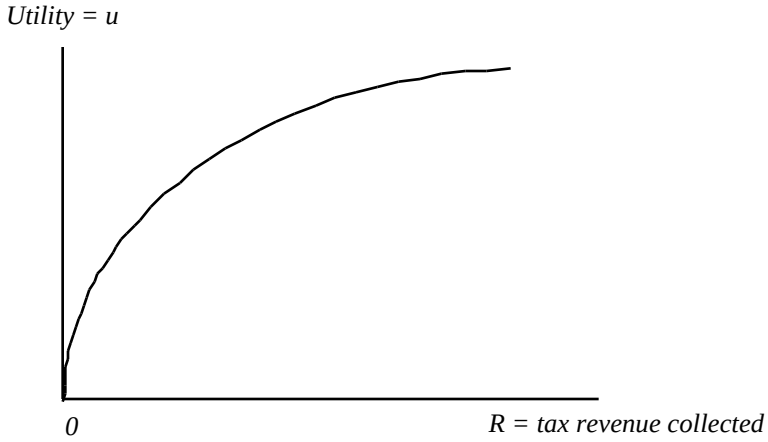
The consumer's net welfare gain presented in equation (7) above omits any increase in welfare generated by the tax revenue raised by the tax on alcoholic drink. In cost benefit analysis, it is conventional to value the utility benefit of a dollar of tax revenue at one dollar. This means that $tq(t)$ is added to $N(q(t))$ defined by (7) to get the net welfare gain due to drink, including tax benefits.

$$\begin{aligned} W[t] \quad & N[q(t)] + tq(t) \\ (9) \qquad & = B[q(t)] - C[g(t)] \\ & = \int_0^{q(t)} B'(x)dx - p^* q(t) \end{aligned}$$

where $q(t)$ is the solution to (8). This leads to a deadweight taxation loss which is equal to the triangle C in Figure A2.5.

Setting the utility value of an extra tax dollar of tax revenue equal to one is not a very reasonable assumption; it would be much more reasonable to assume that the utility value of the first dollar of tax revenue collected is much higher that the billionth dollar collected; ie. the function that converts tax dollars into utility should be concave and increasing as in the figure below.

Taxation Utility Function



Define alcohol tax revenue as

(10) $R(t) \quad tq(t)$

where $q(t)$ solves (8). Let $T(R)$ be the function that transforms tax revenue into utility. Then a new private net welfare gain due to alcohol taxation function $W(t)$ can be defined as

(11) $W(t) \quad N[q(t)] + T[tq(t)] = B[q(t)] - (p^* + t)\, q(t) + T[tq(t)]$.

The private partial equilibrium optimal alcohol taxation problem is then

(12) $\max_t W(t) \quad \max_t B[q(t)] - (p^* + t)\, q(t) + T[tq(t)]$.

(Continued next page)

Box A2.1: **Continued**

The first order condition for (8) is:

(13) $B'[q(t)] - (p^* + t) = 0$.

The first order condition for (12) is

(14) $B'[q(t)]\ q'(t) - (p^* + tq'(t) - q(t) + T'[tq(t)]\{q(t) + tq'(t)\} = 0$.

Using (13), (14) becomes

(15) $T'[tq(t)]\ \{q(t) + tq'(t)\} - q(t) = 0$.

Now under the usual cost benefit assumption, the function $T(x)$ is just x; therefore $T'(x) = 1$, for all x. Under this assumption, (15) reduces to:

(16) $t^* q'(t^*) = 0$.

Since $q'(t)$ will generally be negative for $t > 0$ (up to an upper bound t where the demand for alcohol is driven down to 0), we see that (16) will imply

(17) $t^* = 0$,

that is, the optimal alcohol tax is 0, as could have been predicted by looking at Figure A2.5. However, if $T(R)$ is an increasing, strictly concave function of R, then the solution to (15) will generally be a positive tax rate $t^* > 0$.

However, in practice solving the actual optimal tax problem is much more complicated than outlined in this simple analysis. Determining an optimal tax level is highly information intensive. For example, it requires information on the levels of other taxes and the utility obtained from the revenue raised, as well as detailed information on the responsiveness of demand and supply for all goods and services. We would also need to take consumers' budget constraints into account and have a much a much better understanding of production processes so that realistic assumptions regarding production technology, etc could be included in the analysis.

At this stage in our analysis our consumer has not generated any externalities from his consumption of q^* alcoholic drinks per day in the absence of a tax or $\tilde{q}$ in the presence of a tax t. Let us now assume that our consumer generates an externality cost from consuming any number of drinks per day greater than q = 0 and that the net externality function, $E(q)$ gives the net externality cost of the number of drinks per day. We initially follow the example of Hall and assume that $E(q)$ is an increasing convex function with the following properties:

(18) $E(0) = 0$; $E'(q) > 0$ and $E''(q) > 0$ for $q > 0$.

If we make the additional assumptions:

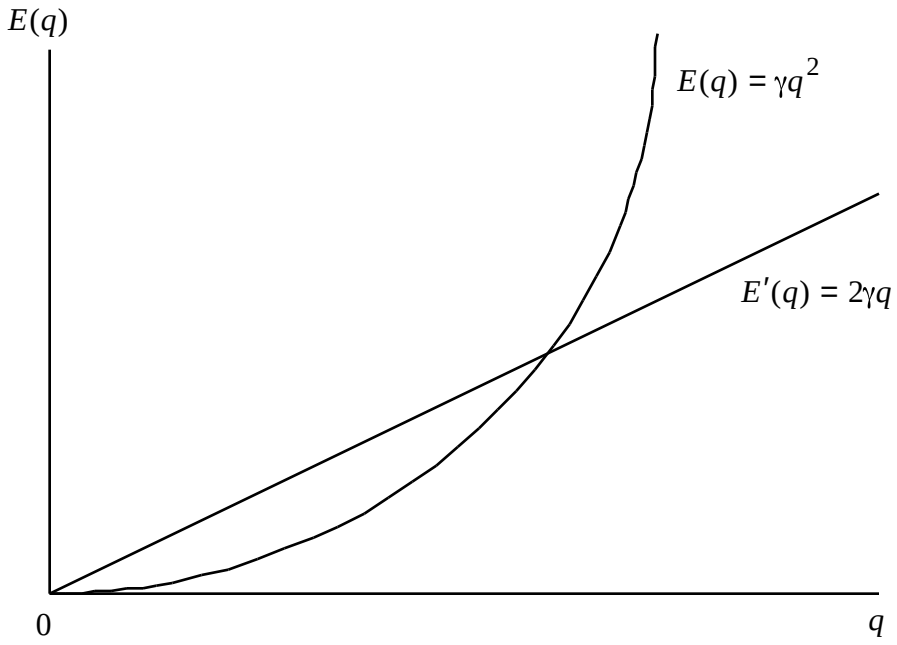
(19) $E'(0) = 0$.

(20) $E(q) = \alpha + \beta q + \gamma q^2$ ie. $E(q)$ is quadratic

then, as illustrated in Figure A2.7, (18) – (20) imply:

(21) $E(q) = \gamma q^2$.

Figure A2.7 **Net Externality and Net Marginal Externality Functions**



Now the planner's social welfare maximisation problem (neglecting the optimal tax considerations briefly discussed above) is:

(22) $\max_q S(q) = \max_q \{B(q) - C(q) - E(q)\}$

$= \max_q \{B(q) - p^* q - E(q)\}$

The first order necessary condition for an interior solution for (23) is:

(23) $S'(q^*) = B'(q^*) - p^* - E'(q^*) = 0$ if (3) is true.

If $B(q)$ and $E(q)$ (see equation (21)) are quadratic, the private marginal benefit and the marginal net externality functions $B'(q)$ and $E'(q)$ are linear and we can determine the socially optimal level of consumption of alcoholic drinks per day. As shown in Figure A2.8, the government can achieve the optimal level of social welfare $S(q^*)$ by imposing a uniform per drink tax of

(24) $t^* \quad E'(q^*)$

Now the net externality cost associated with the optimal level of drinking for the above consumer is

(25) $E(q^*) = \int_0^{q^*} E'(q)dq = area\ C$

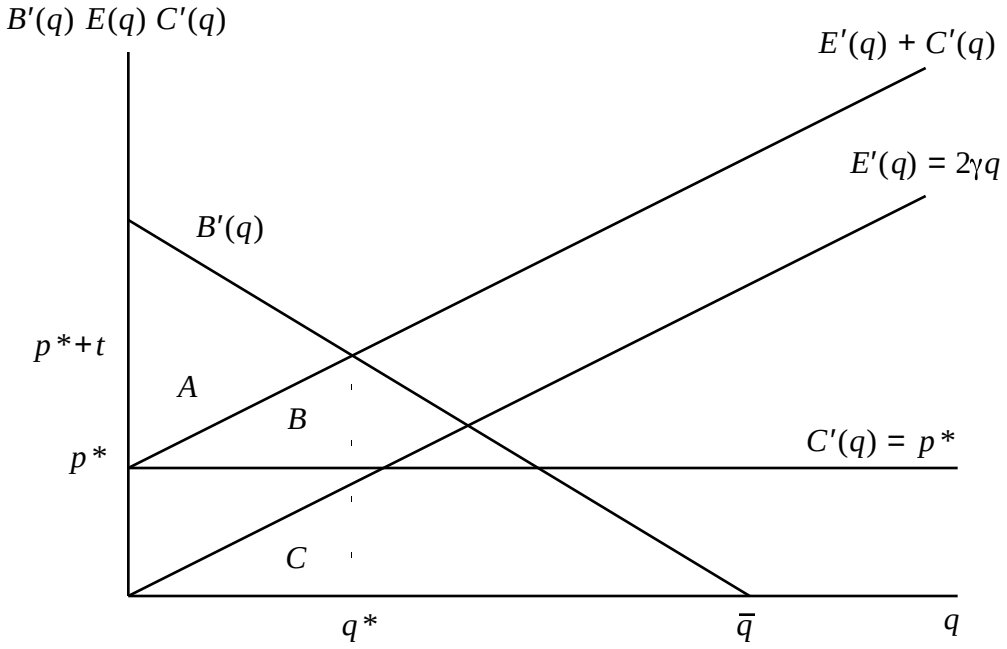
It is easy to see that

(26) $area\ C = area\ B$

and the total tax revenue collected from an optimal tax is

(27) $t^* q^* = area\ A + area\ B$.

Figure A2.8 **Socially Optimal Consumption with a uniform externality tax**



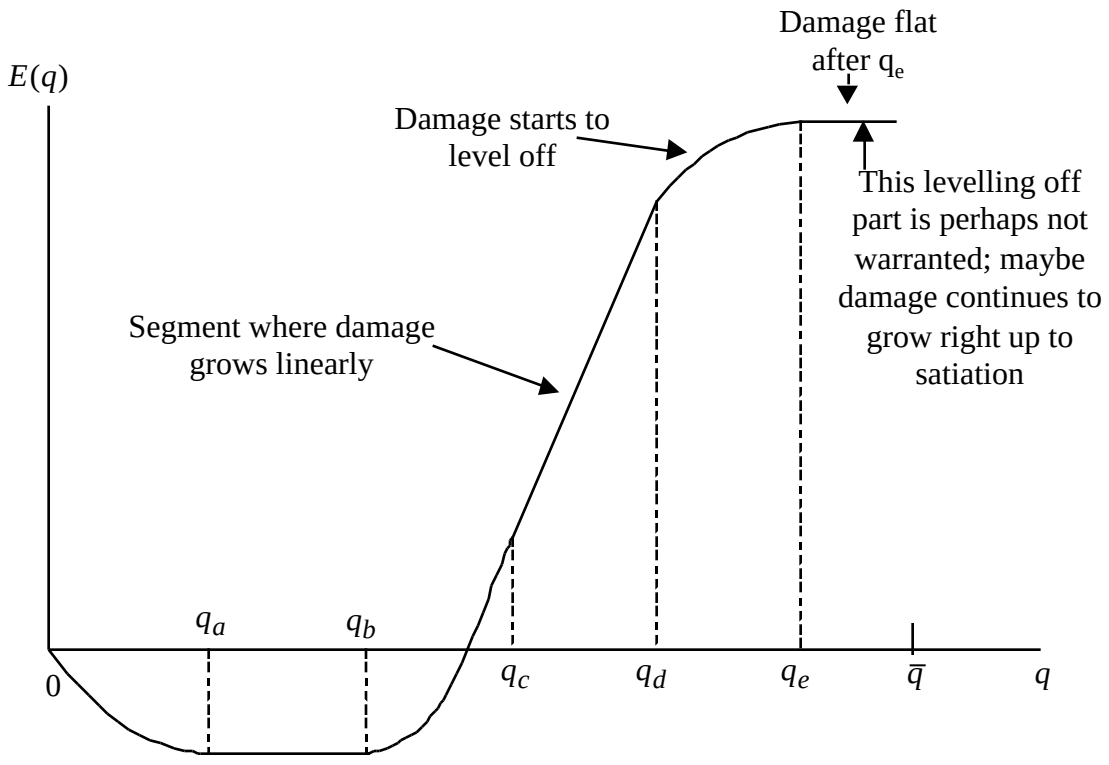
Thus, if the assumptions about the functional form of the net externality function are correct, the taxation revenue which the Government will raise from its optimal externality tax (the area A + area B) will exceed the externality cost (the area C) as area C = area B. If marginal benefits and marginal net externality ($B'(q)$, $E'(q)$) are linear and production costs ($C'(q)$) are constant it can be seen from Figure A2.8 that at the optimal consumption point q^*, tax revenue should be twice as big as the externality cost. The above quadratic model provides a rigorous formalisation of Hall's verbal and geometric model of the alcohol externality problem.

However, the conclusions drawn from this analysis will not hold if the assumption that $E(q)$ is convex and increasing throughout its range is not appropriate. For example, if the consumption of low to moderate amounts of alcohol generates increasing net positive externalities up to some point then the net externality function $E(q)$ will be decreasing for the smaller quantities. Similarly, if the net externality function levelled off at some consumption

point before satiation then the convex and increasing assumption will not be valid. This could occur for example, if any negative external costs such as those that might be associated with Cirrhosis of the liver are the same if the patient drinks q_e or $q_e + 10$.

In these situations it is more plausible that the net externality function $E(q)$ would take the functional form outlined in Figure A2.9 where, for simplicity, we assume that $E(q)$ is piecewise quadratic and linear.

Figure A2.9 **Net externality function with non-convexity in the consumption range**



Note: $\bar{q}$ = satiation level of drink.

If the curvilinear segments in Figure A2.9 are quadratic, then the derivative of the net externality function will look something like the marginal net externality curve $E'(q)$ in Figure A2.10, where the linear net marginal externality curve $E'(q)$ in Figure A2.8 is replaced by a piecewise linear curve.

Figure A.2.10: **Net marginal externality function with non-convexity in the consumption range**

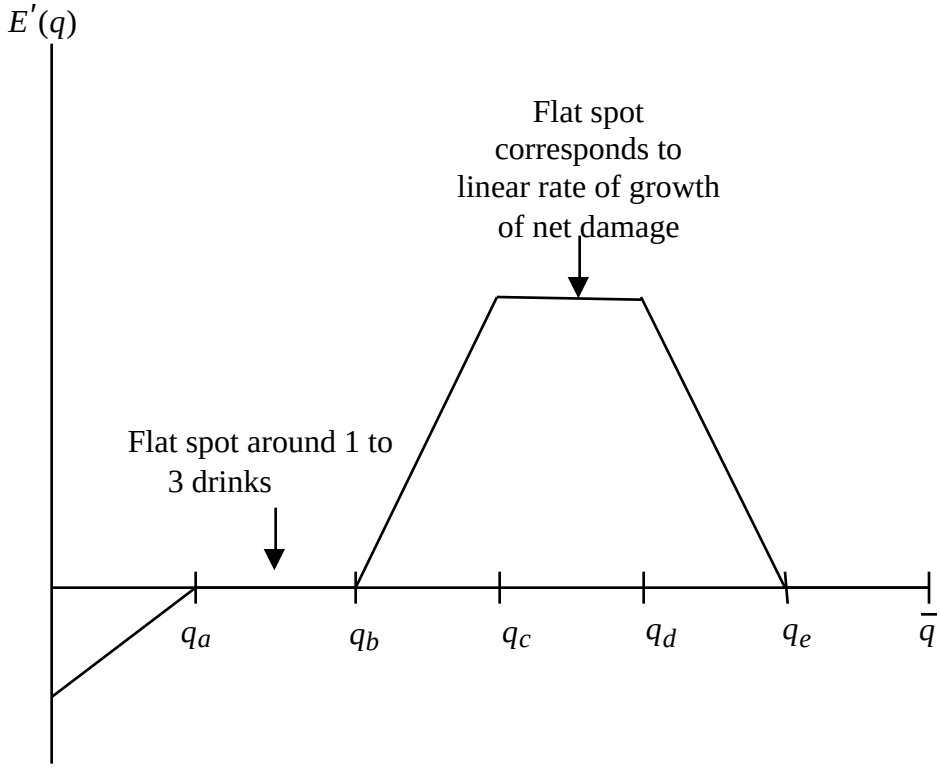


Figure A2.11 highlights that the inverse demand curve $B'(q)$ could intersect $E'(q) + C'(q)$ at any one of the 6 regions depending on the demand curve of the consumer in question. Depending on the point of intersection the appropriate policy response may be:

Region 1: $0 \le q \le q_a$; $t^* < 0$ ♦ *subsidy*

Region 2: $q_a \le q \le q_b$; $t^* = 0$ ♦ *optimal tax* = 0

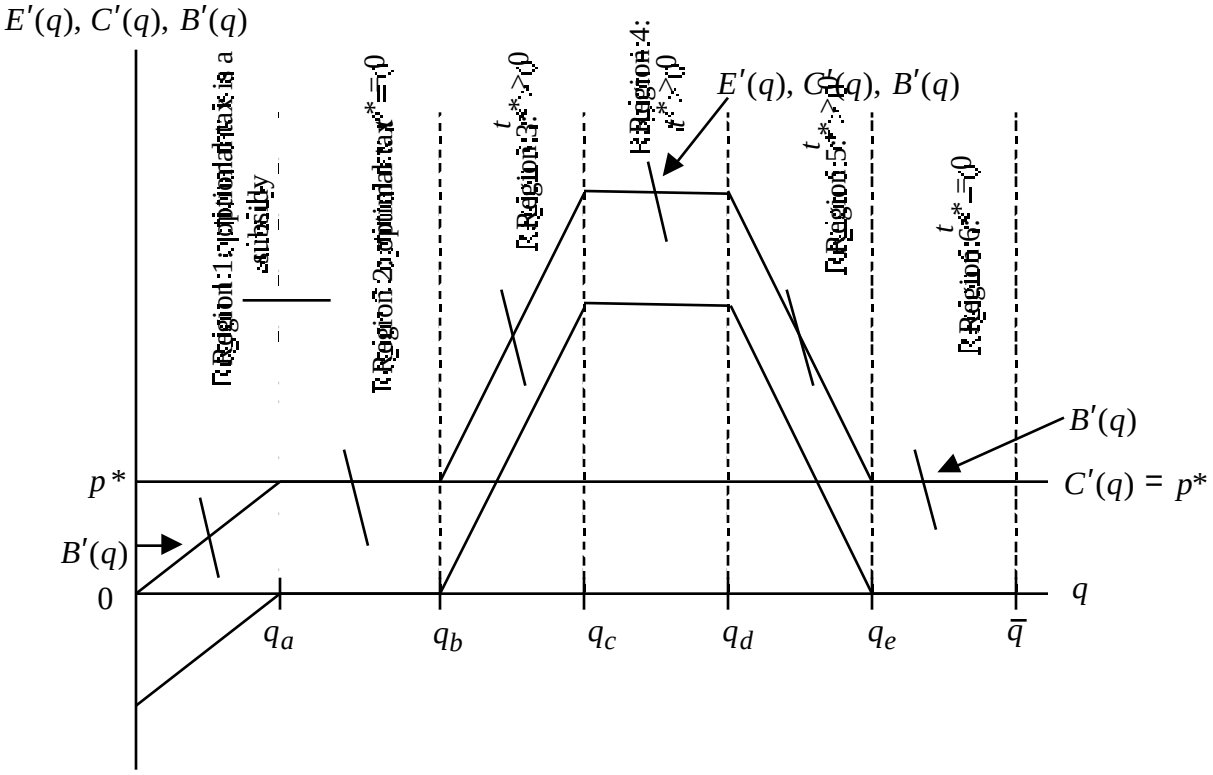
Regions 3, 4, 5: $q_b \le t \le q_e$; $t^* > 0$ ♦ *optimal tax positive*

Region 6: $q_e \le q \le \overline{q}$; $t^* = 0$ ♦ *optimal tax* = 0 .

Medical and other evidence suggests that the consumption of alcoholic beverages creates positive net externalities for those New Zealanders who drink low to moderate amounts of alcohol. The majority of New Zealander's drinking population falls into this category. Hence, there is a strong chance that the inverse demand curve of many of those New Zealanders who drink in moderation will intersect the net marginal cost function in regions one or two. It is also likely that only a small proportion of New Zealanders' inverse demand curves for alcoholic beverages would intersect the net marginal externality function in regions three to

five. In these circumstances a uniform positive externality tax would not be an appropriate response to the negative net marginal externality generated by this relatively small sector of the community.

Figure A2.11 **Alternative demand and equilibrium consumption and externality tax scenarios**



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