MINISTRY OF JUSTICE
Tāhū o te Ture

The Effectiveness of Alcohol Pricing Policies

Reducing harmful alcohol consumption and alcohol-related harm

Not Government Policy

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1. Executive Summary

The purpose of this report is to investigate the impact and effectiveness of a minimum price regime in reducing harmful alcohol consumption. The objectives of this research are to:

1. Determine the impact of a minimum price on:

- consumers
- alcohol-related health, crime, and workplace productivity harms
- the alcohol industry and,
- the Government.

2. Ascertain the most effective minimum price level to reduce harmful consumption without unduly affecting low-moderate consumption.
3. Determine whether the impact of a minimum price could be achieved by excise tax increases, and assess the advantages and disadvantages of a minimum price compared to excise tax increases.

This report considers the appropriate balance between the loss of benefits that low risk or moderate alcohol consumers suffer as a result of the constraint on their behaviour due to the pricing regulations, and the benefits society obtains as a result of reduced alcohol-related harms if the proportion of the population consuming at harmful levels is reduced as a result of a price increase.

Imposing a minimum price per standard drink of alcohol is advocated on the assumption that it will reduce harmful alcohol consumption, particularly among young people, who consume the highest quantities of low cost, high alcohol volume products. The policy intent is to reduce harmful alcohol consumption and alcohol-related harm without unduly impacting on moderate drinkers.

Regulating the minimum price of alcohol is a way to directly raise the price of alcoholic products regarded as being unduly cheap and may prevent retailers from employing strategies such as discounting and loss leading, which are used to undercut competition and to promote purchasing of low priced products.

There are very few examples of minimum pricing being adopted in practice, but a form of minimum pricing has operated in eight of the ten Canadian provinces since the late 1990s. The Scottish Government announced plans to impose a minimum price per unit of alcohol in 2013 although this has been delayed due to legal challenges that are being made by the alcohol industry. In 2013 the UK government announced it would not proceed with a minimum price due to the lack of concrete evidence that its introduction would be effective in reducing harms associated with problem drinking, without penalising people who drink responsibly. In Australia, the Australian National Preventative Health Agency was tasked with investigating a minimum price of alcohol because of increased public interest. Their report, released in October 2012, recommends a minimum price not be introduced nationally in Australia at this time.

1.1 Determining the different pricing options to be analysed

To determine potential levels of minimum price to be analysed, off-licence and on-licence price distribution data was obtained. A minimum price above $1.20 per standard drink would affect over a quarter of alcohol sales and significantly impact the alcohol industry and low risk drinkers. Therefore

the analysis focused on three minimum pricing options: $1.00 per standard drink, $1.10 per standard drink and $1.20 per standard drink.

Price increases could also be achieved via an increase in alcohol excise duties. Therefore the three minimum pricing options were also compared to excise increases to achieve an average price of $1.00, $1.10 or $1.20 per standard drink on the lowest priced alcohol. Overall, six pricing options were analysed:

- A minimum price of $1.00 per standard drink.
- A minimum price of $1.10 per standard drink.
- A minimum price of $1.20 per standard drink.
- An excise increase to achieve an average price of $1.00 per standard drink on the lowest priced alcohol (an excise increase of 82%).
- An excise increase to achieve an average price of $1.10 per standard drink on the lowest priced alcohol (an excise increase of 107%).
- An excise increase to achieve an average price of $1.20 per standard on the lowest priced alcohol (an excise increase of 133%).

The effectiveness of each of the pricing options was analysed by estimating the impact on the consumption of low risk and harmful drinkers, and by determining the impact of changes in consumption on alcohol-related health, crime and workplace productivity harms, and on alcohol industry revenue and Government revenue.

1.2 Estimating the impact of price increases on the consumption of low risk and harmful drinkers

To analyse the impact of the pricing options on different types of drinker, an estimate of the responsiveness of consumers to changes in price was required. To derive such estimates for New Zealand consumers, the Ministry of Justice contracted AC Nielsen to provide estimates of changes in off-licence alcohol consumption from price changes (off-licence price elasticities) based on retail scan data for 70% of the off-licence market. The SHORE and Whariki Research Centre at Massey University was contracted to provide estimates of changes in on-licence alcohol consumption from price changes (on-licence price elasticities) based on data from the cross-sectional *International Alcohol Control* survey.

The NZ estimates generated by AC Nielsen and the SHORE and Whariki Research Centre were considerably larger than international estimates of alcohol price elasticities, resulting in significant changes in consumption when the price of alcohol changes. Such results are not considered to be realistic as the academic empirical literature generally finds that alcohol price increases result in a less than proportionate reduction in consumption (that is, inelastic demand).

The large off-licence price elasticities may be driven by the fact that both regular prices and promotional prices are included in the estimates. The large on-licence price elasticities are likely to be a consequence of a reasonably small sample size and cross-sectional data.

The Ministry of Justice, in consultation with Treasury, decided to use the University of Sheffield elasticity estimates developed as part of their Alcohol Policy Model (discussed in Section 2.6 below). The University of Sheffield estimates show that alcohol consumption will reduce if the price of alcohol rises, but that the percentage decrease in consumption is smaller than the percentage increase in price. The University of Sheffield estimates are similar to those estimated in large meta-

analyses and recent studies, and if anything, are slightly more conservative.[1] The estimates are based on considerably more data than is available in New Zealand and are provided for different types of drinker.

1.3 Analysis of the impact of the pricing options

Table 1 shows the impact of the pricing options on different beverage prices. The excise options result in the greatest increase in prices, particularly for spirits, which could increase by as much as 143% if excise increases by 133%.

Table 1: Impact of price increases on common beverages

Pricing option	Bottle of cheap wine	Bottle of expensive wine	Bottle of mixed spirits (750 ml)	Twelve pack of beer
ORIGINAL PRICE	$7.00	$18.00	$10.00	$10.00
Minimum price of $1.00	$7.20	No change	$11.40	$15.30
Minimum price of $1.10	$7.90	No change	$12.50	$16.80
Minimum price of $1.20	$8.60	No change	$13.70	$18.40
Excise increase of 82%	$8.90	$19.90	$16.70	$14.88
Excise increase of 107%	$9.50	$20.50	$18.70	$16.40
Excise increase of 133%	$10.10	$21.10	$20.80	$17.90

Source: Estimated by the Treasury

Table 2 provides a summary of the effects of a price increase on the annual volume of alcohol purchased and per occasion alcohol purchased for each of the pricing options by drinker type. The annual volume of alcohol purchased is estimated to decrease by two to five percent for the minimum price options, while the excise options result in annual volume decreases about 5 times greater. The minimum price options have a greater impact on low risk drinkers compared to harmful drinkers, while the excise options have a greater impact on harmful drinkers. This appears to be driven by the responsiveness of harmful drinkers to the considerable increase in the price of spirits.

For per occasion purchases, harmful drinkers are more significantly affected than low risk drinkers, although the impacts of the minimum price options are minimal. As with annual volume purchased, an excise increase of 133% to indirectly achieve an average price of $1.20 on the lowest priced beverages has the greatest impact on harmful consumption.

[1] For example, HM Revenue & Customs in the UK produced price elasticity estimates for alcohol consumption based on an internationally agreed methodology. The elasticity estimates are generally larger than those estimated by the University of Sheffield. They are not provided by drinker type or by high or low price beverages. Therefore it was decided to use the University of Sheffield estimates.

Table 2: Summary of changes in the annual volume of alcohol purchased from the pricing options

	Percent change in annual volume of alcohol purchased				Percent change in alcohol purchased per drinking occasion			
	All	Low Risk	Increased Risk	Harmful	All	Low Risk	Increased Risk	Harmful
Minimum price of $1.00	-2.4	-2.6	-2.3	-2.2	-1.0	-0.7	-1.1	-1.5
Minimum price of $1.10	-3.4	-3.7	-3.3	-3.1	-1.5	-1.1	-1.6	-2.1
Minimum price of $1.20	-4.7	-5.1	-4.6	-4.4	-2.1	-1.5	-2.3	-3.0
Excise increase of 82%	-12.2	-11.5	-11.8	-13.1	-8.6	-5.5	-9.7	-10.8
Excise increase of 107%	-15.8	-15.0	-15.3	-17.0	-10.8	-6.7	-12.2	-13.6
Excise increase to achieve minimum price of $1.20 on lowest priced beverages	-19.5	-18.6	-18.8	-21.0	-13.3	-8.3	-15.0	-16.7

Source: Estimated by the Ministry of Justice

Table 3 provides a summary of the impact of the pricing policies on consumers' surplus, industry revenue, Government revenue, and alcohol-related health, crime and workplace productivity harms, along with the overall net effect on society in year 1. The table provides links to the particular methodology and results sections in the report. Table 4 provides the cumulative discounted savings and costs over a ten year period.

Table 3: Impact of the price increases and consumption changes in year 1 ($m)

Impacts	Notes	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ 82%	Excise ↑ 107%	Excise ↑ 133%
Consumers' surplus[2]	Refer Section 8.3 for methodology Refer Section 10.2 for detailed results	-$90	-$129	-$180	-$763	-$971	-$1,188
Transfer of consumers' surplus to industry / Government	Refer Section 8.4 for methodology Refer Section 10.3 for detailed results	$86	$122	$167	$717	$893	$1,066
Industry asset value	Refer Section 8.4 for methodology Refer Section 10.3 for detailed results	-$1	-$1	-$2	-$6	-$8	-$10
Change in Government revenue from reduced demand	Refer Section 8.5 for methodology Refer Section 10.4 for detailed results	-$18	-$25	-$35	-$84	-$111	-$137
Alcohol-related health savings	Refer Section 4 and Section 5 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$11	$16	$23	$83	$104	$129
Alcohol-related crime savings	Refer Section 4 and Section 6 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$45	$66	$94	$332	$420	$516
Alcohol-related workplace productivity savings	Refer Section 4 and Section 7 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$9	$13	$19	$60	$77	$95
NET EFFECT ON SOCIETY	Refer Section 8.4 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$44	$63	$86	$339	$404	$472

[2] Consumer surplus is the difference between what a consumer is willing to pay for an alcohol product and the market price of the product.

Table 4: Cumulative discounted impact of the price increases and alcohol consumption changes over a ten-year period ($m) (discounted at a rate of 8%)

Impacts	Notes	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ 82%	Excise ↑ 107%	Excise ↑ 133%
Consumers' surplus	Refer Section 8.3 for methodology Refer Section 10.2 for detailed results	-$655	-$945	-$1,315	-$5,578	-$7,097	-$8,677
Transfer of consumers' surplus to industry / Government	Refer Section 8.4 for methodology Refer Section 10.3 for detailed results	$630	$895	$1,219	$5,242	$6,521	$7,791
Industry asset value	Refer Section 8.4 for methodology Refer Section 10.3 for detailed results	-$6	-$9	-$13	-$44	-$57	-$71
Change in Government revenue from reduced quantity demanded	Refer Section 8.5 for methodology Refer Section 10.4 for detailed results	-$127	-$181	-$254	-$612	-$802	-$994
Alcohol-related health savings	Refer Section 4 and Section 5 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$83	$120	$170	$615	$772	$952
Alcohol-related crime savings	Refer Section 4 and Section 6 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$324	$474	$676	$2,381	$3,010	$3,703
Alcohol-related workplace productivity savings	Refer Section 4 and Section 7 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$70	$100	$142	$447	$577	$712
NET EFFECT ON SOCIETY	Refer Section 8.4 for methodology Refer Section 10.6 and Appendix 4 for detailed results	$318	$454	$624	$2,452	$2,923	$3,416

Over a ten-year period, a minimum price of $1.00 or $1.20 per standard drink results in net benefits to society of $318 million and $624 million respectively, while excise increases of 82% and 133% result in net benefits to society of $2.5 billion and $3.4 billion respectively over a ten year period. The estimated savings are likely to be conservative as they are based on international estimates of price responsiveness that are much more conservative than New Zealand estimates generated as part of this analysis, and only include some of the harms alcohol imposes upon others.

Our analysis concludes that all pricing options are effective, with an excise increase up to 133% generating positive savings for society. Excise increases up to 133% result in much larger benefits to society compared with a minimum price. This is because an excise increase affects the price of all alcohol (not just low price alcohol) and therefore more significantly impacts consumer behaviour.

However, the distribution of the impacts must be considered when determining the optimal pricing policy. A minimum price is estimated to have a greater impact on low risk drinkers compared to harmful drinkers, while an excise increase has a greater impact on harmful drinkers. The minimum price options benefit the alcohol industry, but reduce Government revenue, while the excise options have a negative impact on the alcohol industry but significantly increase Government revenue.

Trade-offs need to be made when determining what pricing option to implement and variations of the options analysed could also be considered. One possibility is to increase excise and impose a minimum price, which would primarily raise revenue for the Government and set a price floor for the alcohol industry. Such an option could lessen the negative impact of an excise increase on the alcohol industry as a portion of the revenue generated from a price increase on low price products below the minimum price level would be transferred to the alcohol industry.

There are a number of implementation issues that need to be considered if a minimum price is introduced. These include where in the alcohol industry supply chain a minimum price should be set and the most effective means of monitoring and enforcing the regime.

Potential unintended consequences of a price increase include the impact on market structure and competition (in particular the concern that producers may be negatively impacted if the revenue gained from a minimum price is not shared along the supply chain), the changes in product mix available, the potential increase in unregulated home brew, the risk of substitution to more harmful substances, and the negative impact on the budget of low-income families.

Overall, any price increase will effectively reduce harmful alcohol consumption and alcohol-related harm. A minimum price or excise increase would have some impact on low risk drinkers, but the savings to society significantly outweigh the lost benefits to consumers. Although we have modelled behaviour based on substantial excise increases, smaller excise increases would also have net benefits.

1.4 Limitations of the analysis

Some of the limitations of the analysis are outlined below. For a more detailed explanation of the limitations see Section 13.7 below.

Limitations of the International Alcohol Control survey

The *International Alcohol Control (*IAC) survey does not have data for people aged over 65 years. In an earlier survey, the SHORE and Whariki Research Centre found that overall consumption among people aged 65 years and older was 78.5% of that for the population aged 40 to 65 years, and that maximum consumption per occasion was 69.9% of that for the population aged 40 to 65 years. It was assumed that the same proportions of the 65 plus population were in each consumption group (low risk, increased risk and harmful) as for the 45 to 64 year age group, but that in each subgroup

the average daily and maximum per occasion volumes were 78.5% and 69.9% (respectively) of the volumes observed for the equivalent group in the 45 to 64 year age group.

Suitable data was not available for 16 and 17 year olds, so this group was excluded from the analysis. As this group is unlikely to be purchasing alcohol, excluding this group is not considered to be a significant problem, although there is abundant evidence that this group does suffer alcohol-related harms and their exclusion will therefore have the effect of underestimating the harms from alcohol.

Another concern about the IAC survey is its size. When divided into age and gender subgroups, the sample numbers are very small. The confidence intervals for the proportions of different types of drinker and the amount consumed are very large. Given that these are critical inputs to the analysis, the results are very sensitive to the proportions of different types of drinker and the amount they consume.

The IAC survey does not appear to under-report alcohol consumption, which is usually a problem with such surveys, but this may raise concerns given that the consumption data are combined with relative risk data that are based on reported, and therefore likely underestimated, consumption.

Low price spirits at on-licences

The excise increases resulted in negative purchase results for low price spirits at on-licences, that is, purchases reduced beyond zero standard drinks. Therefore purchase decreases were capped at zero purchases so that there was a 100% reduction in the purchase of low price spirits at on-licences for the excise options. As only a very small proportion of beverages sold are low price spirits, this does not have a significant effect on overall purchase changes.

For the analysis of impacts on consumer benefits, industry revenue and Government revenue low price spirits at on-licences were removed due to the low absolute volumes and because some drinks appeared to be being sold below the cost of the excise tax on them (which suggests maybe data collection issues). Also the consumption change analysis seems unrealistic due to the very large price changes that would occur (that is, modelling extremely large price changes is problematic because the elasticities used are point elasticities that become less reliable the larger the price change).

Specification

Despite being a relatively standard approach to a cost-benefit analysis, from an econometrics perspective the health model has misspecification problems. It has omitted variables, endogeneity problems because it is a partial equilibrium model in which we are modelling demand and not supply, autocorrelation, and correlation between the regressors and the error term.

For all the harm models there is the possibility that the functional form and slope of the relative risk functions are mis-specified (for example, most functions are assumed to be linear). The savings in alcohol-related harm generated are highly sensitive to the form and specification of the relative risk function.

Purchase verses consumption

The percentage change in consumption is based on purchasing data from *the International Alcohol Control* (IAC) survey. It is likely that alcohol purchases do not match consumption, with consumption levels being lower than the amount purchased. It is therefore possible that the percentage change in consumption may have been over-estimated.

Use of overseas price elasticity data

We were not able to obtain reasonable estimates of the responsiveness of New Zealand consumers to changes in the price of alcohol (New Zealand alcohol price elasticities). The estimates provided were about three times as large as international estimates, resulting in considerable reductions in consumption for a small price change. We were also not able to derive estimates of responsiveness for different types of drinker.

The University of Sheffield elasticities were used as they are similar to other international estimates and are provided for different types of drinker. These are based on UK consumer purchasing patterns, which may differ from NZ consumer consumption patterns. However, in the absence of reliable NZ estimates, the University of Sheffield estimates are the best option. There are other limitations with the University of Sheffield elasticity estimates. These are discussed in detail in Section 3.6 below.

Changes in price relativities not estimated

It was also not possible to estimate the relative impact of each of the price changes on the quantity of other beverages demanded. The price increase of each beverage was analysed separately. Therefore it is possible that the effects on consumption may have been under-estimated if the relative price changes were smaller than the absolute price change. This is because consumers are less likely to substitute between products if the price of all beverages increases.

Inconsistencies in the price responsiveness of harmful drinkers

Our finding that an excise increase of 133% has a greater impact on harmful drinkers than low risk drinkers is inconsistent with findings in studies such as Wagenaar et al (2009), which found that heavy drinkers are much less responsive to price changes. The University of Sheffield also found that harmful drinkers are much less price responsive than low risk drinkers when total alcohol consumption was considered, rather than consumption by beverage type. We cannot, therefore, conclude with confidence that excise increases will have a greater impact on harmful drinkers compared to moderate drinkers. More research is needed to confirm this, which could be done once revised University of Sheffield estimates of consumer responsiveness to price changes are available next year.

Responsiveness of consumers during a drinking occasion

We also do not have separate estimates of consumers' price responsiveness during per occasion drinking. Recent evidence indicates that people are much less responsive to price increases during drinking occasions (Byrnes, 2012). Therefore, it is possible the effects on per occasion consumption have been over-estimated.

Not all costs and benefits can be quantified

It has not been possible to take into account the impact of alcohol pricing policies on all alcohol-related costs and benefits. In particular, we have not been able to quantify all of the more intangible, psychological and emotional harm alcohol consumption imposes on others. We have also not been able to quantify all of the positive externalities alcohol consumption may generate, such as social lubrication effects and the building of social capital.

1.5 Possible further research

This is the first study of this kind in New Zealand, where various models are integrated to determine the overall welfare effect on society of different alcohol pricing options. The models link aspects of price, drinking patterns, purchase patterns, elasticities, and various types of alcohol-related harms. The analysis was undertaken with limited resources in a limited timeframe. The analysis could be refined and enhanced as new information comes to hand, but it would require a team of people who are dedicated to this work to keep refining and improving the analysis.

In undertaking this research, we attempted to obtain New Zealand price elasticities to determine how responsive different types of New Zealand consumers are to changes in the price of alcohol. Unfortunately, due to limitations with the data available, it was not possible to derive plausible elasticity estimates and the University of Sheffield estimates were used instead. If more time had been available it may have been possible to explore other survey options or to undertake a specific survey over an extended period of time to collect the data necessary to derive robust elasticity estimates. This is something the Government could consider doing in the future.

The University of Sheffield will be releasing new elasticity estimates next year. The modelling undertaken as part of this research could be redone with these new elasticities if time and resources are available.

The development of methods to estimate relative risks or attributable fractions for outpatient events in New Zealand would be useful. Consumption data with sufficient power in all age groups using measures that are appropriate or the application of relative risk data and development of an accurate set of relative risks for acute causes would also be useful. Future work should also identify the impact of policy changes on years of life and/or quality adjusted life years lost due to alcohol in order to understand the relative impact of interventions that affect the consumption patterns of younger or older drinkers.

An important advance will be the development of methods to model the cost of harm from other people's drinking using a similar relative risk function approach. This research is needed not just for New Zealand, but internationally, and New Zealand is now well-placed to lead this research given its early experience with alcohol policy modelling and surveying harms from other people's drinking.

Further research and analysis to develop marginal estimates of the costs of crime would be useful as would more up to date New Zealand studies on the impact of harmful alcohol consumption on workplace productivity.

This study has produced results that will be useful in informing policy decisions. Studies of such an ambitious nature have been conducted in few countries, usually well supported by large academic teams and multi-year funding arrangements, and methods are still new and evolving. Despite its limitations, these results represent an evidence base more thorough than any previously available to alcohol policy decision makers in New Zealand.

2. Introduction

There is significant public concern about the impact of excessive alcohol consumption on public health and crime. Heavy drinking results in a wide range of individual and social costs such as liver disease, gastritis, assaults, sexual offending, family violence and road trauma to name a few. The social costs from the harm associated with heavy drinking places a significant burden on justice, health and social services.

Two recent reports on the costs of alcohol came to vastly different conclusions. The "Costs of Harmful Alcohol and Other Drug Use" was released by BERL in March 2009, commissioned by ACC and the Ministry of Health. BERL estimated that harmful alcohol use in New Zealand cost an estimated $4.4 billion of diverted resources and lost welfare (in 2005/06 dollars).

The BERL report was heavily criticised in a report by Matt Burgess and Eric Crampton from the University of Canterbury: "The Price of Everything, the Value of Nothing: a (Truly) External Review of BERL's Study of Harmful Alcohol and Drug Use". After correcting for BERL's many alleged methodological errors, the report found external costs of alcohol to be $967 million. The range of estimates is so great due to the different underlying assumptions upon which the analyses are based.

In 2010, the Law Commission released a report entitled "Alcohol in Our Lives: Curbing the Harm". The report recommended comprehensive changes to New Zealand's regulatory framework for the sale and supply of alcohol, centred on a philosophy of harm reduction. The Government accepted the majority of the Law Commission's recommendations and the Alcohol Reform Bill was drafted. This Bill was passed on 18 December 2012. The Sale and Supply of Alcohol Act 2012 came fully into force on 18 December 2013.

The objectives of the Sale and Supply of Alcohol Act are to:

- Reduce excessive drinking by young people and adults
- Reduce the harm caused by alcohol use
- Support safe and responsible sale, supply and consumption of alcohol
- Improve community input into local alcohol licensing decisions, and
- Improve the operation of the licensing system.

Key features of the Act include:

- Restricting supermarkets and grocery stores to displaying alcohol in a single area
- Strengthening rules around the types of stores eligible to sell alcohol
- Introducing maximum default trading hours for licensed premises, and
- Increasing the ability of communities to have a say on alcohol licensing.

On the 9th August 2010, the Government agreed to reject the Law Commission's excise tax recommendations (remove excise tax from low-alcohol products and raise excise tax on all other alcohol by 50 per cent), but did agree to monitor overseas developments on minimum pricing regimes and to explore non-regulatory options for obtaining price and sales data from alcohol retailers to inform consideration of a minimum price regime.[3]

On the 7th September 2011, the Cabinet Domestic Policy Committee agreed that the Ministry of Justice continue work to obtain and analyse more detailed retail alcohol price and sales data to

[3] Refer Cabinet Minute (10) 28/8

inform investigation of a minimum price regime for alcohol and directed the Ministry of Justice to provide an assessment of the effectiveness and impact of a minimum price regime for alcohol.[4]

2.1 The purpose of this report

The purpose of this report is to investigate the impact and effectiveness of a minimum price regime in reducing harmful alcohol consumption. The objectives of this research are to:

1. Determine the impact of a minimum price on:
   - consumers
   - alcohol-related health, crime, and workplace productivity harms
   - the alcohol industry and,
   - the Government.
2. Ascertain the most effective minimum price level to reduce harmful consumption without unduly affecting low risk consumption.
3. Determine whether the impact of a minimum price could be achieved by excise tax increases, and assess the advantages and disadvantages of a minimum price compared to excise tax increases.

This report considers the appropriate balance between the loss of benefits that low risk or moderate alcohol consumers suffer as a result of the constraint on their behaviour due to the pricing regulations, and the benefits society obtains as a result of reduced alcohol-related harms if the proportion of the population consuming at harmful levels is reduced as a result of a price increase.

To estimate the benefits associated with reduced harmful alcohol consumption following an increase in the price of alcohol, savings in the following alcohol-related harms are estimated:

- Health-related harms
- Crime-related harms
- Workplace productivity harms.

The methodology used to estimate these savings is outlined in Sections 3 to 7 below. The method used to consider the impact on the alcohol industry and Government of pricing policies is outlined in Section 8. Section 9 outlines the methodology for estimating the overall net effects of a pricing policy on society. Sections 10 and 11 provide the results from the analysis. Section 12 provides the results of the sensitivity analysis, and Section 13 discusses the results.

2.2 Perspective taken in the analysis

A societal perspective is taken in the analysis. We assume that individuals are able to decide what level of alcohol consumption is appropriate for them by weighing up the costs and benefits to themselves of different levels of alcohol consumption.

It could be argued that some alcohol consumers are irrational or 'addicts' and are therefore unable to adequately assess the harm they may be imposing upon themselves from excessive drinking. Another reason that has more recently been postulated for alcohol pricing regulations is the idea of "internalities" or "time-inconsistent decision making". The idea, based on concepts from behavioural economics, is that decision-making is more complex than pure rationality and that some people make decisions that later they regret. For example, a person may go to a bar planning on having a couple of drinks but ends up drinking half a dozen, regretting they do so in the morning. The individual's decisions are not consistent with rational decisions through time (Easton, 2012). In such

[4] Refer Cabinet Minute (11) 33/3

cases, pricing regulations may help people consume the optimal amount of alcohol based on their 'true' desire and provide a way to constrain behaviour.

For the purposes of this analysis we have assumed that all consumers are rational as it is very difficult to obtain precise information about the harm that individuals may be inflicting on themselves in excess of their expectations about self-harm. Rationality is a conservative assumption as we include lost benefits to harmful consumers that would not be included if we assumed they were irrational.

This analysis is concerned with reducing the negative externalities that harmful consumption imposes upon others in society. Alcohol consumption imposes harms on others that individual consumers do not fully consider when deciding to consume alcohol. These harms include costs to the health sector, costs of crime, lost productivity, family problems and so on. The existence of such costs means the social cost of alcohol consumption is greater than the cost facing individual consumers. This leads to inefficiencies in the alcohol market as the level of consumption is too high from a societal perspective. Alcohol pricing mechanisms, such as a minimum price or an excise tax, are a means of internalising these external costs.

2.3 The rationale for pricing policies

Appendix 1 provides an overview of the market for alcohol in New Zealand. It provides data on the proportion of harmful drinkers in NZ and examines the growing price differential between on-licences and off-licences. It also discusses the structure of the alcohol market and the consequent effects on market power, competition and profitability.

Alcohol is very affordable at its lowest price. Currently, the safe limit for adult male consumption can be reached for less than five dollars (based on the price of gin on special), while a can of low quality beer can be bought for the same price or even less than a can of Coca-Cola. Such low prices can encourage harmful or hazardous drinking, particularly among young people.

A minimum price is advocated on the assumption that imposing a minimum price will reduce consumption among young drinkers and harmful drinkers, without unduly impacting low risk drinkers. International evidence shows that increasing the price of alcohol reduces alcohol consumption, so price is an effective lever for influencing harmful consumption and reducing alcohol-related harm.

A minimum pricing policy may be justified if consumption of very cheap alcohol is associated with higher marginal external costs than more expensive products (although increases in alcohol taxes would also have a relatively larger effect on cheaper products). A minimum pricing policy would prevent alcohol retailers engaging in deep discounting and below-cost sale strategies. However, minimum pricing could raise the price of some alcohol products above the market equilibrium price, increasing revenue for the alcohol industry and resulting in a surplus of some products in the market.

Taxes on alcohol are justified as externality-correcting taxes. They signal the social costs alcohol consumers are imposing at the margin (the negative externalities) so that consumers internalise these costs and reduce the amount of alcohol consumed. Therefore alcohol taxation may help to achieve an efficient allocation of resources in society. Setting the optimal tax rate involves a trade-off between the loss of welfare for moderate low risk drinkers against the gains to society from reductions in alcohol-related harm.

The effectiveness of alcohol excise increases also depends on the extent to which the tax is passed onto the consumer. It is recognised that in the short term it is unlikely that there will be a 100% pass through to the consumer. However, this will be achieved in the long term, as it would be unsustainable for producers to continue to absorb the costs into the future.

Both minimum pricing and alcohol excise taxes negatively impact low risk drinkers, who do not impose harms on others in society from their drinking but would have to pay a higher price for alcohol. This leads to inefficiencies in the market as low risk drinkers reduce their consumption of alcohol due to the price increases. These inefficiencies need to be weighed up against savings to society from reduced alcohol-related harm to determine the optimal pricing policy.

Wagenaar et al (2009) conducted a systematic review of studies examining the relationships between measures of alcohol tax or price levels and alcohol sales or self-reported drinking. They looked at a total of 112 studies and found that alcohol prices and taxes are related inversely to drinking. The effects they found are large compared to other prevention policies and programmes and concluded that "public policies that raise prices of alcohol are an effective means to reduce drinking" (p.179).

Wagenaar et al also noted that the magnitude of the price effects varies across groups, situations and times. For example, price interacts with income affecting consumption; the effects of price may vary with different consumption levels; and price effects may reflect different uses of alcohol across diverse social and cultural environments.

In 2008, the University of Sheffield did a systematic review of the effects of alcohol pricing and promotion (Booth et al, 2008). The review found strong evidence linking the price of alcohol to the demand for alcohol, that is, increasing the price of alcohol reduces consumption and alcohol-related harm. The strongest evidence was found for effects of increased prices on total population-level consumption, although evidence also showed effects of increased prices on subpopulations, including young, binge and heavy drinkers. Most of the studies reviewed looked at the impact of price increases in relation to taxation, with fewer studies focusing on other pricing policies.

2.4 International developments in minimum pricing

There are very few examples of minimum pricing being adopted in practice, but a form of minimum pricing has operated in eight of the ten Canadian provinces since the late 1990s. Little research has been undertaken on the impact of a minimum pricing policy on alcohol pricing, consumption and harm in Canada.

However, recent evidence indicates that minimum pricing in one Canadian province has been effective in reducing alcohol consumption. An analysis of time-series and longitudinal models of aggregate alcohol consumption with price indicated that a simultaneous 10% increase in the minimum prices of all types of beverages reduced total consumption by 3.4%. The report concluded that minimum prices of alcoholic beverages can reduce alcohol consumption (Stockwell, 2012).

Another report examining the impact of an increase in minimum prices in Saskatchewan, Canada found that a 10% increase in minimum prices significantly reduced consumption of alcohol by 8.43%, with larger effects for off-licences than on-licences and a greater impact on the consumption of higher strength beer and wine (Stockwell et al, 2012).

In 2008 and 2010, the University of Sheffield developed an "Alcohol Policy Model" to assess the likely impact of a minimum price on consumption and alcohol-related harm. The work was commissioned by the English and Scottish Governments. The Sheffield study suggests that significant savings are possible for health, crime, and employment-related costs (Brennan et al, 2008); (Purshouse, Meng et al, 2009). The Scottish models were updated in 2010 and 2012.

This year the Scottish Government announced plans to impose a minimum price per unit of alcohol. A minimum price of 50p per standard drink was meant to apply from April 2013 and remain in place for at least two years to allow the market to react and settle before the price is reviewed. The legislation contains a sunset clause allowing a minimum price to be abolished in six years if the policy fails.

However, the Scotch Whisky Association and the European Spirits Organisation have taken legal action seeking to have the law abandoned. The industry argues that the minimum price law is an area of policy reserved for Westminster and therefore outside the jurisdiction of the Scottish Government and that it is incompatible with European trade laws. The Scottish Government argues that the law is a public health measure, which is within the Scottish Parliament's powers. The Government also argues that measures to tackle serious public health problems are exempt from competition regulations. The Scottish Government has also received opinions from European Commission (EC) member countries and the Commission itself that question the compatibility of minimum pricing with EC community laws.

The UK Government recently introduced a ban on selling alcohol below duty plus VAT, which came into force in April 2014.

In Australia, the Australian National Preventative Health Agency was tasked with investigating a minimum price of alcohol in Australia, because of increased public interest. In November 2012, the Agency presented a draft report, which recommended that a minimum price not be adopted nationally at this time. This was mainly due to inadequate data being available to analyse the impact of a minimum price at a national level and also the concern that a minimum price would result in monopoly rents for the alcohol industry. The Agency is recommending that local governments and territorial authorities consider implementing a minimum price where it could be effective, and is also recommending alcohol tax reform to ensure all beverages are taxed on a volumetric basis.

2.5 Previous New Zealand studies

Over the last thirty years, several studies in New Zealand have measured the burden of disease and costs associated with alcohol (Ashton and Casswell, 1984);(Rayner and Chetwynd, 1987);(Connor, Broad, Rehm et al, 2005);(Chetwynd and Rayner, 1985; Easton, 1997a; Easton, 1997b);(Chetwynd and Rayner, 1985);(Jones, Casswell and Zhang, 1995);(Devlin, Scuffham and Bunt, 1997b);(Miller and Blewden, 2001).

Most recently, Connor and colleagues estimated the burden of disease due to alcohol in New Zealand, separately estimating the impact on Māori and non-Māori, using the Global Burden of Disease study methods (Connor, Broad, Jackson et al, 2005), and BERL estimated the social cost of the harmful use of alcohol and other drugs (BERL, 2009). Both these studies have limitations, but they do lay some of the groundwork for further research.

To date there have been no attempts at economic evaluations of alcohol policy interventions in New Zealand. This study breaks new ground by employing cutting-edge new techniques and building on previous New Zealand research to estimate the potential impacts of changes in alcohol pricing policy.

2.6 University of Sheffield Alcohol Policy Model

In 2008, the School of Health and Related Research (ScHARR) at the University of Sheffield modelled the potential impact of pricing and promotion policies for alcohol in England for the UK Department of Health Policy Research Programme. This model was updated in 2009 and is known as the *Sheffield Alcohol Policy Model.* In 2009, ScHARR was asked to adapt the English version of the model to a Scottish population.

The aim of the project was to model the potential impacts of changes to policies, especially the population-based impact on health, crime and the wider economy, for the population as a whole and also with a focus on young people, 18 to 24 year old binge drinkers, and harmful drinkers whose patterns of drinking damage their physical or mental health or cause substantial harm to others.

Drinkers were classified as moderate, hazardous or harmful drinkers. Individuals were also classified as “binge drinker” based on the maximum intake of alcohol during a single session. The study examined alcohol-related harm in terms of health, crime and employment.

The research study made use of two detailed individual-level population survey datasets. One provided data on alcohol consumption and the other on alcohol purchasing, including the price paid. Purchasing data was used to generate own-price and cross-price elasticities for 16 different categories of alcohol.

The modelling undertaken analysed 53 separate scenarios to examine the impact of various policies around pricing and advertising of alcohol on health, crime, and employment-related harms. It was found that general price increases (to all products in the on-licence and off-licence sectors at once) tend to exhibit relatively large reductions in mean consumption for the population. Policies targeting price changes specifically on low-price products lead to smaller changes in consumption, as they only cover a part of the market. Targeting low price products also causes some switching between products.

The analysis also found that price increases are not matched by consumption reductions and overall spending on alcohol is estimated to increase. Changes in spending per drinker for each policy were found to be broadly proportionate to the price increase. Those who buy more alcohol are disproportionately affected, and changes in spending affect mostly harmful drinkers.

The societal value of harm reduction for many of the policies examined was found to be substantial when accumulated over the ten year time horizon of the model. Many of the policies had estimated reductions in harm valued at over £500 million and some as high as £5 billion over the ten year period. The financial value of harm reductions was larger as prices increased.

A critique of the Sheffield study was provided by the Centre for Economics and Business Research (CEBR) in 2009. The key issues raised were that the Sheffield report lacks strong evidence on the relationship between alcohol consumption and harm in several key areas, including crime. They questioned the assumption made about a linear relationship between alcohol consumption and harm, noting that in the case of crimes, it seems likely that at high levels of alcohol consumption there is a diminishing propensity to cause crime.

CEBR also queried Sheffield’s results that price changes have a greater proportionate impact on the overall consumption of hazardous and harmful drinkers than moderate drinkers, given that moderate drinkers are more responsive to price changes (CEBR, 2009).

3. Methodology

To determine the effectiveness of different pricing options, the following effects should be considered:

- The effect of the pricing policy on the distribution of price of different types of alcohol
- The effect of the pricing policy on consumption at both on-licence and off-licence premises
- The effect of price-based promotions on consumption and associated benefits from alcohol consumption
- The effect of alcohol consumption on health-related harm for diseases that are wholly attributable to alcohol or partially attributable to alcohol consumption
- The effect of consumption on crime
- The effect of consumption on workplace productivity
- The effect of consumption on harm to others such as family members and friends
- The effect of changes in consumption on volume and value of sales of alcohol and therefore profits to the alcohol industry and tax revenues to the Government.

Evidence is needed about the size of each of the effects that is specific to the New Zealand context. This depends on the availability of New Zealand data. For some of the effects identified above (namely the effect of price-based promotions and the effect of consumption on harms to others), it is not possible to derive realistic estimates because of a lack of data or evidence.

The general approach to modelling was to follow many of the methods described in the University of Sheffield *Alcohol Policy Models* for England and Scotland. The Sheffield approach is considered the leading method for analysis of alcohol policy proposals and as such was without rival in terms of selecting an overall approach. However, there remained the potential for differences in the details as to how the New Zealand models could be developed. In some cases the chosen approach differed from that used in the Sheffield study.

3.1 Modelling the effects of changes in alcohol pricing

To analyse the various effects of different pricing options, five inter-connected models have been built:

1. A model of the relationship between alcohol prices and purchases (both in terms of average annual volumes purchased and the amount purchased on a typical drinking occasion). The model is developed for the total population and by age group and gender for the following drinker types: low risk, increased risk, and harmful drinkers.[5] This model uses estimated own-price and cross-price elasticities for on-licence and off-licence purchases.
2. A model of the link between average daily consumption and the maximum number of drinks consumed on a typical drinking occasion and alcohol-related health costs.
3. A model of the link between average daily consumption and the maximum number of drinks consumed on a typical drinking occasion and alcohol-related crime costs.

[5] The drinker types are defined below.

4. A model of the link between average daily consumption and the maximum number of drinks consumed on a typical drinking occasion and alcohol-related workplace productivity costs.
5. A model of the link between average sales volumes and average value of alcohol sales and consumers' surplus, profits to the alcohol industry and tax revenues to the Government.

3.2 Types of drinker analysed

To assess the effects of price changes on consumption patterns, drinkers were grouped into different categories based on the amount of pure alcohol consumed on average on a daily basis, and the maximum amount consumed on a drinking occasion (with a standard drink defined as 12.5ml pure alcohol). The average volume consumed on a daily basis gives an indication of the risk of chronic harm (such as heart disease, liver disease, unemployment and so on), while the maximum amount consumed on a drinking occasion gives an indication of the risk of acute harm (such as injuries, criminal behaviour, and absenteeism from work).

Drinkers were categorised as low risk, increased risk or harmful drinkers depending on their level of consumption. The thresholds for the different drinker categories were determined in consultation with the Ministry of Health, the Health Promotion Agency, the SHORE and Whariki Research Centre at Massey University, and Susan Joy (an independent Health Economist). It was agreed that thresholds would be based on evidence presented in the *Australian Guidelines to Reduce Health Risks from Drinking Alcohol* (National Health and Medical Research Council, 2009).

In terms of average daily consumption the following drinker categories are used:

- *Low risk:* up to 2 drinks per day (men and women).
- *Increased risk:* 2 to 6 drinks per day for men and 2 to 5 drinks per day for women.
- *Harmful:* 6+ drinks per day for men and 5+ drinks per day for women.

In terms of maximum consumption on a drinking occasion the following drinker categories are used:

- Low *risk:* up to 4 drinks on an occasion (men and women) OR 4 to 6 drinks on an occasion less than once a week (men and women).
- *Increased risk:* 4 to 6 drinks on an occasion at least once a week (men and women) OR 6 plus drinks on an occasion less than once a week (men and women).
- *Harmful:* 6 or more drinks on an occasion at least once a week (men and women).

Figures 1 and 2 show the proportion of drinkers based on daily volumes consumed and maximum quantities consumed on a drinking occasion by age and gender. Appendix 2 provides data on consumption levels for each type of drinker by age and gender. The consumption data is based on data from the *International Alcohol Control Survey (IAC)*, which was conducted by the SHORE and Whariki Research Centre at Massey University. The survey was conducted in 2011 and is based over a six month period. It provides an analysis of data from a population sample of 2,014 drinkers aged 16 to 65 years. As the sample size for 16 and 17 year olds was very small, only those over the age of 18 years were included in the analysis. The IAC survey only included people up to the age of 64 years. In an earlier survey, the SHORE and Whariki Research Centre found that overall consumption among people aged 65 years and older was 78.5% of that for the population aged 40 to 65 years, and that maximum consumption was 69.9% of that for the population aged 40 to 65 years. It was assumed that the same portion of the 65+ population was in each consumption group as for the 45 to 64 age group, but that in each subgroup the average and maximum volumes were 78.5% and 69.9% (respectively) of the volumes observed for the equivalent group in the 45 to 64 age group.

Data in the IAC survey was collected between July and October 2011 using a computer assisted telephone interviewing system. The response rate was 60%. The survey collected comprehensive consumption data and other policy relevant variables including price and purchasing behaviour. The

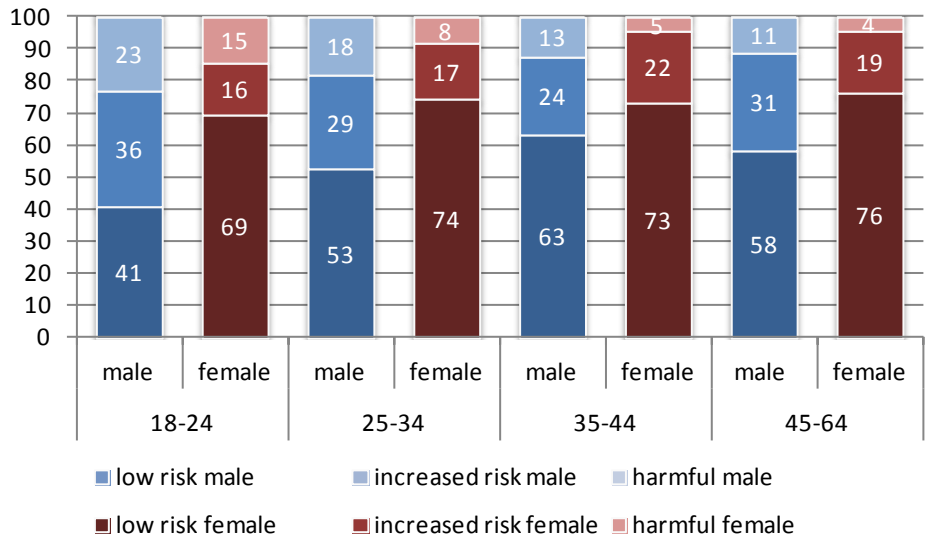
consumption data allows for disaggregation by different drinking patterns and volumes. Purchasing and price data are available by beverage for a range of off-licence premises (and provides linked data between consumption and purchasing and price for each drinker in the sample, which has not been available internationally previously).

A further advantage of the IAC survey is that it utilised a within location-beverage specific measure to collect consumption data. First respondents were asked if they had consumed alcohol at specific locations in the last six months. For each location in which consumption of alcohol had taken place, respondents were then asked questions about how much and how often they drank at each location. Respondents reported quantities of alcohol they consumed in their own terms and those were coded by interviews using the wide range of containers commonly used to serve and sell beverages in New Zealand. Respondents were prompted to recall all beverages consumed on a typical drinking occasion.

The annual volume of absolute alcohol consumed in each location by an individual was calculated by summing the volumes of absolute alcohol consumed on a typical drinking occasion for each location, multiplied by the frequency of drinking at that location. The annual volume of total absolute alcohol consumed by an individual was estimated using the sum of the annual volume of absolute alcohol consumed at each location.

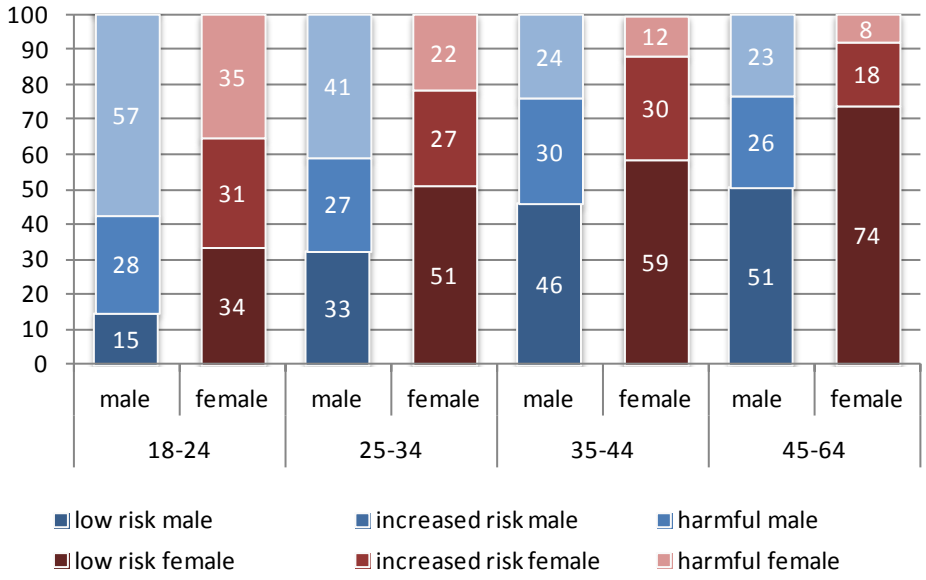
This measure has previously been found to have a high level of validity (Casswell, Huckle and Pledger, 2002);(Wyllie, Zhang and Casswell, 1994). That is, the amount of alcohol consumed that the measure accounts for corresponds very well to the amount of alcohol consumed in the real world; it has good coverage (around 90% of the alcohol available for consumption). This is beneficial as most surveys internationally underestimate real world consumption by around 40 to 60%.

Figure 1: Proportions of the different types of drinker based on average daily consumption, by age and gender



Source: SHORE and Whariki Research Centre, International Alcohol Control Survey, 2011

Figure 2: Proportions of the different types of drinker based on maximum consumption per occasion, by age and gender



Source: SHORE and Whariki Research Centre, International Alcohol Control Survey, 2011

3.3 Modelling the link between price and alcohol consumption

To model the link between price and consumption, price elasticities need to be estimated to show the responsiveness of consumers to changes in the price of alcohol. Numerous international studies have examined the relationship between price and alcohol consumption.

Gallet (2007) and Wagenaar et al (2009) conducted extensive meta-analyses of alcohol demand estimations. Gallet covered results from 132 international studies from 1942 to 2002; Wagenaar et al (2009) looked at 112 studies from 1972 to 2007, again across multiple English-speaking countries. There is quite a bit of overlap between the studies. Table 5 presents a summary of elasticities from these studies as well as the elasticities from the University of Sheffield study discussed in Section 2.6 above.

Table 5: Summary elasticity estimates from across countries

Research	Territory	Mean / median elasticity	Elasticity for moderate drinkers	Elasticity for heavy drinkers
Gallet 2007	**International**	-0.54		
Wagenaar et al 2009	**International**	-0.51	-0.62*	-0.28
University of Sheffield 2008	**UK**	-0.40*	-0.47	-0.21

*Implied elasticities

In general, demand for alcoholic beverages is inelastic to price changes, so that an increase in price results in a less than proportionate decrease in consumption. Heavier drinkers are generally less responsive to price changes than moderate drinkers, in terms of their overall consumption as they are more likely to substitute from one alcoholic product to another when the price of a beverage changes.

A recent Australian study by Byrnes et al (2012) analysed the effect of increasing the price on high intensity drinking. Self-reported patterns of alcohol consumption and demographic data were obtained from the Australian National Drug Strategy Household Surveys conducted in 2001, 2004 and 2007. A pooled three-stage least-squares estimator was used to simultaneously model the impact of the price on the frequency (measured in days) of consuming no, low, moderate and high quantities of alcohol.

The study found that a 1% increase in the price of alcohol was associated with a statistically significant increase of 6.41 days per year on which no alcohol is consumed, and a statistically significant decrease of 7.30 days on which one to four standard drinks are consumed. However, there was no statistically significant change for high or moderate-intensity drinking. The authors concluded that "for Australia, and countries with a similar pattern of predominant high-intensity drinking, taxation policies that increase the price of alcohol and are very efficient at decreasing harms associated with average consumption may be relatively inefficient at decreasing alcohol harms associated with high-intensity drinking" (Byrnes et al, 2012, p.1).

3.4 Estimating price elasticities for the demand for alcohol in New Zealand

To adequately assess the effects of various pricing options on the demand for alcohol in New Zealand, both off-licence and on-licence alcohol price elasticities need to be estimated by beverage type (beer, wine, spirits and RTDs). To take account of the potential substitution between high and low price products within a given beverage category, it is also desirable to separate beverages into high and low price products. Substituting within a beverage category may be a more realistic response to the imposition of a minimum price than switching between drink categories entirely.

This gives 16 categories of alcohol for which price elasticities need to be estimated (8 beverage categories at off-licences and on-licences). For each category an own-price elasticity needs to be estimated (the change in demand for a good from a change in the price of that good), along with 15 cross-price elasticities (the change in demand for a good from a change in the price of another good).

To derive price elasticities for the demand for alcohol in New Zealand, the Ministry reviewed the various NZ datasets available on pricing and consumption. The SHORE and Whariki Research Centre at Massey University and AC Nielsen collect data on off-licence purchases and prices paid.

The SHORE and Whariki Research Centre's *International Alcohol Control* (IAC) survey included both consumption and purchase data. AC Nielsen's data is purchases made at a number of off-licence retailers so may not be a true reflection of consumption patterns. However, the IAC survey only covers a very small percentage of the off-licence market, whereas AC Nielsen data covers 70% of all purchases made in the off-licence market over a longer period of time (weekly for two years).[6] Therefore it was decided that AC Nielsen would estimate the off-licence price elasticities and the SHORE and Whariki Research Centre would estimate on-licence price elasticities.

Initially the intention was for the SHORE and Whariki Research Centre to derive elasticities by type of drinker (low risk, increased risk, harmful) based on daily volumes consumed and maximum consumption on a drinking occasion using the IAC consumption data, AC Nielsen's off-licence price elasticities estimates, and SHORE's on-licence price elasticity estimates. However, due to the small

[6] It should be noted that the 70% of the off-licence market included covers those retailers who are most likely to be regulated. Little is known about the 30% not included in the AC Nielsen data, but such retailers may be less regulated and therefore could contribute more to alcohol-related harm in society.

size of the IAC survey once broken down by age, gender and drinker type, it was not possible to obtain elasticity estimates by drinker type. Therefore the same elasticity estimates are applied to each of these drinker types.

Due to methodological difficulties, it was also not possible to estimate separate price elasticities for daily consumption and for the amount consumed on a drinking occasion. Therefore, the same elasticities have been applied to both types of drinking. This is a significant limitation, as it is likely that people will respond differently to price depending on whether they are purchasing alcohol for daily or weekly consumption or purchasing alcohol during a drinking occasion.

Due to the short timeframes to do this work, it was also not possible to estimate cross-price elasticities between on- and off-licences. Such elasticities would have shown the extent to which consumers increase purchases at on-licence premises if the price of alcohol at off-licence premises increases. Such elasticities could be estimated in the future if further research is undertaken in this area.

Estimating off-licence price elasticities

To estimate off-licence price elasticities, AC Nielsen use a store-level modelling technique to look at variations in brand volumes at an individual store level and to attribute these to changes in marketing conditions. Store-level data provides the variety of conditions required to isolate the different effects and exhibits sufficient changes in shelf price over time to allow modelling of price elasticities. The model also understands changes in price relative to competitive products within each store. Two years of retail sales data to January 2012 was available on a weekly periodicity. Regional breakdowns were also available.

The original intention was to obtain regular price and promoted price elasticities to assess how the responsiveness of consumers to price varies depending on whether a product is on promotion or not. Around 78% of beer and wine purchased at off-licences is sold on promotion, so the promoted price is important. However, we were advised by AC Nielsen that it was not possible to produce both promoted and regular price elasticities separately by beverage category. AC Nielsen can only separate out regular price elasticities from promotional price elasticities if the modelling is run at an item level (by pack).

AC Nielsen conducted the elasticity modelling based on price per litre rather than price per standard drink due to the variation of pack sizes within each beverage category. Their database is not coded with alcohol content by item, so the approach taken to determine high/low pricing was to create a median price non-promotion to remove bias of the discounted price creating high/low segments. The high/low price levels per litre used by AC Nielsen are shown in Table 6 below:

Table 6: High/low price level per litre used by AC Nielsen to determine off-licence elasticities

Beverage category	Low	High
Beer	<=5	<5
Wine	<=10	>10
Spirits	<=35	>35
Ready-to-drink spirits	<=7	>7

It is important to note that as price has been across each beverage category by litre, promotional volume is included in the elasticity estimates. As there is a high percentage of volume sold through promotional activity, the elasticity estimates will include promotional response, and will be driven, in part, by promotional depth and frequency.

Another limitation that needs to be noted is that the off-licence elasticities are based on purchase data not consumption data. It is therefore possible that the amount purchased differs from the amount consumed, particularly if items are bought on promotion and consumers stock up.

On-licence price elasticity estimates

The SHORE and Whariki Research Centre at Massey University was contracted to provide on-licence price elasticity estimates by beverage type. SHORE was going to use Statistics New Zealand data to generate the elasticities. Statistics NZ supplied SHORE with CPI series for on- and off-licence sales of each beverage quarterly from 1999 to 2011. There is limited information however on the consumption of beverages in these categories. The Household Economic Survey collects diary information on purchases of alcohol and place of purchase but a full survey is carried out only once every three years. SHORE was unable to access micro data from the Household Economic Survey to explore whether the diaries contain enough consumption and expenditure information to allow elasticities to be estimated.

SHORE concluded that the data was not sufficient to investigate impacts of minimum pricing at the level of detail required for this analysis and would use the IAC survey data to establish cross sectional elasticities.

The IAC survey is the only data source available in New Zealand with linked data between consumption and purchasing at a range of on-licence premises. Data was merged from the general population, Māori and Pacific samples to give a total of 3,626 individuals consuming at on-licences by beverage type and by type of drinker.

The SHORE and Whariki Research Centre estimated high and low price elasticities on the basis of a median price per standard drink. $1.48 per standard drink (12.5ml pure alcohol) was selected as the default median point for estimating low and high price elasticities for each beverage type (beer, wine, spirits and RTDs) and for total alcohol:

- For the purposes of determining the low price elasticities for each alcohol type, low price is defined as $1.48 per standard drink and below.
- For the purposes of determining high price elasticities for each alcohol type, high price is defined as above $1.48 per standard drink.

A detailed explanation of the methodology used to estimate the on-licence elasticities is provided in a separate report provided by the SHORE and Whariki Research Centre. Note that the high price and low price wine categories were aggregated as the distinction between the two was not as valid as for the other beverages.

Table 7 shows the off-licence and on-licence price elasticity estimates provided by AC Nielsen and the SHORE and Whariki Research Centre.

Table 7: On-licence and off-licence price elasticities used in the modelling by beverage type

			Beer				Wine			Spirits				RTDs			
Elasticities	SHORE/ AC NIELSEN		On Sales		Off Sales		On Sales	Off Sales		On Sales		Off Sales		On Sales		Off Sales	
			High	Low	High	Low	All	High	Low	High	Low	High	Low	High	Low	High	Low
Beer	On Sales	High	-0.65	0.53			0.00			0.71	0.00			0.00	0.00		
		Low	0.00	-1.98			-0.65			0.00	0.00			0.00	0.00		
	Off Sales	High			-1.86	0.00		0.03	0.00			0.01	0.00			0.03	0.00
		Low			0.68	-1.48		0.00	0.03			0.00	0.01			0.00	0.04
Wine	On Sales	All	0.00	0.44			-1.34			0.86	0.00			-1.25	0.00		
	Off Sales	High			0.00	0.00		-1.93	0.00			0.00	0.00			0.00	0.00
		Low			0.00	0.00		0.03	-2.44			0.00	0.00			0.00	0.00
Spirits	On Sales	High	0.00	0.00			0.00			-1.29	0.79			0.00	0.00		
		Low	0.00	0.00			-2.03			0.00	-3.93			-2.46	-2.29		
	Off Sales	High			0.00	0.00		0.00	0.00			-1.76	0.00			0.00	0.00
		Low			0.00	0.00		0.00	0.00			0.03	-0.79			0.00	0.00
RTDs	On Sales	High	2.54	0.00			-0.95			0.00	0.00			-1.54	0.00		
		Low	0.00	0.00			-1.16			0.00	-0.90			0.00	-1.76		
	Off Sales	High			0.00	0.00		0.03	0.00			0.02	0.00			-2.07	0.00
		Low			0.00	0.00		0.00	0.04			0.00	0.01			0.02	-1.48

Off-licence elasticities estimated by AC Nieslen. On-licence elasticities estimated by the SHORE and Whariki Research Centre. Standard errors were not provided with the elasticities.

**Note the blank cells are the cross-price elasticities between on- and off-licences ,which have not been estimated.*

3.5 Assessing the impact of pricing changes using international elasticity estimates

As noted above, a number of significant limitations emerged in the estimation of the NZ alcohol price elasticities. The limitations included an inability to:

- derive elasticities by the different drinker types (low risk, increased risk, harmful), given that international evidence suggests that harmful drinkers are less responsive to price changes than moderate drinkers.
- derive elasticities based on daily volume consumed and elasticities based on quantities consumed on a drinking occasion.
- separate out promotional prices from regular prices.
- estimate cross-price elasticities between on- and off-licence premises.

Another significant concern is that the size of the elasticity estimates generated by AC Nielsen and the SHORE and Whariki Research Centre are very large compared to international estimates, and result in significant changes in consumption when the various pricing options are analysed. The large off-licence elasticities may be driven by the fact that both regular prices and promotional prices are included in the elasticities. The large on-licence elasticities are likely to be a consequence of a reasonably small sample size and cross-sectional data.

It was decided that the significant reductions in consumption estimated using NZ elasticity estimates are not a realistic representation of what is likely to happen in reality and are contrary to all international evidence of the responsiveness of alcohol consumers to changes in price.

To address this, at least in part, it was decided to assess the effects of the various pricing options on consumption using international elasticity estimates in addition to the NZ estimates obtained from AC Nielsen and the SHORE and Whariki Research Centre. It is desirable to have elasticity estimates for high price and low price beverages and to have elasticity estimates for different types of drinker. It is also desirable to have cross-price elasticities between on-licence and off-licence consumption.

Revised elasticities have been produced by HM Revenue and Customs in the UK, using an internationally recognised method. However, the elasticities are not split into high and low price beverages, and are also not provided by different drinker types (Collis, Grayson and Johal, 2010). Only the 2009 University of Sheffield study provides such elasticity estimates. As noted in Table 5 above, the University of Sheffield estimates are similar to those estimated in large meta-analysis.

The University of Sheffield elasticity estimates are based on considerably more data than is available in New Zealand. However, the Sheffield data is based on the Expenditure and Food Survey (EFS), which is a cross-sectional survey, so to derive elasticities from this survey an assumption had to be made that the cross-sectional econometric modelling is representative of longitudinal change.

The EFS also recorded purchases rather than actual consumption, so an assumption is made that people who purchase the alcohol also consume it when the elasticities are used to estimate changes in alcohol consumption. Also, to the extent that UK consumer's purchasing and consumption patterns differ from NZ consumers, the elasticities will not be a true reflection of the likely responsiveness of NZ consumers to price changes.

The University of Sheffield's elasticities include a "binge" drinking component within the elasticity, as they could not derive separate elasticities for average daily consumption and per occasion consumption. Other limitations of the University of Sheffield elasticities are that the functional form of the regression models is log(consumption) verses log(prices). As log(0) is not mathematically

defined, the model essentially does not use zero consumption observations for the estimation of the elasticities.

There have also been criticisms of the high own-price elasticities for harmful drinkers, particularly for spirits purchases. This has resulted in some price increases having a greater impact on harmful drinkers compared to moderate drinkers, despite the fact that harmful drinkers are more likely to substitute to other products. However, the elasticity estimates appear to be more conservative than those recently published by HM Revenue and Customs.

Given these limitations, the team at the University of Sheffield are currently working on new econometric modelling approaches (based on Tobit models which account for zero observations) and testing different methods for the implementation of these regression models in the revised Sheffield Model version 3. At the time of writing this report, revised elasticities were not available and are not likely to be until 2013.

However, given that the University of Sheffield's elasticity estimates for total alcohol purchasing are comparable to the elasticities estimated in a range of international meta-analyses, estimating consumption changes based on these elasticities provides a useful check on the validity and sensibleness of the results generated by using AC Nielsen's and the SHORE and Whariki Research Centre's elasticity estimates. The University of Sheffield elasticities are provided in Appendix 3.

The University of Sheffield's elasticities are not broken down by age and gender. Therefore SHORE's baseline consumption data had to be aggregated to a total consumption level by drinker type (low risk, increased risk, harmful). Sheffield's elasticities for these types of drinker were then multiplied by the estimated average pricing increases for each beverage type, which were then multiplied by the total baseline consumption for each drinker to calculate how the average consumption of each type of drinker will change. However, by using the method employed by Sheffield it was not possible to work out how the proportions of each type of drinker will change. Therefore, it was assumed that the proportions stay the same but average consumption within each drinker category changes.

We followed the University of Sheffield's method and only used their moderate and combined hazardous (or increased risk) and harmful elasticity matrices. The Sheffield researchers noted in their report that the separate matrices for hazardous and harmful drinkers were not considered to be as realistic, as the magnitude of switching behaviour for hazardous drinkers is likely to be greater than that which occurs in reality (Brennan et al, 2008). Therefore Sheffield's "moderate" elasticity matrix was used to estimate changes in "low risk" consumers' consumption, and the "hazardous and harmful" matrix was used to estimate changes in consumption for both "increased risk" and "harmful" alcohol consumers.

We also followed the University of Sheffield approach and multiplied the price increases by the constant elasticity estimates provided by the University of Sheffield. This is a linear approach. However, it could be argued that the reduction in consumption is log-linear for constant elasticities particularly for large price changes. If this is the case, we may have over-estimated the reductions in consumption from a price increase.

3.6 Estimating changes in average price for each pricing option

To determine the different levels of minimum price to be analysed, off-licence and on-licence price distribution data was analysed. Table 8 below shows the percentage of off-licence alcohol sales likely to be affected by different minimum price levels by beverage type. Twenty-four percent of off-licence alcohol sales are below $1.20 per standard drink. The proportion sold for less than $1.20 varies greatly by beverage type with 72% of spirits sold below $1.20 compared with 39% of wine,

39% of RTDs and 17% of beer. Eighty-six percent of off-licence sales are sold for $1.60 per standard drink or less.

Table 8: Cumulative proportion of total volume of off-licence alcohol sales for different minimum price levels by beverage type

	Cumulative proportion of total volume of alcohol sales					
Price per standard drink (12.5 ml of pure alcohol)	Beer	Wine	Spirits	RTDs	Cider	Total alcohol
% below $1.00	3%	25%	21%	16%	2%	10%
% below $1.10	7%	32%	52%	28%	2%	15%
% below $1.20	17%	39%	72%	39%	2%	24%
% below $1.40	70%	52%	83%	73%	2%	65%
% below $1.60	93%	70%	89%	90%	41%	86%

Source: Total Nielsen Liquor Markets, (Total Foodstuffs, Progressive, Henry's, Liquorland, Duffy & Fin, Liquor King & Super Liquor), MAT to 17th July 2011

On-licence products are sold for at least $1.60 per standard drink, which is considered to be too high for a minimum price given the percentage of the off-licence market that would be affected.

Based on the off-licence price distribution data, the following minimum price options are analysed:

- A minimum price of $1.00 per standard drink
- A minimum price of $1.10 per standard drink
- A minimum price of $1.20 per standard drink.

A minimum price above $1.20 would affect over a quarter of alcohol sales and significantly impact the alcohol industry. Therefore a minimum price above $1.20 was not considered.

Each of the three minimum pricing options are also compared to the impact of excise increases to indirectly achieve an average price of $1.00, $1.10 or $1.20 on the lowest priced beverages.

For the minimum price options, average price increases for each beverage type were estimated by working out the price increases at each price band below the minimum price point and multiplying this by the proportion of sales at each of these price bands to obtain an average price increase overall.

For the excise increase options, the following approach was used to determine average price increases. Average price increases for each of the 16 categories (on-licence and off-licence, high and low price, beer, spirits, wine, and RTDs) were calculated with SHORE and AC Nielsen data of the volume of alcohol consumed in each of the price bands. Each price band was assigned an "average price" which represented the volume weighted average price of alcohol purchased in this band. This "average price" was disaggregated into the portions which represented GST, excise, and remaining costs.

For the excise changes, excise was increased by the pricing option amount to indirectly obtain an average minimum price level on the lowest priced beverages. This new amount was then added to the "remaining costs". To this number GST was added to come up with a new, post-excise change "average price" for each band.

Because each drink (beer, wine, spirits, and RTDs) in each market (on- and off-licence) was split into two price categories (high and low), a single price was required for each price category (high and low). This was calculated by taking the volume weighted average price for each price band that falls

within each price category. For ease of understanding, note that each price category (high and low) contains multiple price bands (e.g, $0.90 - $1.00 is a price band in the low cost price category, which includes consumption in all bands up to $1.50). Because the majority of consumption occurs in the $1.00 to $1.40 price bands, a simple average of the average price paid in each band would be misleading.

Therefore, volume weighted average prices were used to arrive at an average price that accounts for the fact that the majority of consumption falls within a particular range. For every pricing option for all 16 categories, pre- and post-intervention prices were derived, and the percentage change between pre- and post-intervention prices. This percentage change in price was used to calculate the reduction in consumption, using price elasticities of demand.

Given time constraints it was not possible to work out relative price changes, for example, how the consumption for low-cost beer changes when the price of low cost beer is changing and the price of low-cost wine is changing. For simplicity, each beverage pricing change was considered in isolation, holding all other prices constant. This may have resulted in an over-estimation of the impact of the cross-price effects. To test the impact of the cross-price effects, a sensitivity analysis was performed where only own-price elasticity effects were considered (that is, we assumed no substitution). As outlined in Section 12 below, this had quite a significant impact on results, substantially increasing savings in alcohol-related harms.

The estimated price increases for the six pricing options are shown in Table 9 below for each beverage type, separated into low price and high price beverages. The most significant price increases are for low-price spirits. Table 10 shows the impact on the price of some common beverage types. Section 10.1 below shows the change in consumption resulting from each of these price changes using both the New Zealand elasticity estimates and the University of Sheffield estimates.

Table 9: Estimated percentage average price increases for each pricing option by beverage type

Licence type	Alcohol type	Price level	Pricing Option					
			Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ 82%	Excise ↑ 107%	Excise ↑ 133%
Off	Beer	Low	1%	2%	3%	25%	33%	41%
		High	0%	0%	0%	18%	24%	30%
	Wine	Low	13%	18%	25%	27%	36%	44%
		High	0%	0%	0%	20%	26%	32%
	Spirit	Low	17%	23%	31%	63%	83%	103%
		High	0%	0%	0%	31%	41%	51%
	RTDs	Low	3%	6%	9%	28%	36%	45%
		High	0%	0%	0%	17%	22%	28%
On	Beer	Low	0%	0%	0%	22%	28%	35%
		High	0%	0%	0%	8%	10%	13%
	Wine	Low	0%	0%	0%	45%	46%	57%
		High	0%	0%	0%	9%	9%	11%
	Spirit	Low	0%	0%	0%	138%	181%	225%
		High	0%	0%	0%	11%	14%	18%
	RTDs	Low	0%	0%	0%	28%	36%	45%
		High	0%	0%	0%	9%	11%	14%

Source: Estimated by The Treasury

Table 10: Impact of price increases on common beverages

Pricing option	Bottle of cheap wine	Bottle of expensive wine	Bottle of mixed spirits (750 ml)	Twelve pack of beer
ORIGINAL PRICE	$7.00	$18.00	$10.00	$10.00
Minimum price of $1.00	$7.20	No change	$11.40	$15.30
Minimum price of $1.10	$7.90	No change	$12.50	$16.80
Minimum price of $1.20	$8.60	No change	$13.70	$18.40
Excise increase of 82%	$8.90	$19.90	$16.70	$14.88
Excise increase of 107%	$9.50	$20.50	$18.70	$16.40
Excise increase of 133%	$10.10	$21.10	$20.80	$17.90

Source: Estimated by The Treasury

4. Estimating the impact of reduced consumption on alcohol-related harm

This section of the report presents the general methodology used to analyse the potential savings in alcohol-related harm that may result from a reduction in harmful alcohol consumption. The analysis is undertaken from the perspective of the costs imposed on others from an individual's harmful alcohol consumption. It includes an analysis of Government costs and the negative externalities (external costs) imposed on others, and the likely savings that could result from a reduction in alcohol consumption. Costs to individual drinkers are not included as these costs are assumed to be taken into consideration when an individual decides to consume alcohol.

It was not possible to estimate the reduction in the more intangible, emotional harm inflicted upon others from harmful alcohol consumption. Connor and Casswell (2012) note that harm from other people's drinking is higher than the harm from one's own drinking, especially for women and children. Therefore the savings estimated in this report are conservative.

To estimate cost savings, models were built to simulate the effects of a change in alcohol consumption on three categories of harm:

- health harms
- crime harms and
- workplace productivity harms.

Each of these models and the methodology used to generate them are discussed in more detail in the following sections. Section 5 outlines the methodology used to develop the health model; Section 6 outlines the methodology used to develop the crime model; and Section 7 provides an overview of the methodology used to develop the workplace productivity models. This section provides a general overview of the methodology.

The general approach to modelling was to follow many of the methods described in the University of Sheffield Alcohol Policy Models for England and Scotland. The Sheffield approach is considered the leading method for analysis of alcohol policy proposals and as such was without rival in terms of selecting an overall approach to developing this model. However, there remained the potential for differences in the details as to how the New Zealand models could be developed. In some cases the chosen approach differed from that used in the Sheffield study.

4.1 A prevalence approach

Economic evaluations in health usually take either a prevalence-based or an incidence-based approach. Prevalence refers to the number of people with a condition at a given point in time while incidence refers to the number of new cases occurring within a defined period. Prevalence is a useful measure in chronic disease and for budgeting at a population level. Incidence is useful for modelling conditions of short duration such as influenza epidemics.

Following from the epidemiological definitions of prevalence and incidence are the prevalence-based and incidence-based approaches in economic evaluation. An incidence-based approach would therefore identify the costs and benefits associated with an incident case, such as when someone begins drinking, or what might be different if an intervention prevented someone from starting to drink. According to Single and colleagues, "the essence of an incidence-based approach is the determination of a per-case lifetime cost estimate that can be applied to new cases" p.37 (Single, et al., 2001). A prevalence-based approach identifies the costs and benefits associated with all past and present alcohol use that accrue in a given year (Single, et al., 2001).

The choice between these two approaches depends on the research question and the disease or health condition of interest. In this case a prevalence-based approach was considered more appropriate because 1) from a Government budgeting perspective, the total costs in a given year (particularly years in the near future) are more relevant than the cost per person over a lifetime, 2) pricing policy is just one of many influences on alcohol consumption so an incidence-based approach that projects forward over many years is likely to be less accurate, and 3) detailed data on consumption patterns are not available over the lifetime of present drinkers so it would not be possible to adopt an incidence-based approach that estimates the current costs if previous drinking had been different (and this would also be less relevant for policy purposes).

4.2 The Alcohol Policy Model

The model shows how changes in alcohol consumption patterns lead to changes in the prevalence of harmful outcomes. A key component of the model is the risk function, which relates consumption to a level of risk of harm.

Alcohol-attributable fractions and potential impact fractions

The University of Sheffield used a similar methodology to that used in Gunning-Scheper's (1989) *Prevent* model. This model was based on the notion of the alcohol-attributable fraction (AAF) and its more general form, the potential impact fraction (PIF).

The AAF is defined as the difference between the overall average risk (or incidence rate) of a particular harm in the entire population (drinkers and non-drinkers) and the average risk of those in the population who are not drinkers, expressed as a fraction of overall average risk. Thus, AAF's are used as a measure of the proportion of harm that is attributable to alcohol. This approach has traditionally been used for chronic health-related harms, but can be applied to other types of harm such as crime and productivity loss.

The AAF is calculated using the following formula:

Equation 1: Alcohol-attributable fraction

$$AAF = \frac{\sum_{i=1}^{m} p_i \left(RR_i - 1\right)}{\sum_{i=1}^{m} p_i \left(RR_i - 1\right) + 1}$$

where RR_i is the relative risk of exposure to alcohol at consumption state i, p_i is the proportion of the population exposed to alcohol at consumption state i, and m is the number of consumption states.

The numerator is the excess expected cases due to alcohol exposure and the denominator is the total expected cases. The University of Sheffield team noted that there are methodological difficulties with AAF studies. One particular problem is the definition of the non-exposed group. This group is likely to include those who used to be heavy drinkers and have given up due to alcohol-

related health problems. It is therefore likely that the AAF may be underestimated as this group of drinkers would not be included in the estimated risk (Brennan et al, 2008, p.64).

The potential impact fraction (PIF) is a generalisation of the AAF based on changes to the prevalence of alcohol consumption (rather than assuming all drinkers become abstainers). A lag may exist between the exposure to alcohol and the resulting change in risk. The PIF is calculated using the following formula:

Equation 2: Potential impact fraction

$$PIF = 1 - \left(\frac{\sum_{i=0}^{m} \hat{p}_i RR_a}{\sum_{i=0}^{m} p_i RR_0} \right)$$

where $\hat{p}_i$ is the estimated proportion in consumption group *i* under the policy change scenario (including abstainers), p_i is the proportion in consumption group *i* in the baseline scenario, RR_0 is the relative risk calculated for the baseline scenario, and RR_a is the relative risk calculated for the policy change scenario. The two RRs may differ if the distributions of consumption patterns shift within consumption groups.

Estimating risk functions for harms

Risk functions were derived to model the impact of a change in consumption on the level of risk of alcohol-related harms. Risk functions show the extent to which the risk of harm changes if consumption is reduced. Even reduced levels of risk from marginal changes in consumption, such as a reduction of only one standard drink a day, can be modelled using the risk functions.

As per the University of Sheffield methodology, (ref. Brennan et al, 2008), the impact of a change in consumption on harm was examined using four categories of risk functions:

1. Relative risk functions already available in the published literature.
2. Relative risk functions fitted to risk estimates for broad categories of exposure (common for chronic health harms).
3. Relative risk functions derived from AAFs for partially attributable harms.
4. Absolute risk functions for wholly attributable harms.

RISK FUNCTIONS FITTED TO RISK ESTIMATES FOR BROAD CATEGORIES OF EXPOSURE

Continuous risk functions were fitted where risk estimates were available using polynomial curves to allow an analysis of the effects of relatively small shifts in patterns of consumption. As Brennan et al (2008) noted, a limitation of this approach is that risk estimates are available for only a few exposure groups, which may underestimate or overestimate the risk beyond the last data point. This was particularly the case for some chronic health harms. An upper threshold was therefore applied for conditions where the predicted estimates were unlikely to match the anticipated behaviour.

DERIVING A RELATIVE RISK FUNCTION FROM THE AAF

For some types of harms, such as crime, workplace, and acute health harms, evidence for AAFs is available, but not for risk functions. This evidence can be used to derive relative risk functions assuming the relationship described in equation 1 above, since the AAF is a positive function of the prevalence of drinking and the relative risk function.

In order to compute a relative risk function from an AAF two assumptions must be made:

i. Assumptions about the form of the curve (or risk function). We assumed a linear function due to lack of data in the literature.
ii. Assumptions about the threshold below which the relative risk is unity (that is, harm is not associated with alcohol).

Alcohol-related harms may be the result of average drinking levels (chronic harms) or due to levels of intoxication (acute harms). Different thresholds were therefore used according to the link between harms and drinking patterns:

- The threshold for harms related to daily consumption was assumed to start from six standard drinks per day for men and five standard drinks per day for women.
- The threshold for harms related to per occasion drinking was assumed to start from six standard drinks on an occasion at least once a week for both men and women.

Based on these thresholds and assuming a linear function, relative risk functions are calculated as follows:

Equation 3: Relative risk linear function

$$RR(c) = 1 \text{ if } c<T$$

$$= \beta(c-T) + 1 \text{ otherwise}$$

where c=consumption level, T=threshold and β=defined slope parameter.

ESTIMATING ABSOLUTE RISK FUNCTIONS FOR WHOLLY ATTRIBUTABLE HARMS

For most harms it is possible to estimate a relative risk function. However, it is impossible to derive such functions for wholly attributable harms (with an AAF of 100%) due to absence of a reference group. In such instances, absolute risk functions were calculated based on the number of events, the drinking prevalence, and the total population as per Brennan et al (2008). As for relative risk functions, assumptions were necessary about the form of the curve and the starting threshold. We applied the same assumptions as for the relative risk functions for consistency.

5. Estimating savings in mortality and morbidity costs from reduced alcohol consumption

This section discusses the methodology used to develop the health harm model. It outlines some key assumptions and rationales for specific methods used in the model.

5.1 Perspective

As a societal perspective is taken in this study, the health component includes changes in hospitalisation, specialist treatment, Accident Compensation Corporation (ACC) and drug treatment costs to Government, but excludes quality adjusted life years, a measure that incorporates both quality of life and life expectancy. Although included in the original project plans, quality adjusted life years were excluded from the results because they are essentially a private cost. The other costs represent an attempt to value externalities. Externalities should be the core component of this type of analysis but are seriously underestimated because most of the harms accruing to people other than the drinker are not considered. These costs are known to be significant (Casswell, You and Huckle, 2011);(Navarro, Doran and Shakeshaft, 2011), but at this stage there is no known method for assigning relative risks to them so they can be included in this sort of analysis. Productivity costs are often included in studies taking a societal perspective but they are excluded here because productivity impacts are addressed separately outside the health part of the model (see Section 7 below).

As discussed in Section 4, a prevalence-based approach was taken.

5.2 QALYs

Early economic evaluations in the health sector considered few outcomes: mainly mortality and numbers of events (e.g. hospitalisations) or conditions (e.g. blindness) (Knapp, 1999). Given the importance of quality of life and reducing the burden of chronic disease and disability, there was a clear need to develop measures that incorporated both mortality and morbidity or quality of life outcomes in a single metric (Klarman, Francis and Rosenthal, 1968);(Fanshel and Bush, 1970). This would enable better comparisons across disparate interventions (for example, a life-extending versus a disability-reducing intervention) (Drummond et al, 2005). Approaches have been developed that are used in economic evaluation to combine morbidity or quality of life outcomes with mortality measures, the most common being quality adjusted life years (QALYs) (Weinstein and Stason, 1977) and disability adjusted life years (DALYs) (Murray and Lopez, 1996).

The exclusion of any measure combining mortality and morbidity outcomes is a limitation of this study. By measuring only numbers of deaths and numbers (and costs) of hospitalisations and other health expenditures, it is not possible to provide a balanced picture of the burden of disease or the potential impact of policy changes. First, a death at age 18 is counted the same way as a death at age 80, despite the fact that death at a younger age affects life expectancy much more. Second, an injury or disease that causes significant ongoing disability is counted the same way as one that

produces only a brief period of recovery, despite significant differences in the impact on a person's life. There is a risk that policy changes that prevent deaths at younger ages or long-term disability will thus be undervalued based on the results of this study.

5.3 Discounting

The main results use a discount rate of 8%, which is the New Zealand Treasury's real discount rate. Discount rates of 0% and 5% are also presented in the sensitivity analysis. All costs are expressed in 2010/11 dollars. It is possible that health costs may increase at a rate greater than the Consumer Price Index. If this is the case, cost savings will be greater than those estimated

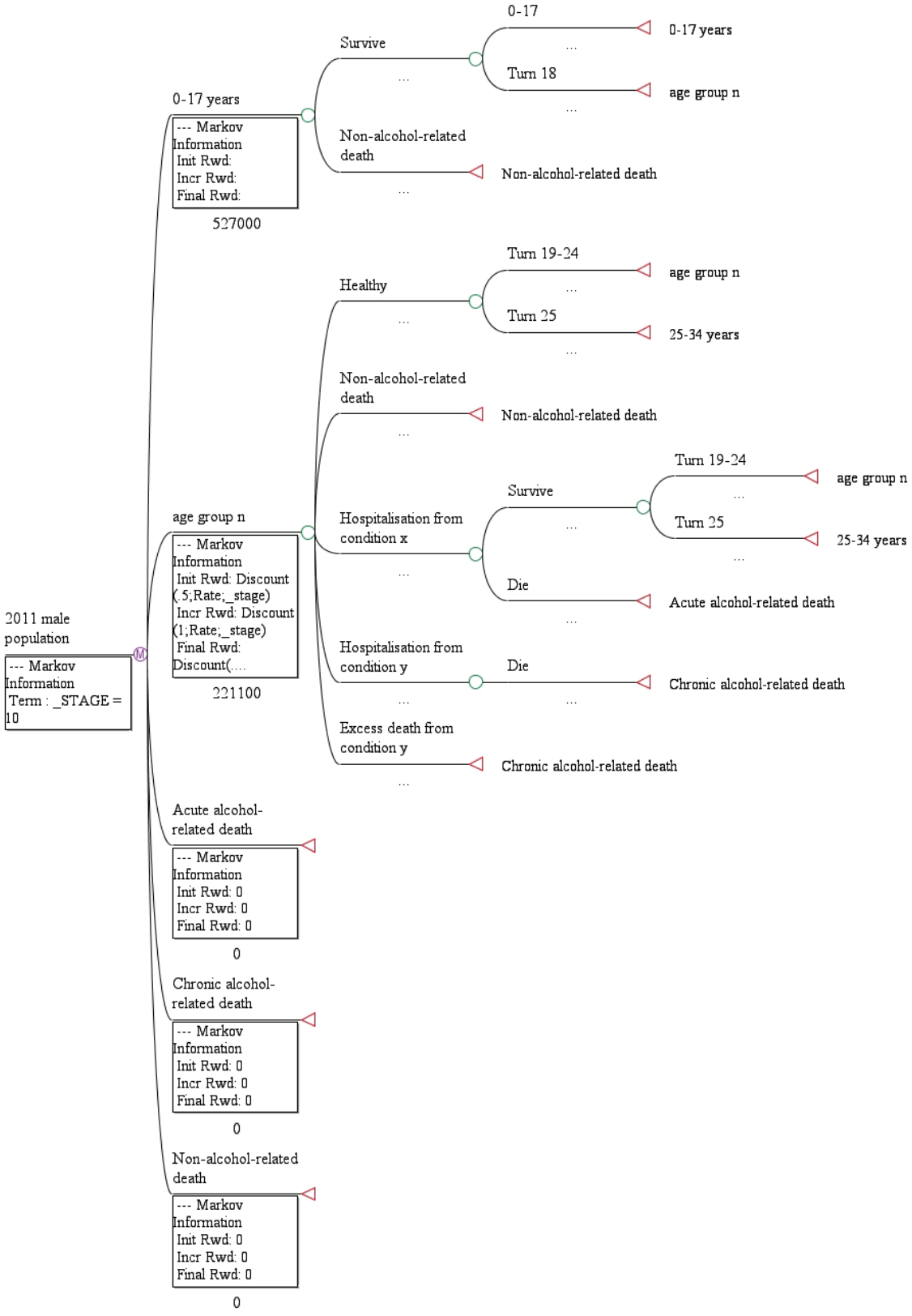
The choice of discount rates means that results will not be comparable with other analyses in the health sector that adopt PHARMAC's recommended discount rate of 3.5% (PHARMAC, 2007). Use of the same discount rate for costs and benefits is probably the most common approach in economic evaluation in the health sector, although it is controversial with many arguments on both sides (Drummond et al, 2005); (Brouwer et al, 2005); (Milne, 2005); (Lazaro, 2002). One of the main issues in this debate is that the value of health effects appears to be increasing over time, which suggests that health effects such as QALYs should be discounted at a lower rate than costs (Gravelle and Smith, 2001). It is possible that the approach of equal discount rates for health effects and costs will underestimate the value of health effects in our model.

5.4 The health models

Structure

Alcohol-related health harms, and estimated changes in those harms as a result of policy change, were modeled in two Markov process models in TreeAge Pro 2011. The two models, for males and females, follow the same structure but were separated because of processing capacity issues with the combined model. A simplified schematic diagram of one of the models is shown in Figure 3. Triangles represent terminal nodes, from which people jump back to the relevant node on the left side of the diagram for the next stage, or, if dead, remain in that node for the remaining stages of the model. Circles in the model are chance nodes from which people have a given probability of progressing to one of the branches to the right. Some nodes and branches are truncated or omitted in the diagram for simplicity.

Figure 3: Schematic diagram of TreeAge model



At the first node in each model, the tree separates into nine branches, one for each of the seven age groups, and one each for the three causes of death: acute alcohol-related, chronic alcohol-related, and non alcohol-related. A cohort, equal to the estimated number of people in that age-group in

2011, enters each of the subgroup branches and progresses along that path in the first stage (year) of the model. At the end of the first stage, each person in the model is either dead from one of the three causes, alive and in the same age group or alive and in the next age group. They progress to the appropriate node for the start of the second stage. The three causes of death each have a terminal node, indicating that people stay in that state and do not progress to the next stage of the model. The model has ten stages to represent the ten years from 2011 to 2020.

The branches for the first age group in the model, 0-17 years, have a different structure from the other age group branches. It is necessary to model births in the first age group so that the total number of people in the model does not diminish over time. This is achieved by giving a probability greater than 1 such that the total number entering the cohort in the second stage is equal to the number entering in the first stage, despite the fact that some of this cohort turned 18 and moved to the 18-24 years cohort in the second stage (here depicted as "age group n"). This method means some effects of population aging are incorporated into the model, but population changes from immigration and emigration are not modelled. As discussed above, the model assumes no deaths or hospitalisations are alcohol-related in the 0-17 years age group. There was thus no need to report results for this age group.

For all other age groups, the tree branches into approximately 41 branches, one for each of 39 alcohol-related conditions (37 for males[7]), one for non-alcohol related conditions, and one for people who remain healthy. This step applies the probability that people in each age group will be hospitalized for each alcohol-related condition. That is, for wholly alcohol attributable conditions it applies the probability of hospitalisation, and for partially alcohol attributable conditions it applies the probability of hospitalisation multiplied by the alcohol attributable fraction for that condition. The main assumption here is that a person can be hospitalised for only one alcohol-related condition in a given year. This is not true, but for modelling purposes (because there is no need to model co-morbidities) it makes no difference which individual is hospitalised as long as the overall probability of hospitalisation is accurate. People in the "healthy" or "non-alcohol-related death" branches at this stage have some probability of hospitalisation for non-alcohol-related causes. The costs of these are modelled but not otherwise shown in the model results.

The next node in each condition-specific branch applies the probability that a person, having been hospitalised for an alcohol-related condition, then dies as a result of that same alcohol-related condition or survives. The critical assumption here it that people who die of a condition in a given year are a subset of the people who are hospitalised for that condition in the same year. In reality some people who die will not have been hospitalised for that condition in that year, but again, as long as the probabilities are accurate the distinction is immaterial. A problem arises only when the probability of dying exceeds the probability of hospitalisation for a given condition. To account for this problem, these conditions were identified and an extra node was added to the relevant age groups to model the excess deaths from those conditions. People who die of an alcohol-related condition enter the next stage of the model in the "acute alcohol-related death" or "chronic alcohol-related death" branches, where they remain for the rest of the model. People who survive either remain in the same age group or move to the next age group to begin the next stage of the model.

There were four conditions for which relative risks were below 1 for at least some age/sex/consumption subgroups: cholelithiasis, ischaemic heart disease, ischaemic stroke, and type 2 diabetes. Relative risks below 1 introduce the possibility that some attributable fractions could be negative. TreeAge is unable to calculate negative probabilities so the results for these four conditions were estimated separately in Excel. This method was not ideal because it meant there

[7] Alcohol-related deaths and hospitalisations from spontaneous abortion and breast cancer are included only for females. There are some cases of male breast cancer in the datasets but there is no evidence as to the relative risks of breast cancer for males at different levels of alcohol consumption.

could be no feedback to the rest of the population model as a result of any increases or decreases in hospitalisations or deaths as a result of these four conditions. For example, if a change in consumption produced an increase in deaths among men aged 65 and older from ischaemic heart disease in the first year, fewer men in this age group should enter the model in the second year. This limitation is not expected to have a major effect on the main cost results because competing risk probabilities are small, chronic effects are introduced gradually over ten years, and results from later years have less effect on the total because of discounting.

Probability calculations

The model includes probabilities relating to population ageing, death (from the 43 alcohol-related and all other causes), and hospitalisation (from the 43 alcohol-related causes), as well as the change in probabilities of death and hospitalisation as a result of consumption changes expected in each policy scenario. Many of these probabilities are calculated in spreadsheets outside the TreeAge model so that variables can be refreshed when new data are available, and to avoid exceeding TreeAge's capacity. The TreeAge model also incorporates adjustments so that chronic effects are phased in over the course of the model. This section explains how probabilities in the model were calculated.

POPULATION

The probability of entering the 0-17 cohort (i.e. new births) is calculated with the aim of maintaining the cohort entering the main model at approximately the same size throughout the life of the model. The calculation is based on the number of people in the population aged under 18 years and the number of deaths in this age group. The probability of birth is therefore:

$$p_b = \frac{n}{n-d}$$

Where p_b is the probability of birth, n is the population aged under 18, and d is the number of deaths in that cohort per year.

The probabilities of moving to the next age group were calculated by Statistics New Zealand based on population projections for the year ending June 2012.

DEATH OR HOSPITALISATION

The probability of an alcohol-related death or hospitalisation is derived from New Zealand data on the number of people in an age/sex group, the average number of deaths or hospitalisations from a given cause in that group, and for partially alcohol-attributable causes, the attributable fraction (see the section below on the calculation of attributable fractions). The formula, calculated for each cause and each age/sex subgroup is:

$$p_a = AAF \times p_d$$

where p_a is the alcohol-attributable probability of death or hospitalisation, *AAF* is the alcohol attributable fraction, and p_d (or p_h) is the total probability of death (or hospitalisation) for that cause in that age/sex group. The formula for the total probability of death (or hospitalisation), calculated for each cause and age/sex group is:

$$p_d = \frac{d}{n}$$

where d is the average number of deaths from that cause in that age/sex group across five years (2004-2008) and n is the average number of people in that age/sex group across the same five years.

For the policy scenarios, the absolute change in the probability of alcohol-related death or hospitalisation from a given cause is subtracted from the baseline probability of alcohol-related death or hospitalisation from that cause. The change in deaths or hospitalisations, again calculated for each cause and age/sex group, is:

$$\Delta p_d = PIF \times p_d$$

where Δp is the change in probability of death as a result of the policy change and *PIF* is the potential impact fraction, which is discussed in the section on alcohol attributable fractions below. Using this method, lives saved as a result of a alcohol pricing change are susceptible to death from other causes with the same probability as the rest of their age/sex group.

PHASING IN CHRONIC EFFECTS

The model assumes that price elasticities of demand are stable over time, and that they change immediately with a change in alcohol policy. This means that changes in alcohol consumption are expected to result in immediate changes in the incidence of acute alcohol-related conditions. Chronic conditions are a result of the cumulative effects of drinking over a longer period so the impact on chronic conditions needs to be phased in over a number of years.

There is no evidence as to the most appropriate time lag (which in reality is likely to vary across conditions and population subgroups) so the model uses the same assumption as in the Sheffield model: that chronic effects occur gradually over ten years. To achieve this, the nodes that calculate changes in the probability of death and hospitalisation refer to a table that multiplies the change in probability by the proportion of change expected in that year. For example, the formula for the probability of hospitalisation is:

$$p_s = p_h - \left(\frac{s}{10}\right)\Delta p_h$$

where p_s is the probability of alcohol-related hospitalisation for a condition in a given stage of a given policy scenario, p_h is the probability of hospitalisation for that condition in the baseline scenario, s is the stage of the model (1 through 10), and Δp_h is the expected change in the probability of hospitalisation for that condition once the effects of a change in consumption for a given alcohol pricing scenario are fully realised.

Alcohol attributable fractions

The alcohol attributable fraction (AAF) for each condition/age/sex is:

$$AAF = \frac{\sum_{i=1}^{m} p_i\left(RR_i - 1\right)}{\sum_{i=1}^{m} p_i\left(RR_i - 1\right) + 1}$$

where p_i is the proportion of the age/sex group in consumption category i, RR_i is the relative risk of death from that condition/age/sex for consumption category i, and categories i=1 to i=m are consumption categories. In this equation abstainers can be excluded from this equation without affecting the result because the RR for abstainers is 1 by definition.

The relative risks are taken from epidemiological studies and are based on the average reported consumption of alcohol for each age/sex/consumption category group. For acute causes relative risks are based on median peak day consumption and for chronic causes, median daily consumption. Relative risks cannot be calculated for wholly alcohol-attributable conditions so absolute risk levels were used.

With the pricing scenarios, alcohol attributable fractions could change due to either a change in the proportion in an age/sex group that is in a consumption category or a change in the median daily or peak day consumption within an age/sex/consumption category group. However, the data provide estimates of changes in consumption levels only. This means that people in some consumption categories theoretically may be drinking at a level below that defined for their category after a change in policy, although this has no effect on the model results.

The reduction in the probability of dying from an alcohol-related death from a given cause for each age/sex group (Δp_d) is:

$$\Delta p_d = p_d - p_d\left(1 - \frac{PIF}{AAF}\right)$$

where p_d is the probability of dying from an alcohol-related death from that cause and *PIF* is the Potential Impact Fraction.

The Potential Impact Fraction for each age/sex/condition is calculated as:

$$PIF = 1 - \left(\frac{\sum_{i=0}^{m} \hat{p}_i RR_a}{\sum_{i=0}^{m} p_i RR_0}\right)$$

where $\hat{p}_i$ is the estimated proportion in consumption group *i* under the policy change scenario (including abstainers), p_i is the proportion in consumption group *i* in the baseline scenario, RR_0 is the relative risk calculated for the baseline scenario, and RR_a is the relative risk calculated for the policy change scenario. The two RRs can differ if the distributions of consumption patterns shift within consumption groups, such as following a reduction in consumption following a price increase.

Payoffs

The TreeAge models can be set to run with various different sets of payoffs in order to calculate costs, deaths, or hospitalisations. As with the probability calculations, various adjustments need to be made to the payoff calculations through the course of the model. This section describes how the payoffs are calculated.

HOSPITAL COSTS

To calculate hospital costs, the cost-weight for each hospitalisation must be multiplied by the price per cost-weight. In each stage of the model, cohort members that are hospitalised for a given alcohol-related condition are assigned the transitional award of the average cost-weight for that condition multiplied by the (discounted) price.

Cohort members that are not hospitalised for an alcohol-related condition still have some probability of hospitalisation for another cause so are assigned the average cost-weight for the whole cohort. The average cost-weight is calculated by taking the average number of case-weighted discharges per person across five years and subtracting the alcohol-related discharges. Data for case-weighted discharges were adjusted to match the calendar year population data and age groups used in the model.

ADJUSTMENTS

On average, events happen in the middle of a year. A model that assumes they all occur at the end of a year would slightly overestimate the life-years that should be assigned to a person who dies in a given year. A half-cycle correction is used to adjust for this potential bias. It essentially assigns half

the life years at the beginning and half at the end of each stage. In the model this is shown as assigning an initial value of 0.5 and a final value of 0.5 for all cohort members alive at the end of the model.

Discounting is incorporated into all the payoffs calculations, whether assigned as incremental or transitional rewards. The formula is:

$$c_d = \frac{c}{(1+r)^s}$$

where c_d is the discounted price per cost weight in a given year (or other discounted payoff such as cost per claim for ACC), r is the discount rate, and s is the model stage (year).

Additional costs

For several alcohol-related cost components there were no ICD codes or other methods for calculating attributable fractions so it was not possible to include them in the TreeAge model. Instead these costs were estimated separately based on additional data and the results of the main model. This subsection outlines how costs for ACC services, pharmaceuticals, and specialist addiction treatment services were calculated

ACC COSTS

Each of the six New Zealand Injury Prevention Strategy priority areas was mapped onto one or more of the alcohol-related causes in the main model. The number of alcohol-related claims by age-group and sex for each cause in the model was then estimated assuming the attributable fractions for alcohol-related ACC claims were proportional to the attributable fractions for hospitalisation for the same causes in the model. Costs per claim were assigned to the alcohol-related cases and aggregated to estimate the total cost to ACC of alcohol-related claims. For the alcohol pricing change scenarios, the proportional reduction in alcohol attributable hospitalisations was applied to the ACC base case results in order to estimate the reduction in ACC-related claims and costs.

PHARMACEUTICALS

The two pharmaceuticals included in the model are for treatment of addiction. Disulfiram is used only for the treatment of alcohol dependence, so was awarded an attributable fraction of 1. Naltrexone hydrochloride can also be used for the treatment of opioid dependence so a fraction less than 1 was considered appropriate. There is no information on the diagnosis of people receiving naltrexone so the fraction was calculated based on the relative prevalence of frequent use. The Ministry of Health's 2007 Alcohol and Drug Use Survey found 0.4 percent of the population used opiates at least weekly while 51.9 percent of the population used alcohol at least weekly. Although few of these people are dependent, this does suggest opioid dependence is relatively uncommon compared to alcohol dependence. An attributable fraction of 0.99 was thus applied to naltrexone.

Costs used for these drugs were costs to DHBs so excluded any patient co-payments. No information was available on the age or sex of patients receiving these drugs so aggregate totals were calculated. To estimate results for the pricing scenarios, the average PIF for mental and behavioural disorders due to alcohol use (the ICD-10 code incorporates detoxification, abuse and dependence) were applied. Although addiction is generally considered a chronic condition, an increase in treatment could be expected soon after an increase in price, so the full effects were introduced in year 1 of the model rather than being phased in over ten years.

ADDICTION TREATMENT SERVICES

Specialist addiction treatment services cover people with addictions to alcohol and other drugs, and often one person will have addictions to more than one of these substances. Based on a rough assumption that 50% of the costs of addiction treatment services are attributable to alcohol, an attributable fraction of 0.5 was applied to the total costs of addiction treatment services. This assumption is considered very conservative given the relatively high prevalence, accessibility, and addictiveness of alcohol. As with pharmaceuticals, no data were available on the age/sex distribution of patients so results were calculated in aggregate based on the average PIF for mental and behavioural disorders due to alcohol. Similarly, changes in demand for treatment services were assumed to occur soon after a price increase so the full effects were introduced in year 1 of the model.

Scenarios

For the baseline scenario, the changes in probabilities of death or hospitalisation as a result of a pricing change are set to 0 in the model. The discount rate is set at 8% for all scenarios and sensitivity analyses investigate the impact of varying the discount rate. In the minimum price and excise policy change scenarios, consumption was adjusted according to elasticity estimates and the resulting changes in probabilities of death or hospitalisation were incorporated into the model.

5.5 Data

The model incorporated data from several sources to estimate the health harms from alcohol consumption. In order to calculate event probabilities, changes expected under policy changes and event payoffs, a range of data were required including consumption data, elasticities, population data, mortality data, hospital inpatient admissions, costs, utilisation data, and relative risk functions.

Population

Population data by age group and sex were sourced from Statistics New Zealand's estimated average usually resident population at 30 June 2011 to create the cohorts that run through the model. Apart from some effects of population ageing, the subsequent nine years in the model also are based on the 2011 population. Population data for 2004 to 2008, sourced from the Statistics New Zealand average usually resident population series, were used as the denominator to estimate probabilities of death and hospital admission, and average costs per person.

Mortality

Mortality data for all causes were sourced from Statistics New Zealand's series of deaths by age and sex, annual to December from 2004 to 2008. These were used to estimate probabilities of death. Mortality data for the partially and wholly alcohol-related causes, by age group and sex for the years 2004 to 2008, were supplied by the Ministry of Health. These were used to estimate alcohol-attributable fractions and probabilities of death by cause.

Hospital discharges and costs

Hospital discharge data for partially and wholly alcohol-attributable causes were provided by the Ministry of Health, from the National Minimum Dataset (NMDS). The NMDS contains records of all publicly funded hospital inpatient events in New Zealand. Two datasets were prepared for this purpose, one containing discharges identified by diagnosis code and the other containing discharges identified by event code. There may be some overlap between the two datasets; if an individual was

admitted for the same cause more than once in a given year, the two events were combined into a single event. Some individuals had discharges for more than one of the causes in the dataset.

Each discharge was associated with a cost-weight, which enables calculation of an approximate cost of each discharge when combined with the relevant price for that year. The datasets were summarised to give the number of events for each cause (allowing probabilities to be calculated) and the average cost-weight by cause for each age group and sex subgroup. Data on total cost-weights by age and sex were provided to enable average hospital costs to be assigned to people who had no alcohol-related discharges. The price applied to the cost-weights was that for the 2008/09 year, inflated to 2010/11 levels using the hospital services price index ($4381.168).

Total numbers of discharges by age group and sex in 2004-2008, used to calculate the overall probabilities of hospitalisation, were sourced from Ministry of Health reports on publicly funded hospital discharges for 2003/04 to 2008/09 (Ministry of Health, 2011a, 2011b);(Ministry of Health, 2010a, 2010b, 2010c);(Ministry of Health, 2009) . These reports provided discharge data by financial year. To convert them to approximate discharges by calendar year, half of the discharges in each relevant financial year were attributed to a calendar year.

Relative risks

For chronic partially alcohol-attributable causes, relative risk functions were sourced from the epidemiological literature cited in the Sheffield Alcohol Policy Model for England or the report itself (Corrao et al, 1999);(Gutjahr, Gmel and Rehm, 2001);(Rehm et al, 2004);(Corrao et al, 2004);(Corrao et al, 2000);(Purshouse, Brennan et al, 2009). For oesophageal varices, no relative risk functions were provided in the Sheffield report, so functions were estimated based on a New Zealand report (Connor, Broad, Rehm et al, 2005).

For acute partially alcohol-attributable causes, relative risks were sourced from the Sheffield report, although this was not ideal because they are derived from attributable fractions and the methods behind their calculation are not entirely transparent. Two other options were considered. One was a meta-analysis that calculated only one relative risk for all acute conditions based on the finding of no statistically significant difference in relative risk across acute conditions (Corrao et al, 1999). This was not considered ideal because it is relatively old, did not provide sufficient specificity given that subsequent studies have found significant differences in the relative risk for different acute causes, and because the relative risks were based on total volume of alcohol consumed, which is known to be a weaker predictor of acute harm than per-occasion consumption (Taylor, Shield and Rehm, 2011).

The other alternative for estimating relative risks for acute causes was a study that estimated relative risks based on a more sophisticated probability-based formula that accounted for both the number of binge drinking occasions and the amount consumed per occasion (Taylor, Shield and Rehm, 2011). This method is probably the most accurate but it was not possible to apply it accurately without more detailed consumption data. The relative risks estimated in the study for Canada could be applied to the New Zealand data, but this approach would also have limited specificity and would assume similarities between New Zealand and Canada that may be unfounded.

There has been significant debate in the epidemiological literature about the extent to which earlier findings of a protective effect of alcohol on ischaemic heart disease may have been overestimated (Sellman et al, 2009);(Zakhari, 1997);(Fillmore et al, 2007);(Doll et al, 1997);(Jackson et al, 2005);(Mukamal and Rimm, 2001);(Corrao et al, 2000). As with all other relative risk literature, a systematic review of this literature is outside the scope of this report. However, because of the controversial nature of this issue, relative risks have been taken from a recent systematic review and meta-analysis which is the most rigorous treatment of the subject yet, and which concludes that there is evidence for a J-shaped relationship between alcohol and ischaemic heart disease in high quality studies (Roerecke and Rehm, 2012).

Alcohol consumption

Nationally representative alcohol consumption data were provided by the SHORE and Whariki Research Centre. For each of the three consumption categories, data were provided on the proportion of the population by age group and sex in each consumption category, and their average daily consumption volume and the average maximum consumption per occasion, in standard drinks.

Survey data covered the population aged 18-64 so it was necessary to estimate the consumption levels of people aged 65 years and over. In an earlier survey, the SHORE and Whariki Research Centre found that overall consumption among people aged 65 years and older was 78.5% of that for the population aged 40 to 65 years, and that maximum consumption was 69.9% of that for the population aged 40 to 65 years. It was assumed that the same portion of the 65+ population was in each consumption group as for the 45 to 64 age group, but that in each subgroup the average and maximum volumes were 78.5% and 69.9% (respectively) of the volumes observed for the equivalent group in the 45 to 64 age group.

Outpatient, primary care and ambulance data

Outpatient and primary care data are excluded from the model because data were not available. People with increased risk or harmful drinking patterns were found to have no excess utilisation of primary care, so it is not necessary to attribute different costs by consumption category (BERL, 2009). Outpatient data, in the Ministry of Health's National Non-Admitted Patient Collection, are not associated with diagnosis codes. Because of this there is no way to attribute a portion of events to alcohol and the data were not included in the study. Similarly, ambulance data are generally unable to be attributed to alcohol so were excluded from the study, with the exception of some ACC-funded ambulance costs.

ACC

ACC provided data on the numbers and costs of injury claims for the New Zealand Injury Prevention Strategy priority categories (assault, drowning, falls, suicide and self-harm, and workplace) by age and sex for the years 2007-2010. Costs include weekly compensation, independence allowance, death benefits (grants and weekly compensation) lump sums, vocational rehabilitation, support for independence (care, capital, assessment and other costs), medical treatment, hospital treatment, dental treatment, conveyance for medical treatment, conveyance by ambulance, and miscellaneous benefits/expenditure.

In the absence of an obvious trend, the average number of claims by age and sex subgroup for each cause was used for current estimates. The age-group was unknown for a small number of claims (an average of around 24 per year) so these were excluded from the analysis. The average number of claims per year is shown in Table 11.

Table 11: Average numbers of ACC claims per year, 2007-2010

		NZIPS priority category					
Age	Sex	Assault	Drowning	Falls	Motor vehicle	Suicide and self harm	Workplace
0-17	F	1673.9	53.6	73828.6	3237.9	343.0	2383.8
	M	3557.0	92.3	98523.5	3768.4	236.7	6616.1
18-24	F	1772.9	14.0	22469.7	3783.2	374.6	7750.1
	M	4200.3	31.5	33159.1	4151.4	214.6	24160.4
25-34	F	1621.5	11.0	25830.0	3222.8	283.8	10760.5
	M	2608.3	31.3	30405.5	3182.0	192.8	33432.3
35-44	F	1478.8	12.3	32521.0	3173.8	308.8	14259.8
	M	1803.3	28.8	30618.8	3070.5	188.3	36688.8
45-64	F	1116.8	22.0	63306.3	4688.8	251.0	26455.0
	M	1424.5	44.3	48223.5	4103.0	173.3	59252.5
65+	F	123.8	9.7	62669.3	1875.5	33.0	1974.0
	M	153.5	16.2	36316.5	1385.5	38.5	8706.5
Total		21534.3	366.6	557871.5	39642.5	2638.0	232439.7

The costs per claim in 2010 were adjusted to 2010/11 prices using the actual hospital price index for that half-year. The estimated costs per claim by age and category for 2010/11 are shown in Table 12.

Table 12: Average costs per ACC claim in 2010, 2010/11 prices

Age	Assault	Drowning	Falls	Motor vehicle	Suicide and self harm	Workplace
0-17	955.87	3641.15	356.90	8989.06	1879.19	971.81
18-24	1013.20	5491.14	877.17	10919.61	1679.51	1198.15
25-34	2060.49	33847.28	1318.87	14755.90	8395.05	2460.83
35-44	3668.94	25727.60	1590.66	13230.42	14235.24	3574.74
45-64	3584.12	28153.24	1544.95	8660.67	19992.54	3067.10
65+	2898.63	4116.64	1030.83	2912.77	9582.12	3832.59

Treatment and drug costs

Specialist alcohol and drug treatment costs for 2011 were obtained from the Ministry of Health. Because polydrug use is common and treated as one condition, it is impossible to separate alcohol attributable treatment costs from other drug treatment costs, so it was assumed that 50% of the costs were attributable to alcohol. This assumption is considered conservative given that the availability and prevalence of use of alcohol is significantly higher than that of other drugs. Costs of two drugs prescribed for the treatment of alcohol use disorders were obtained from PHARMAC.

Prevention program costs

Several Government agencies fund or provide alcohol policy advice, prevention, and harm minimisation programs. These costs, being driven directly by decision makers rather than epidemiology, may not be sensitive to changes in alcohol consumption and alcohol-related harm. As such the costs of these programs are not included in the model.

6. Estimating savings in crime costs from reduced alcohol consumption

This chapter describes the model developed to estimate the savings from less crime and fewer road crashes as a result of reduced harmful alcohol consumption. This was done by:

1. Estimating the total number of crimes for each crime type
2. Determining the proportion of crimes that are attributable to harmful alcohol consumption
3. Estimating the reduction in crimes resulting from reduced harmful alcohol consumption, and
4. Estimating a cost for each crime averted to derive an estimate of savings from reduced harmful alcohol consumption.

To begin, data was obtained to establish the total number of:

- Crime occurrences
- Police apprehensions
- Court cases
- Length of imprisonment
- Home detentions
- Community sentences.

Estimates of total crime are usually higher than recorded police crime. Total crime is best measured by surveys of households and businesses. The estimates for assaults, sex crimes, threats, burglary, theft, fraud, and property damage are based on the 2009 New Zealand Crime and Safety Survey and the 2007 Business Crime pilot study. The number of homicides is from Police recorded crime statistics and excludes fatalities in road crashes. The number of traffic and against justice offences is taken court data.

6.1 Total Number of Crime occurrences

The estimated total number of crime occurrences used in this study is shown in Table 13 below:

Table 13: Estimated total number of crime occurrences

Crime type	ANZSOC division[8]	In the home or in public[9]	In the workplace[10]	Total
Murder/Manslaughter	01	9311.	0	93
Assaults	02	699,000	9,700	708,700
Sex crimes	03	137,000	0	137,000
Threats, Harassment	05	548,000	16,200	564,200
Robbery	06	58,000	14,000	72,000
Burglary	07	342,000	56,700	398,700
Theft	08	223,000	242,000	465,000
Fraud	09	14,600	37,000	51,600
Property damage	12	360,000	1,104,000	1,464,000
Public order	13	44,50012	0	44,500
Traffic	14	40,00013	0	40,000
Breach of orders, conditions	15	26,94014	0	26,940
Miscellaneous offences	16	0	140,000	140,000

For alcohol induced road crashes, the number of victims (whether fatalities or injuries) multiplied by the latest Ministry of Transport factor for unreported crashes was used. The number of victims is shown in Table 14 below.

Table 14: Number of victim fatalities and injuries in road crashes in 2010/11

	Fatalities	Serious injuries	Minor injuries
Non-alcohol induced	216	2,752	28,800
Alcohol induced	43	614	3,305
Total	259	3,366	32,105

[8] The Australia New Zealand Standard Offence Classification (ANZSOC) system has been used to categorise crime. The objective of the ANZSOC is to provide a uniform national statistical framework for classifying criminal behaviour in the production and analysis of crime and justice statistics.

[9] From New Zealand Crime and Safety Survey 2009, unless shown otherwise

[10] From Ministry of Justice Business Crime Pilot Survey 2007, unpublished

[11] From Police recorded crime figures 2010/11 as downloaded from Statistics NZ website

[12] From Ministry of Justice Case Management System database

[13] Ibid.

[14] Ibid.

6.2 Total number of Police apprehensions, court cases, and prison sentences

The number of police apprehensions, court cases and prison sentences are taken from administrative data owned by NZ Police and the Ministry of Justice. Department of Corrections' costs for administering home detention and community sentences are based on the number of offenders sentenced to such sentences. For prison sentences, however, Corrections base their costs on the number of 'prison beds per year', that is, the total length of the prison sentence imposed. This is estimated by working out how many people were given a prison sentence and the average length of the sentence, as shown in Table 15 below.

Table 15: Sentences imposed in 2010/11 by age and gender

Age	Gender	Court cases	Prison sentences	Mean prison length (days)	Prison beds per year	Home detention	Community sentences
18-24	Male	4,833	542	450.4	668.8	176	1,776
25-34	Male	4,219	545	445.3	664.9	114	1,558
35-44	Male	3,324	368	434.7	438.3	78	1,098
45-64	Male	2,012	130	472.8	168.4	32	633
65+	Male	88	3	241.7	2.0	1	16
18-24	Female	1,193	48	349	45.9	32	398
25-34	Female	867	34	612.1	57.0	25	288
35-44	Female	764	21	489	28.1	12	223
45-64	Female	428	14	486.8	18.7	4	99
65+	Female	11	1	30	0.1	0	1

6.3 Data sources used to develop the model

Alcohol Attributable Fractions (AAFs) for the crime model were derived from two distinct sources. The first is the NZ Police's "Alco-Link" data source. This contains data on all types of crime except for road crashes involving alcohol. For alcohol-induced road crashes, data from the Ministry of Transport's Crash Analysis System (CAS) was used. This section discusses both sources of data.

The NZ Police Alco-Link data

Tables 16 and 17 show the proportions of derived alcohol induced offending for male and female offenders, broken down by age and type of offending. As discussed above, the Alco-Link database does not include people detained on traffic-related offending. That data is discussed below.

Table 16: Estimated proportion of crimes caused by harmful alcohol consumption (males)

Male Offenders	18-24	25-34	35-44	45-64	65+
Murder/Manslaughter	44.4%	23.1%	12.5%	54.5%	0.0%
Assaults	35.9%	29.7%	26.9%	29.1%	14.9%
Sex crimes	24.0%	15.3%	7.9%	7.7%	2.7%
Dangerous Acts	34.3%	12.5%	11.6%	4.8%	0.0%
Threats, Harassment	18.4%	17.3%	16.7%	16.5%	14.3%
Robbery	32.9%	26.3%	11.0%	75.0%	0.0%
Burglary	10.4%	10.3%	9.5%	11.5%	16.7%
Theft	15.2%	9.2%	7.0%	10.6%	2.6%
Fraud	2.1%	2.7%	1.4%	2.7%	9.5%
Drugs	12.2%	9.4%	8.9%	8.1%	14.0%
Weapons	29.0%	26.7%	22.2%	28.4%	15.9%
Property damage	30.3%	31.1%	29.0%	32.1%	6.8%
Public order	51.3%	54.9%	44.7%	41.8%	18.1%
Breach of orders, conditions	43.9%	33.3%	27.1%	33.6%	31.8%
Miscellaneous offences	12.7%	11.9%	5.7%	10.0%	7.7%

Source: NZ Police Alco-Link data

Table 17: Estimated proportion of crimes caused by heavy alcohol consumption (females)

Female Offenders	18-24	25-34	35-44	45-64	65+
Murder/Manslaughter	0.0%	25.0%	0.0%	0.0%	0.0%
Assaults	37.2%	34.1%	32.6%	32.2%	11.1%
Sex crimes	0.0%	0.0%	0.0%	0.0%	0.0%
Dangerous Acts	15.1%	6.8%	13.7%	5.0%	0.0%
Threats, Harassment	13.2%	14.6%	16.9%	14.7%	20.0%
Robbery	34.0%	36.4%	16.7%	0.0%	0.0%
Burglary	9.2%	8.8%	14.2%	10.6%	0.0%
Theft	5.1%	4.3%	4.8%	3.5%	1.0%
Fraud	1.3%	1.3%	1.2%	1.1%	0.0%
Drugs	7.8%	6.2%	9.1%	6.4%	0.0%
Weapons	35.2%	33.3%	38.6%	42.5%	25.0%
Property damage	28.3%	33.1%	36.8%	36.3%	12.5%
Public order	40.1%	41.0%	39.1%	35.8%	32.5%
Breach of orders, conditions	42.2%	41.0%	42.2%	43.5%	9.1%
Miscellaneous offences	0.0%	12.5%	10.3%	12.2%	0.0%

Source: NZ Police Alco-Link data

The Alco-Link data is collected by Police at all their watch-houses. Every person detained by the Police is asked a screener question – to establish whether or not alcohol has been consumed within the last 12 hours and whether the arrest is within 12 hours of the offence occurring. Only persons who answer 'yes' to both conditions are counted in the Alco-Link data provided. Persons detained by

Police solely for safety reasons, such as alcohol detoxification, are excluded from the Alco-Link database.

Those who meet the required conditions for inclusion in the survey are classified according to their level of intoxication as follows: not intoxicated, slight intoxication, moderate intoxication or extreme intoxication. For the purposes of this study, only those classified as being in the "moderate" or "extreme" category have been analysed. Those classified as "slight intoxication" have been ignored because it is unlikely that alcohol consumption was a major cause of their offending. However, it was assumed that being moderately intoxicated could cause an individual to commit a crime. Alco-Link data is likely to provide a conservative estimate of alcohol-attributable crime because only those who are detained within 12 hours of committing an offence are screened for their alcohol intake. Offenders who could have been intoxicated at time of offending, but who were not arrested within 12 hours of committing a crime are not included in the Alco-Link database.

In providing the data, NZ Police issued a note that Alco-Link data is provisional only, and not directly comparable to official Police apprehensions data. Also, Alco-Link data is not subject to the same quality review and validation processes that are applied to official statistics.

Nevertheless, the Alco-Link database is considered to be a better source than the alternative data source available – the NZ Arrestee Drug Use Monitoring (NZ-ADUM) data. The NZ-ADUM data is far more rigorously collected and provides a much richer source of data. However, the data is a sample survey at only four watch-houses and for a very limited period of time. Unlike the Alco-Link data, it does not have universal coverage. The biggest weakness in using NZ-ADUM data is that the offences are self-reported by the respondents. This means the basis of offence identification is not comparable to the NZ Police general statistics. When we compared the offences self-reported by respondents in the NZ-ADUM data to the general statistics, they were incompatible and were the ultimate reason for rejecting the NZ-ADUM data.

The Crash Analysis System (CAS) data

As mentioned in the previous section, the Alco-Link data does not contain data on Road Policing. To derive road crash Alcohol Attributable Fractions (AAFs), data from the Ministry of Transport's Crash Analysis System (CAS) was used. Our definition is that every alcohol-related crash is, in effect, a criminal matter – irrespective of whether a criminal prosecution was ultimately undertaken.

Each road crash attended by Police is coded and stored in CAS. In particular, the attending Police Officer notes down all the contributing causes for the crash. The contributing causes can be divided into two basic categories – the mechanics of the crash and any external contributing reasons. Crashes where alcohol was deemed an external contributing factor were selected and analysed.

The alcohol-related crashes were compared to the total number of recorded crashes to yield alcohol-attributable fractions (AAFs). Crashes with other external contributing factors (such as sun-strike or distraction) had their AAFs reduced proportionately by the number of non-alcohol factors. For instance, if a crash was attributed to alcohol and driver-distraction, then the number of deaths and injuries were reduced by half.

AAFs were derived for victim fatalities, seriously injured victims and victims with minor injuries. Lastly, an AAF for traffic offending not involving crashes was also derived from court data.

Table 18 shows the AAFs derived for road crashes involving alcohol. It also shows the proportion of traffic offences processed through the courts that do not involve road crashes.

Table 18: Percentage of victim fatalities, serious and minor injuries in crashes where alcohol was cited as a factor

Sex	Age	Fatalities	Serious injuries	Minor injuries	Non-crash traffic offences (court data)
Male	18-24	34.1%	36.5%	24.5%	59.0%
Male	25-34	26.5%	30.9%	16.1%	60.2%
Male	35-44	17.1%	22.2%	11.1%	65.3%
Male	45-64	15.3%	10.5%	4.2%	71.5%
Male	65+	12.8%	3.2%	2.2%	77.0%
Female	18-24	14.2%	15.7%	11.9%	61.3%
Female	25-34	4.9%	17.8%	9.0%	63.4%
Female	35-44	2.8%	6.1%	6.6%	69.3%
Female	45-64	4.0%	4.6%	2.9%	75.7%
Female	65+	0.0%	1.4%	1.7%	85.5%

Source: Ministry of Transport's Crash Analysis System and Court data

6.4 Risk functions for alcohol-related crime

Risk functions for each age cohort were determined based on the relative risk of alcohol attributable crime for a harmful drinker and a non-harmful drinker. The probability of committing a crime was assumed to be driven by acute, rather than chronic drinking (that is, average maximum consumption per occasion rather than average daily consumption). The risk of reduced criminal activity was assumed to start at 6 drinks for men and women on an occasion at least once a week.

Figures 4 and 5 show relative risk functions for assaults (being one of the most costly alcohol attributable crimes) by gender.

Figure 4: Relative risk functions for assaults – males

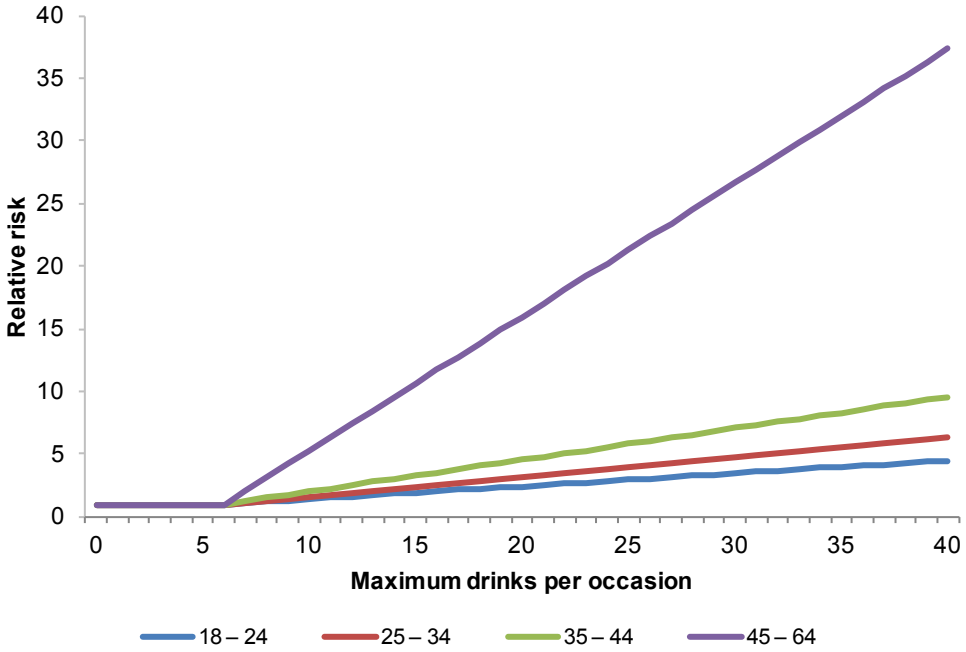
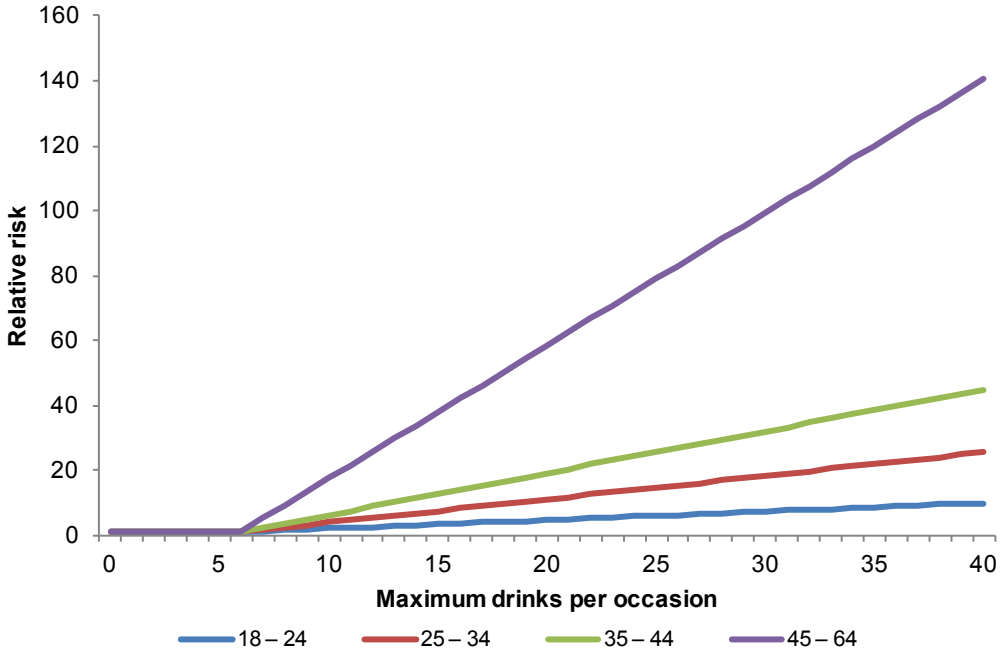


Figure 5: Relative risk functions for assassaults - females



Potential Impact Fractions (PIFs) were derived for each offence type. The PIFs were applied to each offence type to determine the reductions in crime following a reduction in harmful alcohol consumption.

Reductions in crime for those aged 65 years and older were not included in the final model. The slope of the relative risk functions for this age group resulted in negative counts of crime, suggesting that the proposed pricing policies would eliminate all alcohol-related crime by those aged 65 years and older. Given the small volumes of alcohol-related crimes committed by this age group, we

decided to exclude this group from the crime models. This means crime savings may be slightly underestimated.

6.5 Valuing the impact of each type of crime

To determine the cost savings from reduced crime, both Government sector cost savings and private sector cost savings were estimated. The costs to victims were based on the 2006 New Zealand Crime and Safety Survey and the 2007 Business Crime pilot study. From each of these surveys, the average costs to the victims for each crime type were derived and updated to 2010/11 estimates using the Consumer Price Index (CPI). For the Government sector cost savings, marginal cost savings were used where possible.

Private sector costs

The estimated average cost to each victim of crime is shown in Table 19 below. The cost estimates have two components to them –a personal/household cost and a cost to businesses. Both are discussed below.

Table 19: Unit cost of crimes to households and businesses

Crime type	Private unit costs ($)
Murder/Manslaughter	3,670,000
Assaults	4,187
Sex crimes	1,710
Threats, Harassment	2,070
Robbery	5,224
Burglary	2,982
Theft	2,569
Fraud	59,647
Property damage	521
Public order	0
Traffic	0
Breach of orders / Conditions	1,884
Miscellaneous offences	888

PERSONAL AND HOUSEHOLD COST ESTIMATES

All the costs were derived based on responses to questions in the 2006 New Zealand Crime and Safety Survey (NZCASS). These questions were not repeated in the 2009 survey. The costs have been inflated by the CPI to bring them up to the 2010/11 period.

Some categories of crime are deemed to have no cost at the personal or household level. These include:

- Drugs
- Weapons
- Traffic
- Public order offences
- Miscellaneous offences.

For the Breach of Orders / Conditions crime category, all the personal costs are related to victims of a breach of a protection order and other domestic violence order breaches.

BUSINESS COST ESTIMATES

All the costs shown are derived from the 2007 Business Crime pilot study. As with the personal and household costs, these have been inflated by the CPI to 2010/11 dollars.

The largest crime type to affect businesses is fraud. This is followed by theft and property damage. The cost attributed to 'miscellaneous offences' is cybercrime. Businesses reported small and almost negligible costs.

INTERACTION BETWEEN THE TWO SURVEYS

Both surveys targeted different populations – so the costs are generally additive. However, that does not imply that there is no interaction in the data from the two surveys for some offence types.

For property offence types, such as burglary, theft, fraud and damage, there is indeed no interaction. The victims are the person, the household or the business individually.

However, with confrontational offences, such as assaults and threats, the victims may be both at the personal level and at the business level. For such offences, the personal costs taken from NZCASS are also applied to the victims of such crimes that take place in business premises.

Government sector marginal costs

To calculate the total savings in private sector costs, it was appropriate to use the unit costs derived from the surveys as the total costs to a victim of a crime are avoided if that crime is no longer committed. This is not so with the cost to Government. The cost of a crime to Government include all the resources required to respond to and sanction criminal activity, including police officers, court staff, prison guards, probation officers and prison beds. In this instance, it is appropriate to consider the marginal costs saved from a reduction in criminal activity. Using average costs is likely to over-estimate cost savings as we are only interested in changes at the margin.

The appropriate manner of analysis is to use the marginal costs for each organisation. Unfortunately, only the Department of Corrections was willing to provide any data on marginal costs. The marginal costs provided by the Department of Corrections are shown in Table 20 below.

Table 20: Marginal costs to Corrections for prison and community sentences

Sentence	$ (annualised)
Imprisonment (per bed-year, up to 60 beds)	6,000
Imprisonment (61 – 300 beds)	44,250
Imprisonment (more than 300 beds)	52,050
Home Detention	21,100
All other community sentences (average)	3,862

Source: Department of Corrections

Given that only the Department of Corrections would provide marginal costs, we started our analysis using the average costs derived from the updated Ministry of Justice 2005/06 Costs of Crime study. This study showed that, for the 2010/11 period, the average savings to Police, Courts and Corrections for crimes averted due to reduced harmful alcohol consumption was $50 million, $24 million and $152 million respectively.

Using the Corrections' marginal costs estimates, the costs of crimes averted to the Corrections prison service is $37 million. This gives a factor of 0.23 as the ratio of Corrections' marginal costs to average costs. In the absence of better marginal costs estimates for Police and Courts[15], we have applied this factor to the Police and Courts average costs estimates to derive estimated marginal cost savings.

The marginal costs to DHBs were calculated based on cost-weights provided by the New Zealand Health Information Service in 2007. The costs to ACC and the New Zealand Fire Service are also included.

Other agencies that incur crime-related expenditure have not been included because of the type of crime prosecuted. For instance, Inland Revenue prosecutes crimes on tax evasion. But such crimes are unlikely to be related to harmful alcohol use.

Road crash costs

The Ministry of Transport's latest costs for road crashes were used. A fatality is estimated to cost $3.69 million, a serious injury $390,000 and a minor injury $20,700. These costs include both the cost to the individual and other costs attributed to government departments, territorial authorities and the effect of a crash to the roading network.

Beyond year 1

The baseline model calculated the cost savings using various crime data from 2010/11. For 2011/2012 to 2019/20, the cost of crime (before discounting) is forecast to reduce by 1% per year as crime is expected to decline. The actual share of the number of crimes for each of the eight population subgroups varied, based on Statistics NZ's population projections. Thus the share of crimes committed by 25 to 34 year old males is projected to increase quite dramatically while the proportion of crimes committed by 35 to 44 year old females is projected to decrease.

Estimated costs saved over a ten-year period were discounted at a rate of 8%, as recommended by the NZ Treasury.

[15] An alternative costing for police and courts gave savings of $32.5 and $18.6 million respectively. This costing hasn't been used because it is based on informal data for cases involving 17 year olds charged with offences carrying a maximum penalty of 5 years or less. This estimate can be seen as an upper bound of Police and Court savings.

7. Estimating savings in workplace productivity from reduced alcohol consumption

A number of studies have attempted to estimate the costs of lost productivity due to harmful alcohol consumption. In terms of New Zealand research, BERL (2009) estimated a cost of $1,764 million in lost productivity from harmful alcohol consumption. Delvin et al (1997a) estimated lost annual production costs of $704 million in NZ$1991, (based a 10% unemployment rate and a 10% discount rate), while Easton (1997a) had the highest estimate of lost productivity at $1,800 million. Jones et al (1995) estimated the cost of absenteeism and impaired productivity due to alcohol consumption to be $57 million. Overall, these costs are estimated to make up a considerable proportion of total costs to society.

These studies have taken a full societal perspective, including the costs of lost productivity to the individual alcohol consumer. They indicate that the costs of lost productivity to the individual due to alcohol consumption are likely to be very large.

For the purpose of this analysis, only the benefits to society from an increase in production or productivity due to a reduction in alcohol consumption will be estimated. That is, we take a welfare perspective and consider the impact on the welfare of society as a whole. The benefits from increased productivity to the individual alcohol consumer will not be considered in this analysis as we assume that individual consumers consider the potential impact on their productivity when making the decision to consume alcohol.

The estimated savings in productivity from reduced alcohol consumption must be treated with caution due to the range of assumptions that must be made and the lack of data available in some cases. We perform sensitivity analysis on a number of the key assumptions to assess how the results vary if changes are made to the underlying assumptions. The results of the sensitivity analysis are presented in Section 12 below.

Reduced harmful alcohol consumption is likely to affect productivity in five key areas:

1. Productivity savings due to a reduction in premature mortality of a worker through an alcohol induced illness or accident.
2. Productivity savings due to a reduction in unemployment, where some workers are now able to obtain jobs who otherwise would not have been employed due to their alcohol consumption problems.
3. Productivity savings due to a reduction in the number of days people are absent from work due to an alcohol induced illness or injury.
4. Productivity savings due to a reduction in the number of days of impaired productivity on the job from harmful alcohol consumption that may result in deterioration of physical function or decision making ability, permanent injury, lateness, or through the effects of problem drinking on other co-workers.
5. Productivity savings in the household or volunteer sector for any of the reasons outlined above.

7.1 Estimating the production benefits from reduced premature mortality

For reductions in pre-mature mortality, it is possible to estimate worker-years saved. How these years are then expressed in terms of actual production saved is more problematic and is the subject of considerable debate among economists.

How lost productivity is valued depends on the assumptions made about the labour market. One assumption is that the economy is at "full employment". In this situation all the available labour resources are being used in the most economically efficient way. Any unemployment is due to non-cyclical types of unemployment and can be regarded as frictional. In this case, the loss of a worker from the labour force means that his/her total output is reduced by the value of his/her marginal productivity, which will equal their gross wage if employers are profit maximisers. This is known as the *human capital approach*.

Another assumption that could be made is that unemployment in the economy is caused by a demand constraint or cyclical unemployment. This occurs when there is not enough aggregate demand in the economy to provide jobs for everyone who wants to work. The loss of a worker will have little output implications, as he/she can be replaced from the pool of unemployed workers, at the cost of recruitment and training. This is known as the *friction cost method*.

For the purpose of this analysis we have used the human capital approach, as in the long-run full employment is a reasonable assumption as wage rates will adjust to an over-supply of labour so that the labour market returns to equilibrium. From a welfare perspective we assume that those who die prematurely will produce less but will also consume fewer resources so that the overall effect on society balances out. Therefore only the frictional costs associated with replacing the deceased worker needs to be estimated.

The model for reduced premature mortality

The number of deaths saved from reduced alcohol consumption was estimated in the health mortality model by age and gender. The employment rate for each age and gender group was used to estimate the number of workers who would remain working (rather than die) as a result of their reduced alcohol consumption.

As noted above, we assume that those who remain in work also consume more resources, so from a welfare perspective society is no better off. Therefore the only savings that need to be estimated are the frictional costs the employer no longer incurs as a result of not having to replace a deceased worker.

A friction period occurs whenever a previously employed worker dies as a result of their harmful alcohol consumption. The length of the friction period is based on the average vacancy duration, which depends on the level of unemployment and on the efficiency of the labour market in matching labour demand and supply. Koopmanschap (1995) noted that the friction period is longer than the duration of the vacancy since time may elapse between the emergence of production losses and the decision to create the vacant position. In addition, time will pass between filling a vacancy and the first working day of the new employee, especially if he or she is already employed.

Data is not available in New Zealand on the average duration of job vacancies at a national level. Therefore we used the average length of job vacancies at the Ministry of Justice as a proxy for the national average. The average time from the date a vacancy is advertised to the date an appointment is made is 7 weeks. An extra 4 weeks was added to allow for the lapse of time between the emergence of a vacant position and the date the position is advertised and the time between the

date the position is filled and the date the person starts work. The friction period is therefore estimated to be 11 weeks.

Note that this may be an upper-bound estimate as the Ministry predominately employs higher educated personnel who may take longer to recruit. However, it is possible that a 'replacement chain effect' may occur if a worker is replaced by another employed worker who then needs to be replaced. A number of friction periods may occur until a worker is replaced by the pool of unemployed. Estimating the replacement chain effect is difficult but we consider a friction period of 11 weeks is likely to be conservative.

The production savings from reduced premature mortality consist of the reduced costs associated with filling a vacancy and training new personnel. To estimate this, we use the gross mean weekly earnings as a proxy for recruitment and training costs. We multiply the length of the friction period by median weekly earnings for part-time and full-time workers. We assume the same length of friction period for part-time and full-time workers. We then multiply this by the estimated number of part-time and full-time workers who remain employed but would have died if they had not reduced their alcohol consumption. This is discounted at 8% over the duration of the model (ten years). The model is also adjusted for estimated changes in the population over the ten year period based on a median population projection series.

We assume that any additional Government revenue from those who remain in work is balanced by an increase in the consumption of government services, so from a welfare perspective society is no better off. Therefore an increase in Government revenue in the form of PAYE tax from reduced premature mortality is not included.

7.2 Estimating the savings from reduced unemployment

Determining the savings in unemployment-related costs from a reduction in alcohol consumption is difficult as it could involve two scenarios:

1. Someone may retain their job when they otherwise may have lost it due to their alcohol problem.
2. Someone who was unemployed may obtain a job as a result of reducing their alcohol consumption.

In the first scenario, the benefits from a welfare perspective of reduced alcohol consumption are the frictional costs saved that would have been incurred in either replacing a worker who loses their job and the additional Government revenue (PAYE tax) that is being generated by those individuals who remain employed rather than losing their job. The additional production generated by the individual who remains employed is balanced by his/her continued consumption of resources, so from a welfare perspective, there is no additional benefit to society beyond the frictional costs saved and the additional PAYE tax.

In the second scenario, an individual is able to obtain work as a result of their reduced alcohol consumption. Therefore production increases, but their consumption of resources also increases resulting in no change in benefits from a societal welfare perspective. Using the human capital approach and assuming full employment, frictional costs are saved as there are now additional workers available to fill job vacancies that would otherwise have had to have been taken from individuals employed elsewhere. The additional tax revenue generated by the now employed individual is counted as a benefit to society as the employed individual is now generating revenue to pay for his/her consumption of government services that he/she was not generating when unemployed (but was still consuming the government services).

It should be noted that benefit payments to those who are unemployed or sick because of their alcohol consumption are a transfer payment from one sector of the population to another, and are

not therefore a cost to society as a whole. Transfer payments represent a redistribution of income, taking money away from some individuals (taxpayers) and giving it to others who are eligible. These payments are therefore not included in the analysis.

We do not have data on the number of people who lose their job as a result of their alcohol consumption, but MacDonald and Shields (2004) provide evidence about the reduced probability of working if you are a problem drinker. Given the inability to differentiate between the two possible scenarios, benefits to society are estimated by determining the additional number of people employed as a result of a reduction in alcohol consumption, with the benefits valued in terms of the savings in frictional costs and the additional Government revenue generated as a result of an increase in PAYE tax.

MacDonald and Shields (2004) report the results of a new study into the association between problem drinking and employment for a large sample of English males of working age. The study analysed data from the Health Survey for England (1997 – 1998) and focused on males aged 22 to 64 years. The survey provides information on both the quantity and frequency of alcohol consumption, with data collected by face-to-face interviews.

MacDonald and Shields use a bivariate probit framework because of the likely existence of unobservable heterogeneity jointly determining both problem drinking and working. The study uses different measures of problem drinking (frequency, quantity, and psychological and physical symptoms of drinking). A limitation of the study is that, although the researchers found robust evidence that problem drinking significantly reduces employment prospects, the statistically significant quantitative estimates are wide ranging (from 0.069 to 0.31) reflecting the different definitions of problem drinking and alternative identification restrictions adopted.

The reduced probability of working and risk functions

MacDonald and Shields (2004) define a problem drinker as one who consumes more than 45.3 units of alcohol per week or 6.5 units of alcohol per day. As this is very similar to the threshold for a harmful drinker based on daily volume consumed used in this analysis, we use the results based on this definition of a problem drinker.

Defining a problem drinker on the basis of the quantity of alcohol consumed, it was found that the change in the probability of working from being a non-harmful drinker to being a harmful drinker was 16.6% (with all other explanatory variables held at their sample mean values). The smaller probability of 6.9% (based on a definition of a problem drinker as a daily drinker) is tested in the sensitivity analysis.

As for the health and crime models, risk functions were developed to examine the impact of a small shift in consumption. No Alcohol Attributable Fractions are available in the literature, but it was possible to calculate the excessive risk of not working based on the employment rate, the proportion of harmful drinkers, and the reduced probability of not working if someone is a harmful drinker.

Risk functions for each age cohort were then determined based on the relative risk of unemployment for a harmful drinker and non-harmful drinker. The probability of working was assumed to be driven by chronic, rather than acute drinking (i.e. average daily volume rather than average per occasion volume). The risk of reduced employment was assumed to start at 7 drinks for a man and 6 drinks for a woman based on our definitions of a harmful drinker.

The risk functions for males and females respectively are presented below.

Figure 6: Risk functions for not working – males

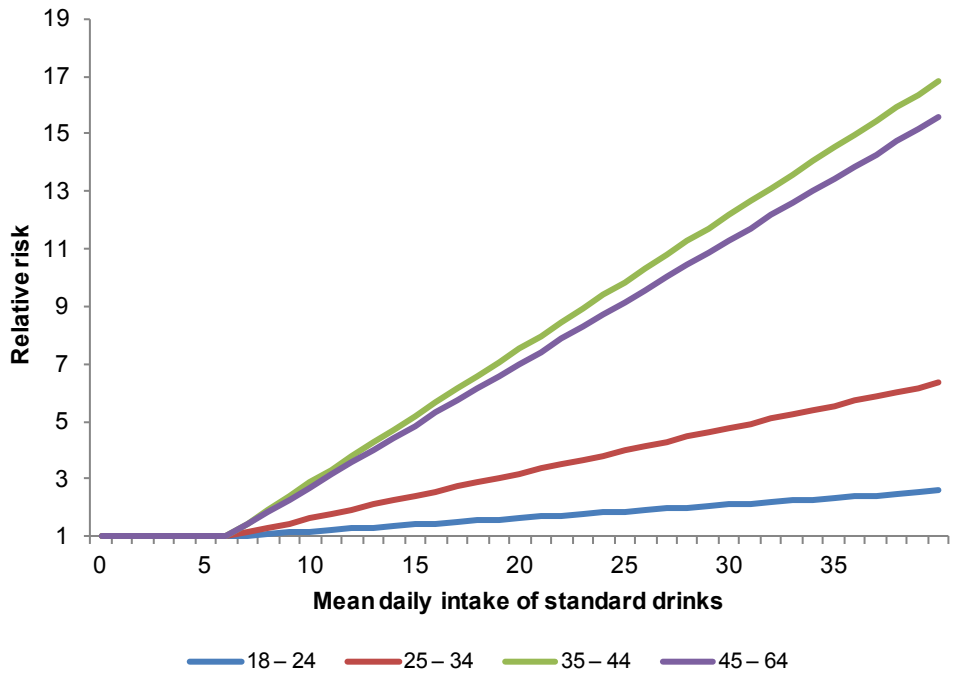
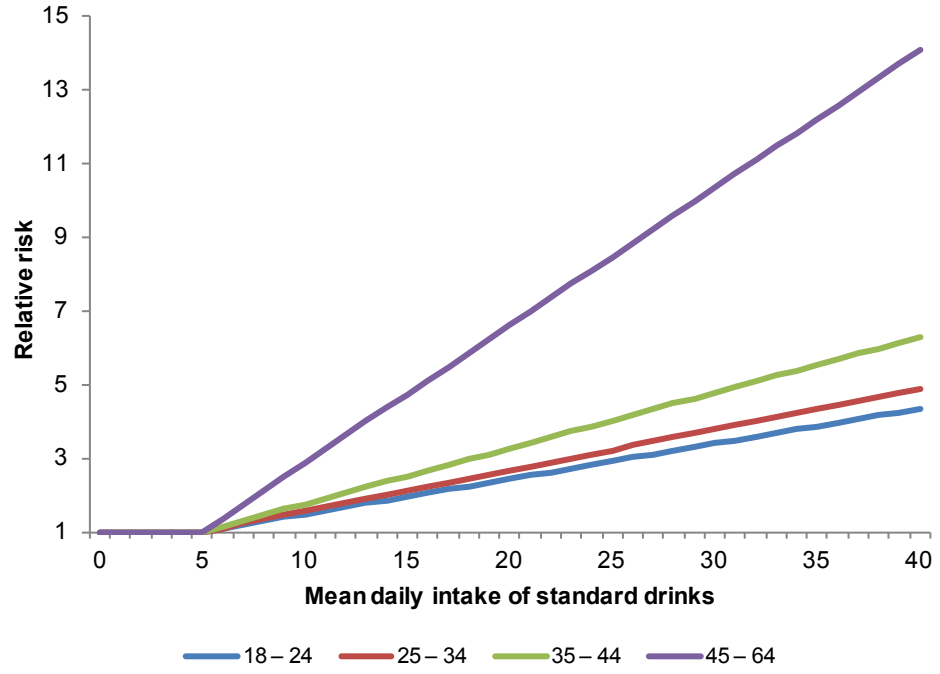


Figure 7: Risk functions for not working – females



The model for unemployment

Based on the relative risks, Alcohol Attributable Fractions (AAFs) were calculated for each age group and gender. Potential Impact Fractions (PIFs) were then calculated based on the consumption distribution at time *0* and time *t* and applied to the unemployment rate to derive a new unemployment rate. The number of additional people employed as a result of a new pricing scenario

was then estimated and a new employment rate derived. No time delay was assumed between the changes in alcohol consumption and the reduced risk of not working.

Benefits from increased production resulting from reduced unemployment are estimated by multiplying the length of the friction period (11 weeks) by median weekly earnings for part-time and full-time workers. This is then multiplied by the additional people employed (on a part-time and full-time basis). Average annual PAYE tax is also multiplied by the additional people employed to obtain an estimate of the increase in Government revenue generated. The model is run over a ten year period and is discounted at a rate of 8%. The model is also adjusted for estimated changes in the population over the ten year period based on a median population projection series. To consider the potential impact of a replacement chain effect, we test how the results change based on an assumption of a 20 week friction period in the sensitivity analysis outlined in Section 12 below.

7.3 Estimating the savings from a reduction in absenteeism from work

We assume that short-term absence from work will result in a production loss and/or extra costs to maintain production during the period of the absence. Colleagues may need to work over-time or temporary workers may need to be hired from a firm's own pool of workers or from agencies. Alternatively production may fall, while costs remain unchanged.

Evidence on the impact of alcohol on absenteeism

Jones et al (1995) is the only New Zealand study to provide an estimate of the number of days people are absent from work due to harmful alcohol consumption. A sample of Auckland residents was asked "how many times in the last 12 months have you been away from work because of your drinking?" From a total of 2,638 drinkers who were either in full-time or part-time employment, 98 respondents or 3.7% of the sample reported an alcohol-related absence at least once. Based on an individual's gross earnings, a working day foregone was equivalent to one day's lost wages and approximated to a loss of $15.6 million nationally for a population of 3.4 million. Seventeen percent of the heaviest drinkers (six drinks per occasion) had taken at least one absentee day compared to 0.4% of the lightest drinkers (one drink per occasion) with the daily cost of lost production between the heaviest and lightest drinkers varying from $54.80 per person to $0.40 per person.

Roche et al (2008) examined absenteeism due to alcohol consumption in Australia. Their paper presents a secondary analysis of selected data from the 2001 National Drug Strategy Household Survey (NDSHS). This survey asked respondents to report the number of days missed from work due to their personal use of alcohol or due to any illness or injury in the three months prior to the survey. The NDSHS also provided details of respondents' short- and long-term patterns of alcohol consumption (that is, both acute and chronic harm).

Of the workers who responded to the question concerning alcohol-related absenteeism, 3.5% reported missing at least one work day due to their alcohol use, compared with 39.7% absent due to an illness or injury not related to alcohol. A significantly larger percentage of males (4.2%) compared to females (2.5%) reported missing at least one day due to their alcohol use. The likelihood of missing a day of work due to alcohol consumption declined with age.

As alcohol consumption increases, so does the likelihood of alcohol-related absenteeism. Compared to low risk drinkers, workers drinking at high-risk levels at least weekly (11 drinks or more a day for a male and 7 drinks or more a day for a female) were 21.9 times more likely to report alcohol-related absenteeism. Workers drinking at long-term risky levels (males between 29 and 42 units per week, females 15 to 28 units per week) or high-risk levels (males ≥ 43 units per week, females ≥ 29 units

per week) were 4.3 and 7.3 times (respectively) more likely to report alcohol-related absenteeism compared to low risk drinkers (Roche, 2008).

Estimating the wholly attributable fractions

Data by age and gender on the average number of days absent due to varying levels of alcohol consumption was provided by the SHORE and Whariki Research Centre at Massey University. This was based on survey data from the 1995 study by Jones and colleagues. From this data we were able to estimate the number of days absent as a result of "harmful" alcohol consumption (the top 25% of drinkers) or "increasingly risky" alcohol consumption (those in the top 25% to 50% of drinkers and those in the bottom 25% to 50% of drinkers).[16] The estimates are shown in Table 21 below:

Table 21: Estimated days of absenteeism from increasingly risky or harmful alcohol consumption

Gender	Age group	Estimated days of absenteeism from increasingly risky alcohol consumption per employee	Estimated days of absenteeism from harmful alcohol consumption per employee
Male	18-24	0.090	0.854
	25-34	0.090	0.537
	35-44	0.013	0.088
	45-64	0.003	0.018
Female	18-24	0.089	0.253
	25-34	0.021	0.052
	35-44	0.021	0.113
	45-64	0.000	0.015

Estimated by the Ministry of Justice based on data from the SHORE and Whariki Research Centre

It was not possible to derive relative risk functions for absenteeism due to the absence of a reference group. Absolute risk functions were therefore calculated based on the estimated days of absence and the average alcohol consumption levels per drinking occasion for "increasingly risky" drinkers and for "harmful" drinkers.

As for relative risk functions, assumptions were necessary about the curve form and starting threshold. In the absence of evidence to the contrary, linear risk functions were assumed. No days of absence were assumed for low risk drinkers with a threshold of 4 drinks or less per drinking occasion. The absolute risk functions for absenteeism for males and females are shown in Figures 8 and 9 below:

[16] It should be noted that the sample sizes are very small when broken done by age and gender, so there is a large variation in the estimated number of days absent at a 95% confidence level. The results of the analysis must therefore be treated with caution.

Figure 8: Absolute risk functions for absenteeism – males

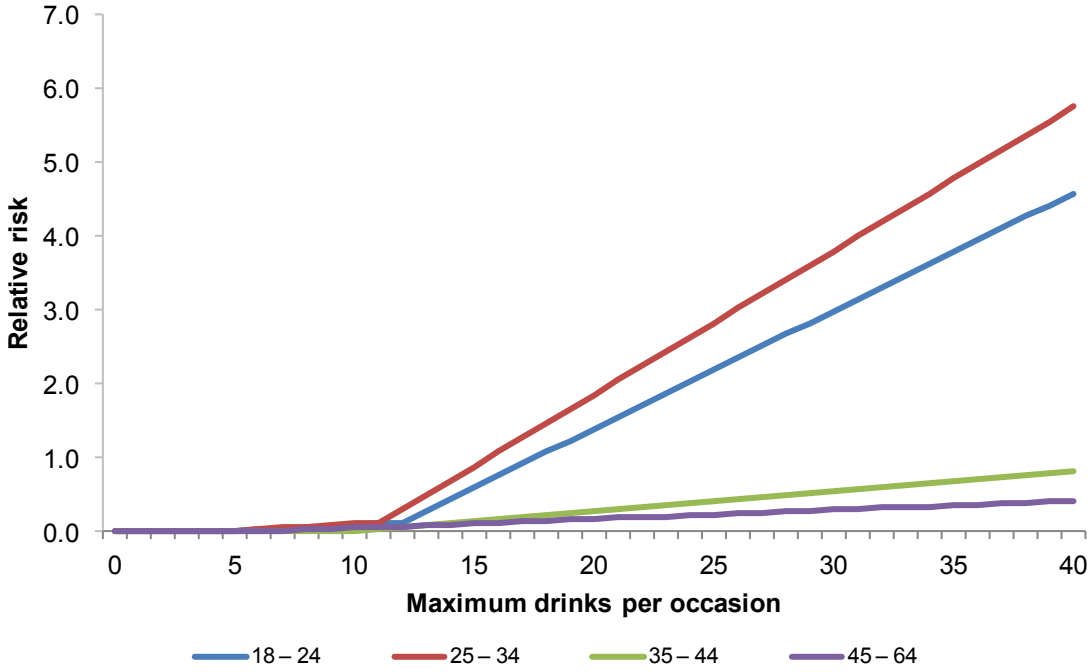
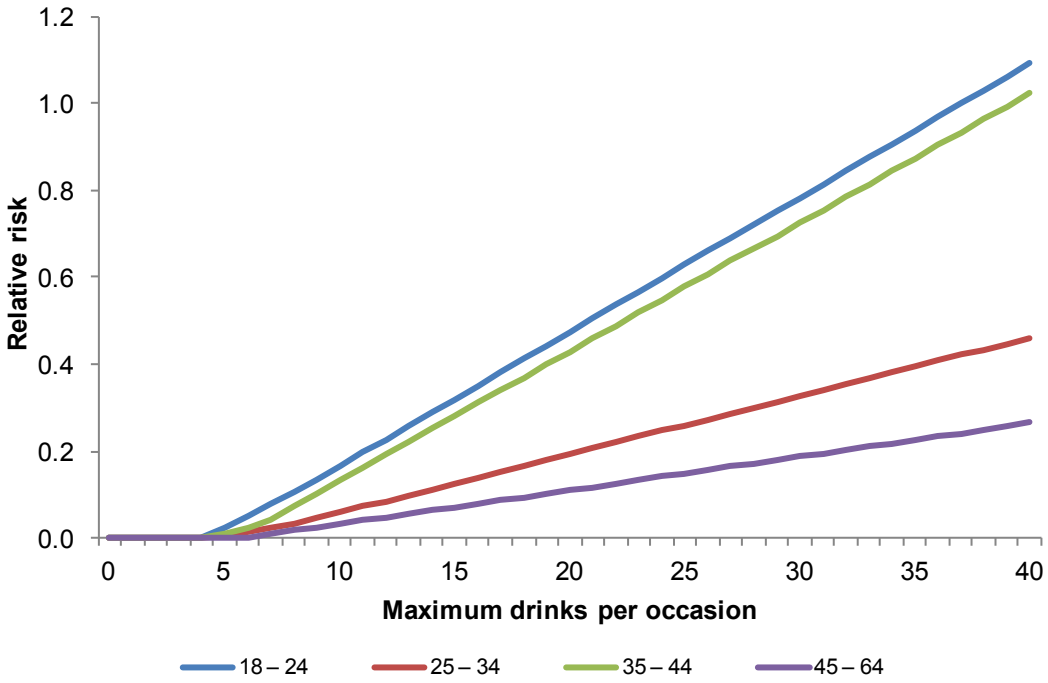


Figure 9: Absolute risk functions for absenteeism – females



The model for absenteeism

It is not possible to obtain an absence rate for New Zealand as this data is not collected. The only data obtainable on absence by age and gender is weekly absence rates from the United Kingdom Labour Force Survey 2008. These rates are used in the model.

The absence rates are based on the proportion absent for at least one day. Therefore we assume that men and women take 1.5 days of absence per week when they are absent from work. Based on

the weekly absence rate and the assumption about the number of days absent per week, a daily absence rate was derived by age and gender.

The reduction in the number of days absent per year due to a reduction in alcohol consumption for all employees is calculated by multiplying the total days of absence for all employees by the Potential Impact Fractions (PIFs) for each age group and gender. The reduced days of absence are then multiplied by median daily earnings to obtain an estimate of savings. The model is run over a ten year period and is discounted at a rate of 8%. The model is also adjusted for estimated changes in the population over the ten year period based on a median population projection series.

7.4 Estimating the savings from a reduction in impaired productivity on the job due to alcohol consumption

Harmful alcohol consumption may impede the physical and mental capabilities of the drinker, making them less productive at work. They may also suffer a permanent accidental injury, which also reduces their productivity. A worker's heavy drinking could also affect their co-workers, who may need to cover for the impaired worker or who may be emotionally affected by their co-workers behaviour. Harmful alcohol consumption is therefore likely to reduce the efficiency of part of the work force and the total value of production in the economy (Rayner, Chetwynd and Alexander, 1984). A reduction in harmful alcohol consumption will therefore result in reduced days of impaired productivity.

Evidence of the impact of alcohol consumption on productivity at work

There is very little research on the extent to which alcohol consumption impairs productivity on the job. In terms of New Zealand research, a recent University of Otago study (Polak and Conner, 2012) investigated the drinking patterns of a sample of university students and the effect of different levels of alcohol consumption (none, low risk levels, heavy drinking and extreme drinking) on the next-day physical, cognitive and emotional functioning of the participants. The researchers found that next-day functioning was similar regardless of whether participants abstained from drinking or drank at the low risk level the night before. Beyond this, functioning decreased in a step-wise fashion, showing impairments after heavy drinking, and further impairments after extreme drinking.

Polak and Conner (2012) found that extreme drinking the night before was associated with the least amount of sleep, feeling the least refreshed, excessive tiredness and a higher incidence of feeling ill. Heavy and extreme drinking was associated with greater concentration problems and poorer workload management. A limitation of this study is that drinking and functioning was self-reported so may not be a completely accurate representation of actual levels of drinking and impairment. Also, the study contained a sample of second year university students, so may not be transferable to the rest of the population.

Jones et al (1995) examined a sample of Auckland workers who were asked "How many times in the last 12 months have you felt your performance in a paid job was reduced by drinking or its after effects?" Twelve percent of employed workers felt that their drinking had had some detrimental effect on their work capabilities. For the heaviest drinkers, 30.2% reported episodes of reduced efficiency while none of the lightest drinkers experienced reduced efficiency at work. The average number of days when work performance was reduced was 3.93 days for the heaviest drinkers, compared with no days for the lightest drinkers.

Due to a lack of New Zealand data on efficiency losses, an estimate from a 1970 US study was used to ascertain the degree to which alcohol impairs productivity. The study estimated that the efficiency of alcohol abusing workers was 25% lower than non-abusers. The estimate was made on the basis of widely sampled "expert" opinion and was not based on any empirical analysis of

observed behaviour among the federal civilian workforce. Reduced efficiency was measured as a 25% reduction in the annual salary per employee. No measures of drinking levels for these drinkers were given in the report. Jones et al (1995) calculated the cost of reduced efficiency by multiplying the number of days of 25% impaired productivity by individual income.

Casswell et al (2011) investigated alcohol's harm to others based on self-reports from a representative sample of New Zealanders. Of those respondents who reported having a heavy drinking co-worker, 39% reported experiencing at least one harm, of which 44% said that their productivity at work had been reduced.

In terms of international studies, a 2008 study by Norwich Union in the UK found that one-third of workers admitted to going to work with a hangover and 15% admitted being drunk at work. Ten percent of staff said this happened at least once a month and 5% said that it happened once a week. Of those who had had a hangover or been drunk at work, 85% said it affected their mood or performance, with more than one-third saying they found it hard to concentrate or were less productive, and 42% felt tired to the point of being very sleepy (Patron 2008).

One-fifth of people working in construction and 15% in wholesale and agriculture admit to going to work hung-over once a week. Staff in labour-intensive roles admitted that their alcohol intake not only affected their productivity, but also potentially threatened the health and safety of themselves and others. The research also found that nearly eight in 10 employers believe alcohol is the number-one threat to employee wellbeing and is encouraging sickness absence. However, only 9% of workers consider this to be the case (Paton, 2008).

Wiese et al (2000) noted that a person with a hangover is at increased risk of injury and poor job performance. They have diminished visual-spatial skills and dexterity, even after alcohol can no longer be detected in their blood.

Estimating the alcohol attributable fractions and absolute risk functions

Based on data collected for the 1995 paper by Jones et al, the SHORE and Whariki Research Centre provided data on the percentage of people who felt that their work performance was reduced and the average number of days when their work performance was reduced by age and gender. It was not possible to obtain suitable data by age and gender on the extent to which the productivity of other workers is affected by the drinking patterns of their co-workers.

The AAFs for each age group and gender are assumed to be equal to 1 as we are only considering impaired productivity on the job due to alcohol consumption and we do not have data on the extent to which productivity is impaired by other factors. Therefore in this model any impairment in productivity is assumed to be fully attributable to alcohol consumption. Absolute risk functions were calculated based on the estimated days lost due to impaired productivity and the average alcohol consumption levels per typical drinking occasion for "increasingly risky" drinkers and for "harmful" drinkers. The estimated days lost due to impaired productivity are shown in Table 22.

Table 22: Estimated days of impaired productivity on the job from increasingly risky or harmful alcohol consumption

Gender	Age group	Estimated days of impaired productivity from increasingly risky alcohol consumption per employee	Estimated days of impaired productivity from harmful alcohol consumption per employee
Male	18-24	0.669	0.030
	25-34	0.602	0.067
	35-44	0.113	0.048
	45-64	0.078	0.067
Female	18-24	0.467	0.215
	25-34	0.310	0.088
	35-44	0.393	0.076
	45-64	0.144	0.008

Estimated by the Ministry of Justice based on data from the SHORE and Whariki Research Centre

In the absence of evidence to the contrary, linear risk functions were assumed. No days of impaired productivity were assumed for low risk drinkers with a threshold of 4 drinks or less per drinking occasion. The absolute risk functions for males and females are shown in Figures 10 and 11 below:

Figure 10: Absolute risk functions for impaired productivity on the job – males

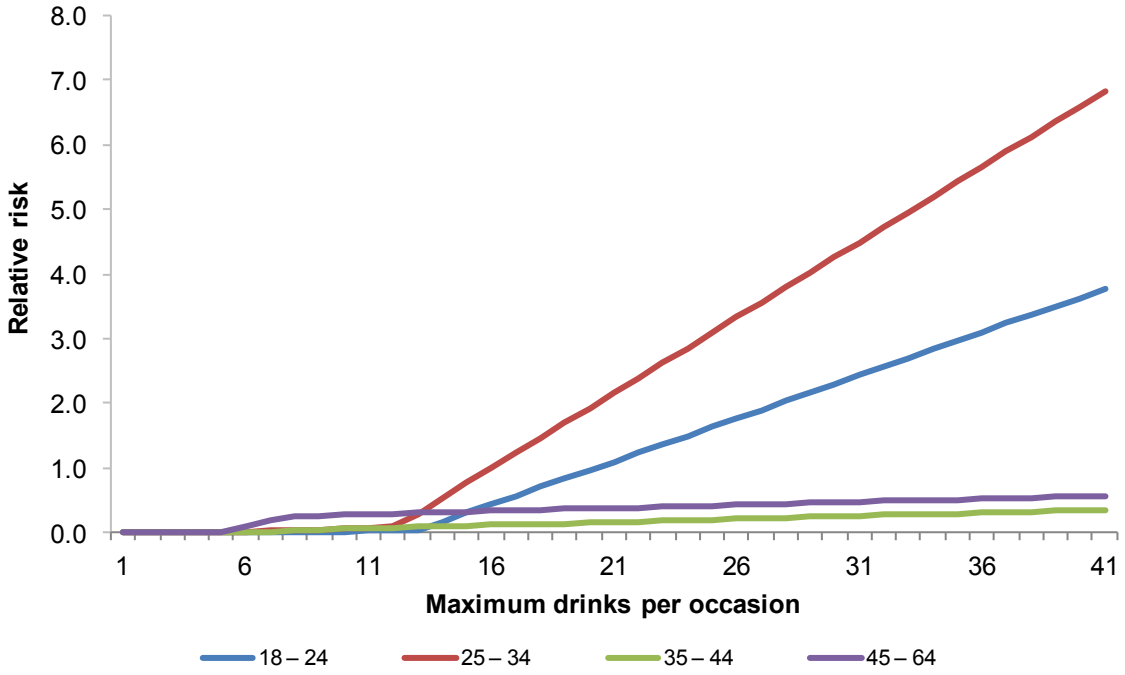
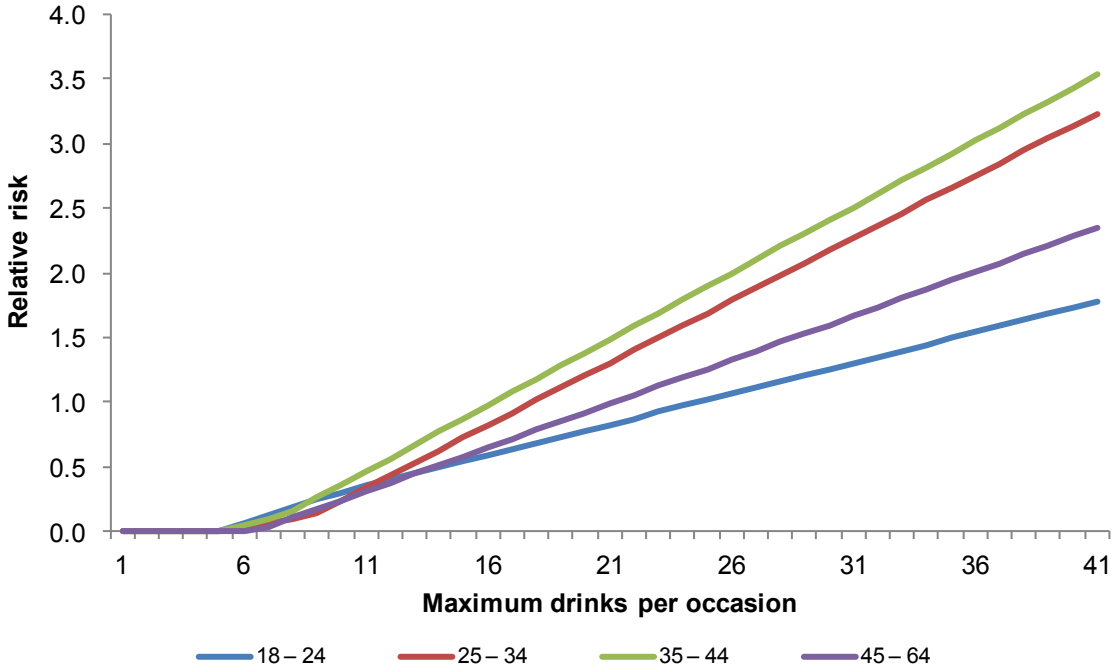


Figure 11: Absolute risk functions for impaired productivity on the job – females



The model for impaired productivity on the job

The reduction in the number of days of impaired productivity on the job per year due to a reduction in alcohol consumption for all employees is calculated by multiplying the total number of days of impaired productivity for all employees by the Potential Impact Fractions (PIFs) for each age group and gender. The reduced days of impaired productivity are then multiplied by median daily earnings to obtain an estimate of savings. The model is run over a ten year period and is discounted at a rate of 8%. The model is also adjusted for estimated changes in the population over the ten year period based on a median population projection series.

7.5 The value of lost household production and volunteer services

The value of lost household production and volunteer services resulting from problem drinking is very difficult to estimate because these services are unpaid, with no record of employment levels or hours worked. For this reason it is difficult to put a monetary value on a reduction in productivity in the household sector due to harmful alcohol consumption. Given the ambiguity that exists in this area and the limited time available to undertake the analysis, we have not estimated the potential savings in household productivity from a reduction in harmful alcohol consumption.

8. Estimating the impact of reduced alcohol consumption on consumers' surplus, industry revenue and Government revenue

Although the primary aim of an alcohol pricing policy is to reduce harmful alcohol consumption and alcohol-related harms, it is important to consider the impact of alcohol price increases on alcohol consumers, alcohol industry revenue and Government revenue to provide a complete picture of the likely effects of a pricing policy.

8.1 Estimating baseline data

Modelling was developed and analysed by the Ministry of Justice in collaboration with The Treasury to estimate the impact of alcohol pricing strategies on:

- The consumers' surplus of low risk, increased risk and harmful alcohol consumers
- Alcohol industry revenue, including off-licence and on-licence retailers
- Government revenue.

It is important to note that the estimated impacts from increased alcohol prices and reduced consumption must be treated with caution due to the range of assumptions that needed to be made and the lack of data available in some areas.

AC Neilsen provided off-licence data for 2011 including:

- Volume of alcohol sales (litres)
- Value of alcohol sales
- Estimated standard units of alcohol sales
- Average price per litre of alcohol
- Average price per standard unit of alcohol.

This data represented 70% of total off-licence volume sales and included off-licence retailers such as Foodstuffs, Progressives, Henry's Beer Wine and Spirits, Liquorland, Duffy & Fin, Liquor King and Super Liquor. Off-licence volumes and sales from these vendors were scaled up to represent 100% of off-licence sales in New Zealand. The SHORE and Whariki Research Centre at Massey University provided data on the proportion of total alcoholic beverages consumed at off-licences (76%) and on-licences (24%), as well as the proportion for each beverage type consumed (beer, wine, spirits, RTDs). The consumption proportions are closely similar to the sales proportions estimated by Euromonitor International, a market intelligence firm, in their report *"Alcoholic Drinks in New Zealand"* (Euromonitor International, 2012). Thus, it was decided that consumption proportions would be used instead of purchasing proportions, as they are more reflective of the actual alcohol market.

The SHORE and Whariki Research Centre also provided the average price per standard drink per beverage type and price band at on-licences. By combining AC Neilson and SHORE's data, on-licence volume of sales (litres), standard units and value of sales were estimated. Table 23 provides a

summary of the baseline data, which is an estimated reflection of market sales and is comparable to Euromonitor estimations.[17]

Table 23: 2011 baseline alcohol sales, volumes and standard units, per beverage type

Alcohol Sales 2011	Beverage Type	High price Off-licence	Low price Off-licence	High price On-licence	Low price On-licence	Total
Sales ($000)	Beer	168,258	814,792	1,398,802	728	2,382,580
	Wine	538,606	504,823	688,019	1,594	1,733,041
	Spirits	51,997	166,185	529,379	12,910	760,471
	RTDs	40,321	158,296	158,923	371	357,911
	Total Revenue	**799,182**	**1,644,096**	**2,775,123**	**15,602**	**5,234,003**
Volume (Litres 000s)	Beer	25,751	181,006	88,470	140	295,366
	Wine	30,089	50,797	14,098	176	95,160
	Spirits	787	4,859	2,248	409	8,302
	RTDs	3,882	24,558	6,186	57	34,683
	Total Volume	**60,508**	**261,219**	**111,002**	**781**	**433,511**
Volume (Standard Units 000s)	Beer	94,001	631,031	310,239	489	1,035,761
	Wine	272,511	471,081	130,631	1,630	875,854
	Spirits	26,085	161,063	74,513	13,557	275,216
	RTDs	20,846	131,876	33,218	306	186,245
	Total Standard Drinks	**413,443**	**1,395,051**	**548,602**	**15,982**	**2,373,076**

The data in Table 23 above and the estimated consumption changes by beverage type for each pricing option were used to determine the effects of each pricing policy on consumers' surplus, industry revenue and Government excise revenue.

The effects on each beverage type (beer, wine, spirits and RTDs) were analysed separately. The beverages were divided into low and high price categories, and by on-licence and off-licence consumption. The data was then aggregated to determine the impact of a change in total alcohol consumption on:

- The lost consumers' surplus of moderate, increased risk and harmful drinkers
- The total gain/loss to industry revenue (at both on- and off-licences)
- The total gain/loss to Government excise revenue
- The size of the deadweight loss.

[17] See Appendix 5 for a comparison of Euromonitor sales proportions with the SHORE and Whariki Research Centre's consumption data.

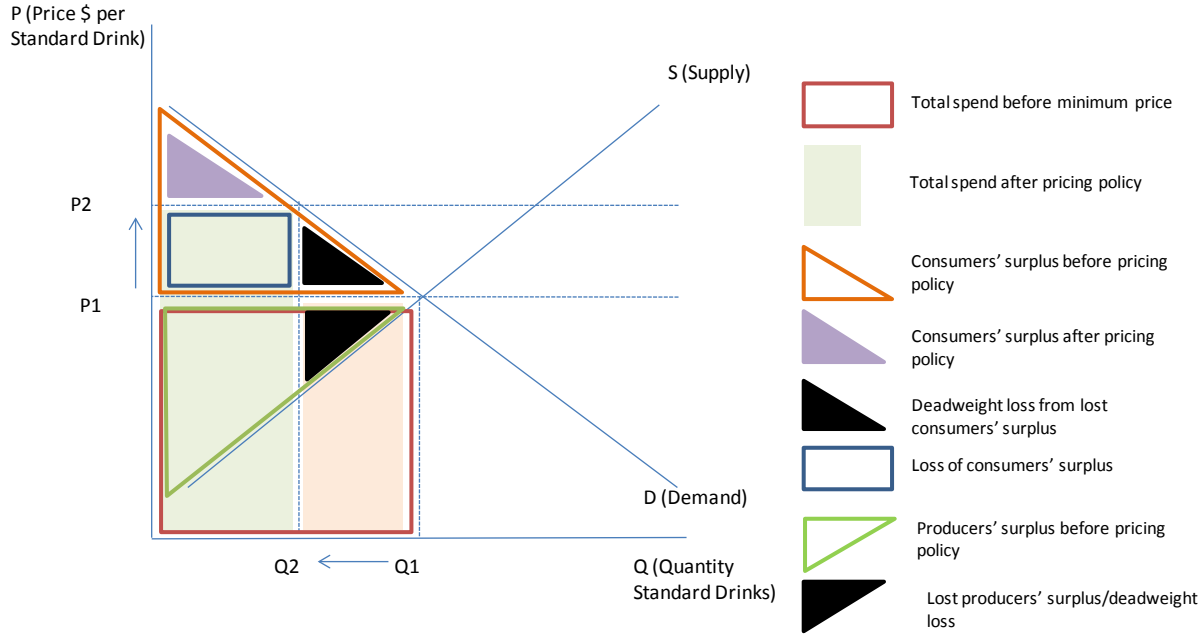
8.2 Modelling the impact of a price increase

Price elasticity of demand

Figure 12 below illustrates the demand curve for alcohol. The slope of the demand curve shows that there is an inverse relationship between the price of alcohol and the quantity demanded, that is, as price increases the quantity demanded decreases. As discussed in Section 3.3 above, demand for alcohol is considered to be inelastic, which means that consumers are less responsive to price changes, reducing consumption by a smaller proportion than the increase in price.

Figure 12 illustrates the impact of a price increase from P1 to P2, which results in a fall in consumption from Q1 to Q2. This fall in consumption has an impact on the value of the consumers' surplus and the amount of industry or Government revenue received. It also results in a deadweight loss to society. Each of these impacts is discussed in more detail below.

Figure 12: Short-run impact of a price increase on consumers' surplus, industry revenue and Government revenue

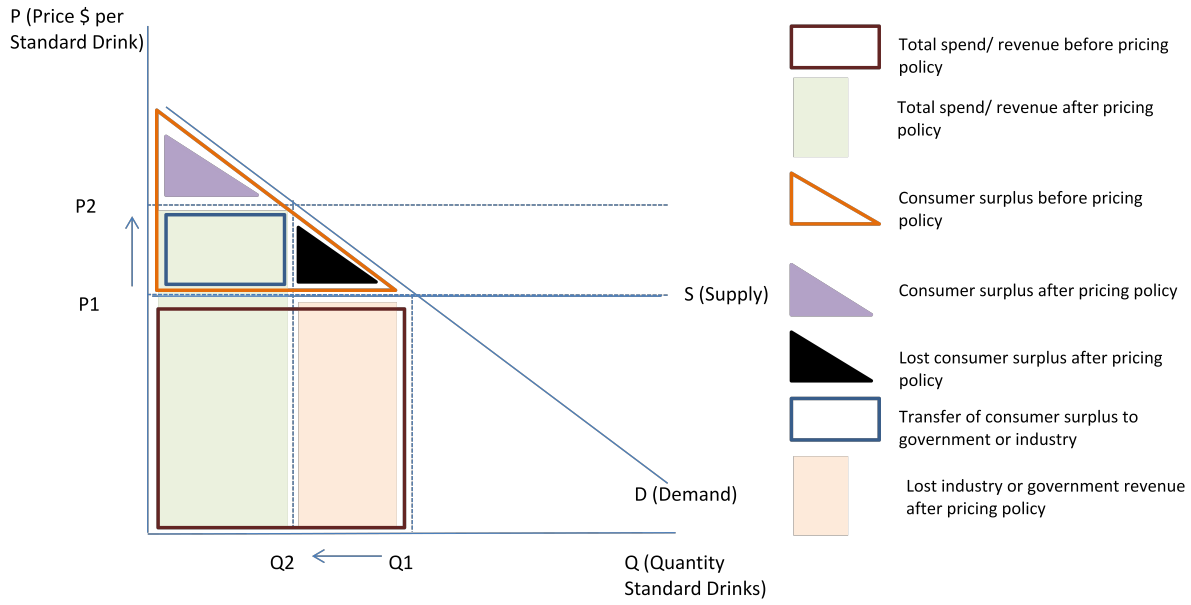


Price elasticity of supply

The price elasticity of supply demonstrates how the quantity of alcohol supplied by the alcohol industry will change following a change in price. The industry's supply of alcohol in the short run is elastic and sensitive to price changes. Thus, industry supply will be impacted by a change in price in the short run, as illustrated by the lost producer surplus in Figure 12.

However, as suitable data was not available, it was not possible to quantity the elasticity of supply for the purposes of this study. Therefore, a long-run perfectly elastic (or horizontal) supply curve is modelled, as illustrated in Figure 13.

Figure 13: Long-run impact of a price increase on consumers' surplus, industry revenue and Government revenue



Long run horizontal industry supply curve

The long-run horizontal industry supply curve is a suitable assumption to make for estimating the impact of a pricing policy on the alcohol industry. This is because in the long run, it can be assumed that the alcohol industry would be able to adjust production to maximise long-run profit. Short-run profits or losses to the industry will encourage firms to enter or exit the industry. For example, if there are industry losses due to an excise increase, some alcohol producers would leave the market if revenue gained is less than cost, causing prices to increase and reducing the loss made by the remaining producers. Producers will continue to leave up to the point where there are no more losses and industry profits are zero. If there are industry profits resulting from a minimum price, new alcohol producers would enter the market if revenue is greater than cost, causing prices and profits to fall. Producers would continue to enter the industry up to the point where profits are zero.

Producers would only stay in business as long as the price is as high as the long-run average costs of production. In the long-run, it is assumed that firms will make zero profit as price equals the average cost of production.

8.3 Impact of price increases on consumers' surplus

Reduced consumers' surplus is an important cost to take into account when considering an increase in the price of alcohol. Byrnes (2012, p.2) notes that alcohol consumers can respond to a price increase in seven ways. They:

1. do not change consumption
2. reduce frequency of consumption
3. reduce quantity of consumption
4. reduce both frequency and quantity of consumption
5. reduce frequency and increase quantity
6. reduce quantity and increase frequency
7. switch to cheaper alcohol.

Costs to consumers of a minimum price will depend on the level of the minimum price. Consumers who currently purchase alcohol priced at less than the minimum price per standard drink would be directly affected by the pricing policy.

An increase in price will cause all alcohol consumers to reduce or switch consumption depending on their own-price elasticities and cross-price elasticities. However, consumers are likely to respond in different ways based on their underlying consumption patterns. Low risk, increased risk and harmful consumers base their consumption decisions on different values, experiences and the benefits they receive from consuming alcohol. Although harmful drinkers make up a small proportion of the drinking population (about 10%), their spending on alcohol is higher (for example 26% higher than the amount spent by low risk drinkers).

Quantifying the impact of a pricing policy on consumers' surplus

Consumer surplus is a measure of consumer satisfaction and is the difference between what a consumer is willing to pay for an alcohol product and the market price of the product. The consumers' surplus before a pricing policy is represented by the orange triangle in Figure 12 above, the area between the demand curve and the price paid before the pricing policy. The total satisfaction received from consuming alcohol is the sum of the total expenditure on the product, plus the consumers' surplus (dark red rectangle plus orange triangle).

Consumer surplus is lower if demand is elastic (that is, the demand curve is relatively flat) than if demand is inelastic (a steep demand curve). Consumer surplus increases when the price of a product falls and decreases when price increases. It was not possible to quantify the consumers' surplus received before a pricing policy is imposed as data was not available on what price consumers are willing to pay for alcohol relative to market price.

With a pricing policy resulting in an increase in price from P1 to P2, the quantity demanded falls from Q1 to Q2. The total amount spent on alcohol increases from P1 x Q1 (red rectangle) to P2 x Q2 (see Figure 12 above). The difference between the price consumers are willing to pay and the price of the product is reduced from the orange triangle to the purple triangle. The increased consumer expenditure (shown by the blue rectangle) is transferred as increased revenue to either the alcohol industry or Government depending on whether a minimum price or excise increase is imposed.

A proportion of the original consumers' surplus disappears completely due to the decline in consumption from the price increase. This results in a loss to society as the market is no longer operating efficiently. The lost consumers' surplus is a cost to the economy, as the benefits lost by alcohol consumers are not gained by either the Government or the alcohol industry. The lost consumers' surplus is part of the deadweight loss and is represented by the black triangle. Consumers' surplus falls by the amount of the transfer of consumer expenditure to the industry or the Government plus the lost consumers' surplus from reduced consumption.[18]

Total loss in consumers' surplus =

- Transfer of consumers' surplus to the industry or Government + lost consumers' surplus from reduced quantity demanded[19]
- ((P2-P1)*(Q2) - GST) + (½(P2-P1)*(Q2-Q1)[20]

[18] Note that income effects have not been included in the model. We have therefore assumed zero income effects.

[19] In the case of an excise tax increase, GST on alcohol also increases as GST is imposed on the excise inclusive product price. The higher amount of GST is not an increase in the total amount of GST collected by the Government, because the increased spending on alcohol necessarily implies reduced spending on other goods (that are subject to GST) given a consumer's fixed budget constraint.

Quantifying the impact on consumers' surplus by drinker type

In order to determine the lost consumers' surplus for each drinker type (low risk, increased risk and harmful consumers), the estimated changes in consumption following a price increase were applied to the baseline volume of standard drinks consumed by each drinker type to determine the new quantity of standard drinks per drinker following a pricing policy, and in turn the impact on spending and consumers' surplus.

It could be argued that harmful alcohol consumption is irrational and therefore such drinkers do not acquire any benefits. Traditional economic theory assumes that all consumers behave rationally when making decisions. As Easton (2002, p.42) noted:

"In the sort of liberal economies of which New Zealand is an example, it is generally assumed that individuals know their best interests – or that no other person or agency knows the individual's interests better".

However, alcohol is unlike most other commodities and may result in irrational behaviour. This is explained further in Appendix 6. Our analysis assumes that all alcohol consumers are rational and that they consider the benefits and costs to themselves of alcohol consumption before consuming alcohol. If harmful consumption is irrational, then we will have over-estimated the loss in consumers' surplus.

8.4 Impact of price increases on alcohol industry revenue

Total industry revenue is the total amount of income received by a company for the sale of goods and services (Total revenue (TR) = price(P)*quantity (Q)). Total cost (TC) is the total cost of production made up of fixed costs (FC) and variable costs (VC) (TC = FC + VC). Industry profit (P) is the difference between total revenue (TR) and total costs (TC) (P = TR - TC). The following sections explain how we estimated the impact on industry revenue from a minimum price and an excise increase.

Impact of a minimum price on alcohol industry revenue

With a minimum price of $1.00 per standard drink, all products priced below $1.00 would increase to $1.00 per standard drink. If the price elasticity of demand is inelastic, consumers will spend more on alcohol. Regardless of the price elasticity of demand, there is a reduction in consumers' surplus. The cost of a minimum price per standard drink to the alcohol industry is reduced demand (peach rectangle in Figure 13). However, a proportion of the reduced consumers' surplus is transferred to the industry as revenue (blue rectangle in Figure 13). Therefore, if the price elasticity of demand is inelastic, as international and domestic literature suggests (for example, (Wagenaar, Salois and Komro, 2009)), the alcohol industry will benefit from a minimum price as an increase in the price of low price products would result in increased revenue that would offset the lost revenue from reduced demand. Furthermore, as the price differential between off-licence and on-licence sales reduces, consumers may switch or substitute from off-licences to on-licences, resulting in increased revenue for on-licence premises.

There are three possible impacts of a minimum pricing policy on the alcohol industry:

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[20] This is based on the area of a triangle. A straight line demand curve was used as an approximation of the impact of the price changes.

1. Industry revenue increases from a transfer of consumers' surplus to the alcohol industry resulting from increased prices (for low price beverages at off-licences).
2. Industry revenue reduces from a fall in quantity demanded that is not gained by the industry.
3. Industry revenue increases from an increase in the quantity demanded of beverages that do not have a change in price. This is as a result of substitution to low and high price beverages at on-licences and to high price beverages at off-licences.

Each of these impacts is discussed in turn.

1. The increase in industry revenue resulting from a transfer of consumers' surplus or expenditure to the alcohol industry from the increase in the price of low price products is calculated for two different impacts. [21]

For beverages where there is an increase in price and a decrease in quantity demanded, the gain in industry revenue =

- (Change in price)*(New quantity of standard drinks) – GST = ((P2-P1)*(Q2) – GST[22]).

For beverages where there is an increase in price and an increase in quantity demanded (due to substitution effects), the gain in industry revenue =

- (Change in price)*(New quantity of standard drinks) – GST – Excise =
- ((P2-P1)*(Q2) – GST – Excise).

The overall impact on industry revenue also includes the lost industry revenue from reduced demand as well as the increase in industry revenue resulting from substitution to other beverages.

2. The lost industry revenue from reduced quantity demanded caused by a minimum price is represented by the peach rectangle in Figure 13, and is calculated by:
   - (Baseline price per standard unit excluding GST and excise)*change in quantity demanded
   - (P1-(GST + excise))*(Q2-Q1)

3. Although prices remain the same, demand increases for low and high priced products at on-licences and high price products at off-licences resulting from the reduced price differentials, which results in substitution effects based on cross-price elasticities. Thus the decrease in industry revenue (peach rectangle) is not as large as it would be if there was no substitution.

For beverages where there is no increase in price but an increase in quantity demanded, the total gain/loss of industry revenue =

- (Baseline price*change in quantity of standard drinks) – GST – Excise =
- ((P1*(Q2-Q1)) – GST – Excise)

The overall impact on industry revenue accounts for these three impacts =

[21] This is a static rather than dynamic analysis. It is possible that some or all of this surplus is "competed away" through non-price competition.

[22] There is no need to account for increased excise. Overall excise falls as there has been no excise increase (simply a regulatory minimum price) and total consumption falls. GST is subtracted as this increased amount is returned to the government.

- 1. Transfer of consumers' surplus to industry revenue – (2.Lost industry revenue due to the fall in quantity demanded + 3.Increased revenue resulting from substitution effects).

Impact of an excise increase on alcohol industry revenue

Alcohol industry revenue is negatively impacted by an excise increase. As a proportion of the loss of consumers' surplus is transferred to the Government as increased excise revenue, the industry is negatively impacted by a reduction in the quantity of alcohol demanded due to the increased prices. An excise increase raises prices across all beverage types and price bands.

The lost industry revenue is represented by the peach rectangle and is found by calculating:

- (Baseline price per standard unit excluding GST and excise)*change in quantity demanded
- (P1-(GST + excise))*(Q2-Q1)

PASS THROUGH RATE OF EXCISE / TAX INCIDENCE

"Understanding the pass-through rate from tax increases to prices is a key pre-condition to shedding light on how tax changes would affect consumers, producers, retailers and society as a whole" (Hunt, Rabinovich and Baumberg, 2010, p.15).

Alcohol excise duties are levied at the wholesale end of the market. Producers negotiate prices with the retailers who sell the products to consumers. The ultimate tax incidence between producers, retailers and consumers is likely to depend on the relative bargaining power of producers and retailers as well as price elasticities of supply and demand. As lower price alcohol products have lower profit margins, increased excise will have a greater impact on the price of cheaper products as it is more difficult to absorb the increase. However, if excise is not passed onto consumers, producers must find efficiencies elsewhere or exit the market. The alcohol industry in New Zealand resembles an oligopolistic market where a small number of large firms maintain market power. This makes it more difficult to determine who bears the tax increase (Leicester, 2011).

Based on our assumption of a long-run perfectly elastic supply curve, we have assumed a 100% pass through rate of excise to consumers in the long-run. For an excise increase, if excise duties are not passed through to the retail price of alcohol they will be borne earlier in the supply chain. Some producers have expressed the view that they are unable to pass on excise to the final consumer. This may be true in the short-term, but if producers leave the market as it is unsustainable to continue to absorb the costs, remaining producers will be able to pass through the excise increase as their bargaining power will increase. In economic terms, this is represented by the long-run perfectly elastic supply curve. The long term view is much more relevant for a policy intervention like an excise increase, and therefore modelling a 100% pass through rate is appropriate.

If supply is inelastic and demand is elastic, the tax is borne by the producer. If supply is elastic and demand is inelastic, the tax is borne by the consumer. If both supply and demand are elastic or inelastic, the tax burden is shared. In New Zealand, the supply of alcohol is relatively elastic and demand is relatively inelastic. Therefore, the burden is largely borne by consumers through a higher pass through rate.

Hunt et al (2010) carried out a regression analysis to determine the relationship between excise duties and retail prices in the UK. The study found that the excise increase is passed through to the consumer at different levels varying per beverage type.

- 86% passed through for wine,
- 130% passed through for lager,
- 133% passed through for bitter,
- 121% passed through for whisky,
- 95% passed through for vodka,

- 85% passed through for lager (4x cans).

Although far from identical, we consider that the alcohol markets in the UK and New Zealand share enough similarities that we would expect similar pass through rates of excise in New Zealand. This seems to be approximately 100%.

Impact on industry surplus

Industry surplus quantifies the difference between what price a producer or retailer is willing to sell an alcohol product for (the marginal cost of every unit), and the price received for the product, i.e. equal to industry profit plus fixed costs. Like consumers, alcohol producers and retailers will also be impacted by a minimum price and excise increase. However, as suitable data was not available, it was not possible to quantity the elasticity of supply for the purposes of this study. In order to determine the impact of a price increase on industry revenue, a long run perfectly elastic supply curve is modelled, assuming 100% pass through rates to consumers and no deadweight loss of producer surplus.[23]

Lost industry asset value

The supply curve represents the long-run costs of the industry. We assume that it is horizontal because we presume that for the industry as a whole, there are no economies of scale in the long-run. Because we consider the alcohol industry to be competitive, we assume that the supply curve represents the marginal cost of alcohol production. The revenue just covers producers' costs including a normal return on equity, and if the level of demand changes, either because of a tax or because of changing tastes, industry capacity will adjust and the marginal cost and industry profitability will remain the same.

Because capacity cannot adjust instantaneously, the short-run supply curve is not horizontal. It is upward sloping. However, in the equilibrium it intersects with the demand curve at the same price as the long-run supply curve. This is a standard result of the basic theory of supply and demand.

If the demand curve shifts down, then the industry will move down the short-run supply curve and get a lower price. To some extent it will produce less and to some extent it will export more (or the country will import less). The lower price will persist until industry capacity reduces (as assets are life expired and not replaced). As capacity reduces, the industry will move up the short-run supply curve again until it is back on the long-run supply curve. During this period, revenue will be insufficient to cover the cost of capital, so accounting profits will be lower (though they could still be positive), and shareholders will suffer a capital loss and the value of their assets will decrease. This represents a welfare loss that should be taken into account in a cost-benefit analysis.

Some of the factors of production that were earning this revenue are not fixed and are easily substituted into other areas of the economy. However, it is likely that fixed assets specific to the alcohol industry are not able to be substituted into other areas of the economy. The value of these assets will decrease, and this decrease is not offset by a benefit that accrues elsewhere. In effect, some proportion of the capital assets becomes obsolete. This amount is difficult to measure or estimate, but will be a function of the reduced revenue. For the purposes of the modelling work, we have assumed that producers earn only 90% of the revenue by exporting the amounts that were previously consumed in New Zealand. We have attributed the 10% reduction to the value of a capital

[23] A long run perfectly elastic supply curve indicates that the quantity supplied is very responsive to price changes. With a percentage increase in price, the percentage change in quantity supplied is infinitely large. Producer surplus is zero as the price the producer is willing to supply goods for is equal to the market price.

asset with a ten year life and discounted it over the ten year period. The lost asset value is illustrated by the slim purple rectangle in Figure 14.

Lost industry asset value =

Ten percent of the lost industry revenue due to reduced quantity demanded =

0.1*1/2((Q2-Q1)*(P1-(GST + excise))

This amount is not a deadweight loss, as it is not a result of economic inefficiency.[24] It is the result of a regulatory intervention, however, and therefore the cost must be included in any cost-benefit analysis of a regulatory intervention.

8.5 Impact of the pricing options on Government excise revenue

Impact of a minimum price on Government excise revenue

Government excise revenue would be negatively impacted by a minimum price. As a proportion of the loss of consumers' surplus would be transferred to the industry under a minimum price, the Government would be negatively impacted by the reduced quantity of alcohol purchased due to the increased prices. However, this impact would be somewhat reduced by increased quantity demanded for some beverages resulting from substitution effects. The lost Government excise revenue is illustrated by the blue rectangle in Figure 14 below.

Lost Government excise revenue =

- ((Change in quantity of standard drinks)*(baseline excise rate)
- (Q2-Q1)*(baseline excise rates)

The lost Government excise revenue is accounted for in calculating the net societal or welfare effect of the pricing policy.

Impact of an excise increase on Government excise revenue

With an increase in excise duty, although there would reduced excise revenue resulting from a reduction in the quantity of alcohol demanded due to the increase in prices across all alcohol products, this would be offset by the proportion of consumers' surplus that is transferred to the Government in the form of an increase in excise revenue.

There are two possible impacts of an excise increase on Government excise revenue:

1. Increased Government revenue resulting from a transfer of consumers' surplus to Government excise revenue.

    1.1. This includes increased Government revenue from reduced quantity demanded due to increased prices (low and high price beverages at off-licences, low price beverages and high price RTDs at on-licences) and increased Government revenue resulting from increased quantity demanded of beverages due to substitution after relative price changes (for example, high price beer, wine and spirits at on-licences).

1.2. Lost excise revenue due to reduced quantity demanded.

Each of these impacts is discussed in turn.

[24] Economic inefficiency is defined as an economic state in which every resource is not optimally allocated.

1. For an increase in Government revenue resulting from a transfer of consumers' surplus or expenditure to the Government as excise revenue from a price increase and an increase or decrease in quantity demanded, the gain/loss in Government revenue =

- (Change in price)*(New quantity of standard drinks) – GST =

  ((P2-P1)*(Q2) – GST).

4. The lost Government excise revenue due to reduced demand caused by an excise increase is represented by the red rectangle in Figure 14, and is calculated by =

- ((Reduced quantity of standard drinks (Q1-Q2))*(baseline excise rate).

The overall impact on Government excise revenue accounts for these two impacts =

- 1. Transfer of consumers' surplus to Government revenue – 2. Lost excise revenue due to reduced quantity demanded.

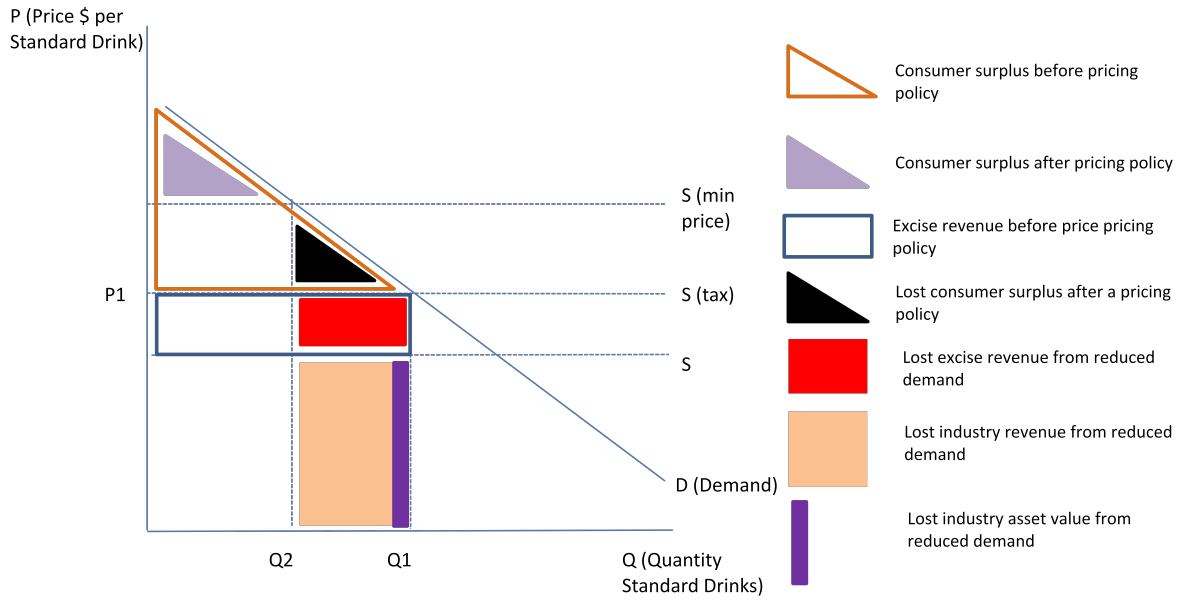
8.6 Deadweight loss of a pricing policy

Figure 14 below illustrates how the deadweight loss for a minimum price includes both the lost consumers' surplus plus the lost Government excise revenue.

Deadweight loss for a minimum price and excise increase =

- Lost consumers' surplus + lost excise revenue from reduced quantity demanded
- (½(P2-P1)*(Q2-Q1)) + ((Q2-Q1)*(original excise rate))

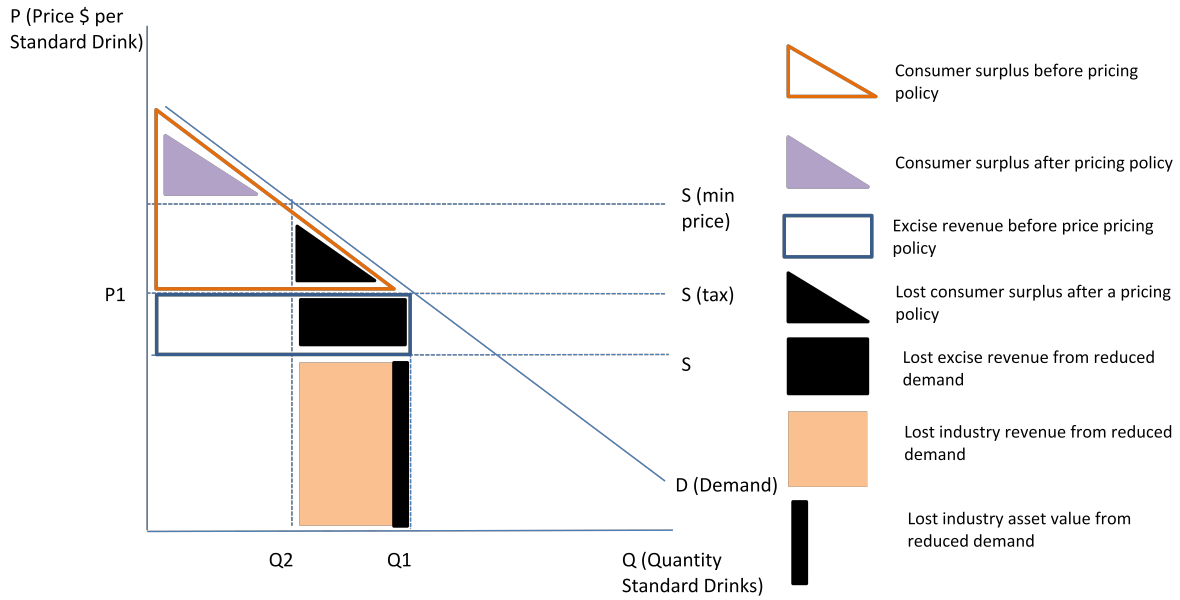
Figure 14: Deadweight loss from a price increase, black triangle plus red rectangle



8.7 Costs of the pricing policy

The cost of the alcohol pricing policies includes the lost consumers' surplus, the lost excise revenue plus the lost value of industry assets due to the increased prices and consequent reductions in quantity demanded.

Figure 15: Costs of a pricing policy (black portions)



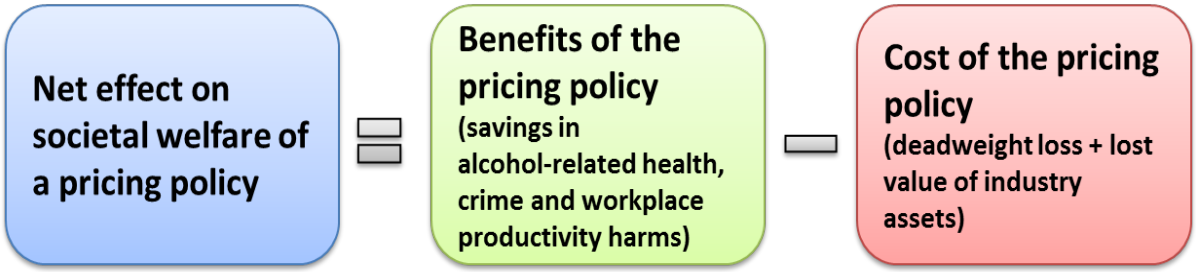
9. Net societal effect of a pricing policy

The net societal effect of a pricing policy weighs up the harm savings from reduced alcohol consumption against the costs of the pricing policy.

As noted above, the cost of the pricing policy is comprised of the lost consumers' surplus, along with lost excise revenue, plus the lost value of industry assets due to the increased prices and consequent reductions in demand.

Figure 16 shows that the overall net effect on society of a pricing policy comprises the savings in alcohol-related health, crime and productivity harms minus the costs of the pricing policy.

Figure 16: Determining the net effect on society of a pricing policy



10.Results

In this section results are reported for:

- The impact of price changes on the consumption of low risk, increased risk and harmful drinkers.

1.1. The impact of price changes on alcohol-related health, crime and workplace productivity harms.

- The impact of price changes on the consumption benefits of low risk, increased risk and harmful drinkers.
- The impact of price changes on the alcohol industry.
- The impact of price changes on Government revenue.

10.1 Estimated consumption effects from changes in price

The effect on alcohol consumption of the following pricing changes was analysed:

1. A minimum price of $1.00 per standard drink
2. A minimum price of $1.10 per standard drink
3. A minimum price of $1.20 per standard drink
4. An excise increase to achieve indirectly an average price of $1.00 on the lowest priced beverages (an increase of 82%)
5. An excise increase to achieve indirectly an average price of $1.10 on the lowest priced beverages (an increase of 107%)
6. An excise increase to achieve indirectly an average price of $1.20 on the lowest priced beverages (an increase of 133%).

Estimated consumption changes from the pricing options are estimated for the three different drinker types (low risk, increased risk and harmful drinkers) using baseline purchasing data from the International Alcohol Control (IAC) survey. For the excise increase options, it is assumed that in the long-run the excise increase will be fully passed onto the consumers.[25]

As noted in Section 3 above, consumption changes were estimated using both New Zealand price elasticities estimated by AC Nielsen and the SHORE and Whariki Research Centre, and the elasticities estimated by the University of Sheffield.

The results are not directly comparable. The NZ elasticities are not provided by different types of drinker, while the University of Sheffield's elasticities distinguish between low risk drinkers, increased risk and harmful drinkers. For both sets of elasticities, the same elasticities were applied to determine estimated changes in average daily consumption and maximum consumption per

[25] This is a reasonable assumption as in the long-term suppliers will adjust their supply if, in the short-term, they bear the cost of the excise increase. A reduction in supply will increase the price retailers have to pay for products and in the long-term the excise increase will be passed onto consumers.

occasion. However, the University of Sheffield's elasticities do incorporate a "binge" component within them.

Table 24 shows the changes in the annual volume of alcohol purchased using New Zealand elasticity estimates. Table 25 shows changes in the annual volume of alcohol purchased using the University of Sheffield elasticity estimates. The tables show considerable differences in the results, with changes in annual purchases based on NZ elasticities being around two to four times that of changes in annual purchases based on the University of Sheffield elasticities.

Table 24: Changes in the annual volume of alcohol purchases from the pricing options (using the New Zealand elasticity estimates provided by AC Nielsen and the SHORE and Whariki Research Centre)

Pricing options	New purchases (annual volume – 1000 litres)				Percent change			
	All	Low Risk	Increased Risk	Harmful	All	Low Risk	Increased Risk	Harmful
Initial purchases	23,619	6,915	8,462	8,242				
Minimum price of $1.00	22,207	6,466	7,903	7,838	-6.0	-6.5	-6.6	-4.9
Minimum price of $1.10	21,733	6,300	7,785	7,649	-8.0	-8.9	-8.0	-7.2
Minimum price of $1.20	21,053	6,078	7,590	7,385	-10.9	-12.1	-10.3	-10.4
Excise increase of 82%	14,031	4,011	4,992	5,028	-40.6	-42.0	-41.0	-39.0
Excise increase of 107%	11,364	3,181	4,062	4,121	-51.9	-54.0	-52.0	-50.0
Excise increase of 133%	8,696	2,351	3,131	3,214	-63.2	-66.0	-63.0	-61.0

Source: Estimated by the SHORE & Whariki Research Centre

Table 25: Changes in the annual volume of alcohol purchases from the pricing options (using the University of Sheffield's elasticity estimates)

Pricing options	New purchases (annual volume – 1000 litres)				Percent change			
	All	Low Risk	Increased Risk	Harmful	All	Low Risk	Increased Risk	Harmful
Initial purchases	23,619	6,915	8,462	8,242				
Minimum price of $1.00	23,059	6,734	8,264	8,061	-2.4	-2.6	-2.3	-2.2
Minimum price of $1.10	22,821	6,659	8,178	7,983	-3.4	-3.7	-3.3	-3.1
Minimum price of $1.20	22,509	6,562	8,069	7,878	-4.7	-5.1	-4.6	-4.4
Excise increase of 82%	20,748	6,122	7,460	7,166	-12.2	-11.5	-11.8	-13.1
Excise increase of 107%	19,891	5,879	7,168	6,844	-15.8	-15.0	-15.3	-17.0
Excise increase of 133%	19,015	5,632	6,868	6,515	-19.5	-18.6	-18.8	-21.0

Source: Estimated by the Ministry of Justice

For the three minimum price options, annual alcohol purchases decrease by around 6 to 11 percent using NZ elasticity estimates compared with a 2 to 5 percent decrease using the University of

Sheffield elasticity estimates. In both cases, a minimum price has a slightly greater impact on low risk drinkers than harmful drinkers.

The minimum price options encourage switching to higher price products. For all beverages types, purchases of low price off-licence beverages decrease, while purchases of high price off-licence beverages increase. On-licence purchases of all beverage types increases for both high and low price beverages. Overall, the minimum price options only cover about 10% of the total alcohol market for a minimum price of $1.00 per standard drink and 24% of the market for a minimum price of $1.20 per standard drink. Given that harmful consumers do not limit their purchases to low price products, there is a risk of substitution to other products, limiting the reduction in harmful consumption.

Excise increases have a much larger effect on alcohol purchases compared to the minimum price options as the price increases are greater and affect all beverages (both on-licence and off-licence), not just those beverages that were purchased below the minimum price. Generally, the excise increases result in much larger purchase decreases. This is because an excise increase affects the price of all alcohol (not just low price alcohol) and therefore more significantly impacts consumer behaviour.

The effects on different types of drinker

The effect of excise increases on the different types of drinkers is not consistent between the two sets of data. Purchase effects using NZ elasticity estimates show low risk drinkers being more impacted by excise increases than harmful drinkers, while purchase effects using the University of Sheffield elasticity estimates show harmful drinkers being more impacted than low risk drinkers.

This inconsistency is explained by the fact that different elasticity estimates are used for low risk and harmful drinkers when applying the University of Sheffield elasticity estimates, while the same NZ elasticity estimates were applied to low risk and harmful drinkers. Therefore differences in the price responsiveness and beverage preferences of different types of drinker are accounted for with the University of Sheffield estimates, but not the NZ estimates. In particular, the own-price elasticities for low and high price spirits (at both on- and off-licences) are much higher for harmful drinkers than low risk drinkers, and this appears to be driving the more significant reduction in the amount purchased by harmful drinkers compared to low risk drinkers.

Appendix 4 provides a summary of purchase changes at on-licences and off-licences by beverage type based on the University of Sheffield elasticity estimates. It should be noted that the excise increases resulted in negative purchase results for low price spirits at on-licences, that is, purchases reduced beyond zero standard drinks. Therefore purchase decreases were capped at zero purchases so that there was a 100% reduction in the purchase of low price spirits at on-licences for the excise options. As only a very small proportion of beverages sold are low price spirits, this does not have a significant effect on overall purchase changes.

Harmful drinkers are more likely to consume beer (low and high price), high price off-licence spirits and low price RTDs compared to other drinkers. Based on results generated using the University of Sheffield elasticities, the minimum price options have no effect on off-licence beer purchases and a small positive effect on on-licence beer purchases (i.e. purchases increase). Purchases of on-licence beer increase by a greater extent for harmful drinkers than low risk drinkers.

The minimum price options do result in substantial decreases in the purchase of off-licence low price spirits (a 7.8% reduction in the amount purchased by harmful drinkers for a minimum price of $1.00 per standard drink and a 14.6% reduction in the amount purchased by harmful drinkers for a minimum price of $1.20 per standard drink). However, purchase decreases are slightly greater for low risk drinkers than harmful drinkers. The purchase of on-licence spirits increases slightly for each type of drinker under the minimum price options, but overall spirits consumption decreases.

The minimum price options result in small decreases in the purchase of off-licence RTDs, with the decreases being slightly greater for harmful drinkers compared to low risk drinkers.

The most significant price increases in the excise options are for low price spirits sold at both off-licences and on-licences. According to University of Sheffield elasticity estimates, harmful drinkers have greater own-price elasticity estimates for low and high price spirits at off-licence and on-licences compared to low risk drinkers. Harmful drinkers are therefore more price responsive to changes in the price of spirits compared to low risk drinkers. Given that an increase in excise has the greatest impact on the price of spirits, this results in larger purchase decreases for harmful drinkers compared to low risk drinkers, particularly for on-licence spirits.

Overall it appears that excise increases have a greater impact on harmful drinkers than low risk drinkers, based on University of Sheffield elasticity estimates. This is driven by the greater own-price elasticities, particularly for spirits. However, this result is inconsistent with findings in studies such as Wagenaar et al (2009), which found that heavy drinkers are much less responsive to price changes (with an elasticity of -0.28 compared to -0.62 for all drinkers). The University of Sheffield also found that harmful drinkers are much more price inelastic compared to low risk drinkers when total alcohol consumption was considered, rather than consumption by beverage type.

We also do not have separate elasticities for per occasion drinking, and recent evidence indicates that people are much less price responsive during drinking occasions (Byrnes et al, 2012). Therefore there is a risk that the effects on purchases could have been over-estimated for per occasion purchases.

Therefore we cannot conclude with confidence that excise increases will have a greater impact on harmful drinkers. More research is needed to confirm this, which could be done once revised University of Sheffield elasticity estimates are available.

Estimating the effects of price changes on median daily consumption and maximum consumption per occasion

The purchase effects derived from the NZ elasticity estimates are not realistic based on international elasticity estimates and what we know about people's responsiveness to price changes. It is simply not feasible to conclude that a minimum price of $1.00 per standard drink that increases prices on average by 4.2% at off-licences will result in a decrease in purchases of 6% across all drinkers. Likewise, an excise increase that results in an average price increase of 31% is unlikely to result in a drop in purchases of 41% (using an excise increase of 82%). It is expected that the decrease in the quantity purchased would be smaller than the increase in price.

Therefore it was decided that the effect on alcohol consumption from a change in the price of alcohol would be estimated using the percentage changes in alcohol purchased based on the University of Sheffield elasticity estimates. Even though the University of Sheffield elasticity estimates are not based on New Zealand consumer purchasing and consumption patterns, the results generated are more plausible.

The estimated percentage changes in alcohol purchased were applied to baseline consumption data from the IAC survey to derive changes in median daily consumption of alcohol and changes in the maximum drinks consumed on a drinking occasion. Tables 26 to 29 provide the results for estimated changes in median daily standard drinks and maximum standard drinks per occasion for each pricing option.

The estimated changes in median daily consumption and maximum consumption per occasion were then used to estimate savings in alcohol-related health, crime and productivity harms, and to estimate the effects on consumer surplus, industry revenue and Government revenue. If more time had been available, it may have been possible to derive more realistic elasticity estimates using New Zealand data. However, given the very limited data that is available on alcohol purchasing and

consumption patterns in New Zealand, improved estimates may not be possible until better data is available that tracks consumers purchasing and consumption patterns over a significant period of time.

Table 26: Estimated changes in median daily consumption for males by drinker type (based on University of Sheffield elasticity estimates)

Age Group	Volume	N	Prevalence	Median standard drinks per day						
				Baseline	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ of 82%	Excise ↑ of 107%	Excise ↑ of 133%
18-24	None		0.118							
	Low risk	50	0.362	0.5	0.5	0.5	0.5	0.4	0.4	0.4
	Increased risk	44	0.318	3.3	3.2	3.2	3.1	2.9	2.8	2.7
	Harmful	28	0.202	13.3	13.0	12.9	12.7	11.6	11.0	10.5
25-34	None		0.101							
	Low risk	63	0.472	0.8	0.8	0.8	0.8	0.7	0.7	0.7
	Increased risk	35	0.262	3.6	3.5	3.5	3.4	3.2	3.0	2.9
	Harmful	22	0.165	14.2	13.9	13.8	13.6	12.3	11.8	11.2
35-44	None		0.110							
	Low risk	116	0.564	0.7	0.7	0.7	0.7	0.6	0.6	0.6
	Increased risk	44	0.214	2.8	2.7	2.7	2.7	2.5	2.4	2.3
	Harmful	23	0.112	9.7	9.5	9.4	9.3	8.4	8.1	7.7
45-64	None		0.132							
	Low risk	210	0.506	0.7	0.7	0.7	0.7	0.6	0.6	0.6
	Increased risk	110	0.265	3.2	3.1	3.1	3.1	2.8	2.7	2.6
	Harmful	40	0.096	8.3	8.1	8.0	7.9	7.2	6.9	6.6
65+	None		0.132							
	Low risk		0.506	0.5	0.5	0.5	0.5	0.5	0.5	0.4
	Increased risk		0.265	2.5	2.5	2.4	2.4	2.2	2.1	2.0
	Harmful		0.096	6.5	6.4	6.3	6.2	5.7	5.4	5.2

Note: IAC Survey did not cover 65+ year olds drinking so have assumed that proportions in each category are the same as 45-64 year olds, and that overall consumption is 0.785 of 45-64 year olds.

Table 27: Estimated changes in median daily consumption for females by drinker type (based on University of Sheffield elasticity estimates)

Age Group	Volume	N	Prevalence	Median standard drinks per day						
				Baseline	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ of 82%	Excise ↑ of 107%	Excise ↑ of 133%
18-24	None		0.164							
	Low risk	91	0.581	0.5	0.5	0.5	0.5	0.4	0.4	0.4
	Increased risk	21	0.134	3.0	2.9	2.9	2.9	2.6	2.5	2.4
	Harmful	19	0.121	7.7	7.5	7.5	7.4	6.7	6.4	6.1
25-34	None		0.187							
	Low risk	141	0.603	0.5	0.5	0.5	0.5	0.4	0.4	0.4
	Increased risk	33	0.141	2.9	2.8	2.8	2.8	2.6	2.5	2.4
	Harmful	16	0.068	8.1	7.9	7.8	7.7	7.0	6.7	6.4
35-44	None		0.160							
	Low risk	231	0.616	0.5	0.5	0.5	0.5	0.4	0.4	0.4
	Increased risk	69	0.184	2.7	2.6	2.6	2.6	2.4	2.3	2.2
	Harmful	15	0.040	8.0	7.8	7.7	7.6	7.0	6.6	6.3
45-64	None		0.192							
	Low risk	345	0.617	0.6	0.6	0.6	0.6	0.5	0.5	0.5
	Increased risk	87	0.156	3.1	3.0	3.0	3.0	2.7	2.6	2.5
	Harmful	20	0.036	6.3	6.2	6.1	6.0	5.5	5.2	5.0
65+	None		0.192							
	Low risk		0.617	0.5	0.5	0.5	0.4	0.4	0.4	0.4
	Increased risk		0.156	2.4	2.4	2.4	2.3	2.1	2.1	2.0
	Harmful		0.036	4.9	4.8	4.8	4.7	4.3	4.1	3.9

Note: IAC Survey did not cover 65+ year olds drinking so have assumed that proportions in each category are the same as 45-64 year olds, and that overall consumption is 0.785 of 45-64 year olds.

Table 28: Estimated changes in maximum drinks per occasion for males by drinker type (based on University of Sheffield elasticity estimates)

Age Group	Volume	N	Prevalence	Maximum standard drinks per occasion						
				Baseline	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ of 82%	Excise ↑ of 107%	Excise ↑ of 133%
18-24	None		0.118							
	Low risk	18	0.130	3.5	3.5	3.5	3.4	3.3	3.3	3.2
	Increased risk	34	0.246	12.0	11.9	11.8	11.7	10.8	10.5	10.2
	Harmful	70	0.506	16.8	16.6	16.4	16.3	15.0	14.5	14.0
25-34	None		0.101							
	Low risk	39	0.292	3.2	3.2	3.2	3.2	3.0	3.0	2.9
	Increased risk	32	0.240	11.1	11.0	10.9	10.8	10.0	9.7	9.4
	Harmful	49	0.367	13.4	13.2	13.1	13.0	12.0	11.6	11.2
35-44	None		0.110							
	Low risk	84	0.409	3.4	3.4	3.4	3.4	3.2	3.2	3.1
	Increased risk	55	0.268	10.0	9.9	9.8	9.8	9.0	8.8	8.5
	Harmful	44	0.214	12.8	12.6	12.5	12.4	11.4	11.1	10.7
45-64	None		0.132							
	Low risk	182	0.439	3.1	3.1	3.1	3.1	2.9	2.9	2.8
	Increased risk	94	0.227	6.7	6.6	6.6	6.5	6.1	5.9	5.7
	Harmful	84	0.203	7.9	7.8	7.7	7.7	7.1	6.8	6.6
65+	None		0.132							
	Low risk		0.439	2.2	2.2	2.1	2.1	2.0	2.0	2.0
	Increased risk		0.227	4.7	4.6	4.6	4.6	4.2	4.1	4.0
	Harmful		0.203	5.5	5.4	5.4	5.4	4.9	4.8	4.6

Note: IAC Survey did not cover 65+ year olds drinking so have assumed that proportions in each category for that age group are same as 45-64 year olds, and that maximum consumption was 69.9% of 45-64 year olds.

Table 29: Estimated changes in maximum drinks per occasion for females by drinker type (based on University of Sheffield elasticity estimates)

Age Group	Volume	N	Prevalence	Maximum standard drinks per occasion						
				Baseline	Min. price $1.00	Min. price $1.10	Min. price $1.20	Excise ↑ of 82%	Excise ↑ of 107%	Excise ↑ of 133%
18-24	None		0.164							
	Low risk	44	0.281	3.1	3.1	3.1	3.1	2.9	2.9	2.8
	Increased risk	41	0.262	8.4	8.3	8.3	8.2	7.6	7.4	7.1
	Harmful	46	0.294	13.7	13.5	13.4	13.3	12.2	11.8	11.4
25-34	None		0.187							
	Low risk	97	0.415	3.1	3.1	3.1	3.1	2.9	2.9	2.8
	Increased risk	52	0.223	7.8	7.7	7.7	7.6	7.0	6.8	6.6
	Harmful	41	0.175	10.1	10.0	9.9	9.8	9.0	8.7	8.4
35-44	None		0.160							
	Low risk	185	0.493	3.1	3.1	3.1	3.1	2.9	2.9	2.8
	Increased risk	93	0.248	6.7	6.6	6.6	6.5	6.1	5.9	5.7
	Harmful	37	0.099	9.8	9.7	9.6	9.5	8.7	8.5	8.2
45-64	None		0.192							
	Low risk	335	0.599	3.1	3.1	3.1	3.1	2.9	2.9	2.8
	Increased risk	81	0.145	5.8	5.7	5.7	5.7	5.2	5.1	4.9
	Harmful	36	0.064	7.8	7.7	7.6	7.6	7.0	6.7	6.5
65+	None		0.192							
	Low risk		0.599	2.2	2.2	2.1	2.1	2.0	2.0	2.0
	Increased risk		0.145	4.1	4.0	4.0	4.0	3.7	3.6	3.4
	Harmful		0.064	5.5	5.4	5.3	5.3	4.9	4.7	4.5

Note: IAC Survey did not cover 65+ year olds drinking so have assumed that proportions in each category for that age group are same as 45-64 year olds, and that maximum consumption was 69.9% of 45-64 year olds.

10.2 Estimated effects of alcohol pricing policies on alcohol-related harms

Figure 17 shows the estimated savings in health, crime and workplace productivity costs for the pricing options analysed.

Figure 17: Impact of the pricing options on health, crime and workplace productivity harms

Estimated by the Ministry of Justice and Susan Joy (Health Economist)

Table 30 provides a summary of the estimated savings in health, crime and workplace productivity harms for each of the pricing options in the first year and Table 31 provides a cumulative discounted summary over a ten year period. Appendix 5 provides a detailed summary of the impact on alcohol-related harm for each of the six pricing options.

The most significant cost savings are for alcohol-related crime costs, representing 69% of all savings. The Government costs associated with consequences and responses to crime were estimated at $15 billion in 2010/11. The most significant driver of savings in crime-related costs is for reductions in alcohol-related violence and driving offences.

Minimum prices of $1.00 or $1.20 per standard drink result in the smallest reductions in alcohol-related crime, with savings of $45 million and $94 million respectively per annum (0.3% and 0.6% of total crime costs). Excise increases result in much greater savings of $332 million and $516 million for excise increases of 82% and 133% respectively (or 2.2% and 3.4% of total crime costs). Over a ten year period, the cumulative discounted crime savings range from $324 million for a minimum price of $1.00 per standard drink to $3.7 billion for an excise increase of 133%.

The next most significant savings are for alcohol-related health costs (17% of total savings). A minimum price of $1.00 per standard drink is estimated to result in net savings to the public health system of $11 million in the first year and $83 million cumulatively discounted over a ten year period. The excise options produce larger savings than the minimum price options ($83 million to $129 million in the first year, and $615 million to $952 million cumulatively discounted over a ten year period).

A majority of the estimated health cost savings in the first year and over ten years result from reductions in acute causes that reduced costs to ACC and acute hospital admissions. Net savings were found for hospitals in the first year and over ten years. This was despite the fact that costs for

chronic causes were expected to increase in the first year, as a result of the significant protective effects of alcohol modelled for some conditions among men over 65 years of age. Reductions in deaths from acute causes, ACC costs, and acute hospital admissions were skewed towards younger age groups, and represented greater changes in life expectancy than the chronic effects. Savings were significantly greater for men than for women.

Savings in workplace productivity costs range from $9 million to $95 million in the first year. Most of the productivity savings are the result of reduced costs associated with unemployment, both in terms of the savings to companies from not having to replace workers who lose their jobs due to harmful alcohol consumption and the additional PAYE tax generated from individuals who are employed who otherwise would not have been because of their harmful alcohol consumption. Savings in unemployment-related costs could be as high as $73 million if the alcohol excise tax rate is increased by 133%.

Table 30: Value of harm reductions in year 1 ($000)

Pricing option	Value of harm reductions in year 1 ($000)						
	Healthcare savings	Crime savings	Productivity savings from reduced pre-mature mortality	Unemploy-ment savings	Absenteeism savings	Impaired productivity savings	Total value of harm reductions in Year 1
Minimum price of $1.00	11,151	45,126	76	7,498	757	1,010	**65,618**
Minimum price of $1.10	16,231	66,132	110	10,736	1,112	1,480	**95,802**
Minimum price of $1.20	22,914	94,210	156	15,121	1,590	2,113	**136,104**
Excise increase of 82%	83,295	331,955	589	45,591	5,795	7,870	**475,096**
Excise increase of 107%	104,430	419,628	740	59,188	7,334	9,956	**601,276**
Excise increase of 133%	128,804	516,258	906	73,098	9,026	12,251	**740,344**

Source: Health costs estimated by Susan Joy (independent Health Economist). Crime and workplace productivity savings estimated by the Ministry of Justice.

Table 31: Cumulative discounted value of harm reductions over ten years ($000) (discounted at a rate of 8%)

Pricing option	Cumulative discounted value of harm reductions over 10 years ($000) (discount rate of 8%)			
	Healthcare savings	Crime savings	Workplace productivity savings	Total value of harm reductions Years 1-10
Minimum price of $1.00	82,690	323,515	69,761	**475,966**
Minimum price of $1.10	120,329	474,188	100,384	**694,900**
Minimum price of $1.20	169,853	675,573	141,783	**987,208**
Excise increase of 82%	615,307	2,380,815	447,484	**3,443,607**
Excise increase of 107%	771,559	3,009,648	577,300	**4,358,507**
Excise increase of 133%	951,627	3,702,737	712,334	**5,366,697**

Source: Health costs estimated by Susan Joy (independent Health Economist). Crime and workplace productivity savings estimated by the Ministry of Justice.

10.3 Estimated effects of alcohol pricing policies on consumers' surplus

All pricing options result in an increase in consumer expenditure on alcohol, ranging from a 1.2% increase in spending (or an increase of $61 million) for a minimum price of $1.00 per standard drink to a 16.2% increase in spending for an excise increase of 133% (or an $845 million increase in expenditure).

For all pricing options, at a total population level, there is a significant reduction in consumers' surplus, as the increase in price reduces the difference between what consumers are willing to pay for alcohol products and the market price (particularly for the excise options). The reduction in consumers' surplus is made up of the transfer of consumers' surplus to the alcohol industry or Government plus the lost consumers' surplus due to reduced consumption, which is neither gained by the industry nor the Government. The lost consumers' surplus is accounted for in calculating the net societal or welfare effect of a pricing policy. Total loss of consumers' surplus ranges from $89 million for a minimum price of $1.00 per standard drink to $1.2 billion for an excise increase of 133%. For a minimum price of $1.00 per standard drink, $3 million is lost consumers' surplus that is not gained by the alcohol industry or the Government (4% of the total loss of consumers' surplus). For an excise increase of 133%, $121 million is lost consumers' surplus (10% of the total loss of consumers' surplus).

Table 32: Impact of the pricing policies on consumers' surplus ($000)

Pricing Option	Transfer of consumers' surplus to industry or Government ($000)	Lost consumers' surplus ($000)	Total loss of consumers' surplus ($000)
Min price $1.00	-$86,226	-$3,404	-$89,630
Min price $1.10	-$122,442	-$6,890	-$129,332
Min price $1.20	-$166,808	-$13,111	-$179,919
Excise increase of 82%	-$717,497	-$45,895	-$763,392
Excise increase of 107%	-$892,526	-$78,841	-$971,367
Excise increase of 133%	-$1,066,364	-$121,220	-$1,187,584

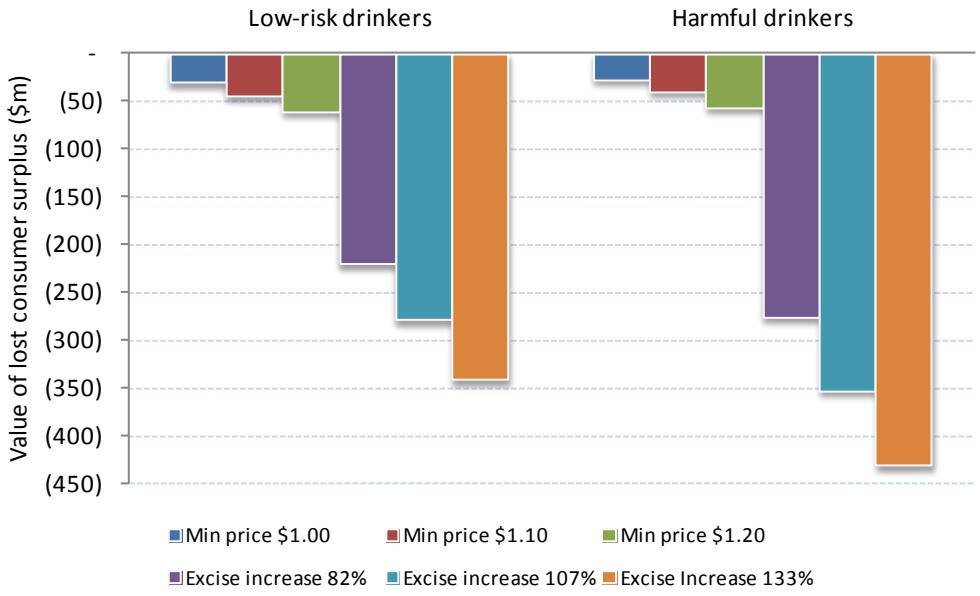
Source: Estimated by the Ministry of Justice and The Treasury

Over a ten year period, the cumulative discounted total loss of consumers' surplus ranges from $655 million for a minimum price of $1.00 per standard drink to $8.7 billion for an excise increase of 133%. For a minimum price of $1.00 per standard drink, 4% percent of this (or $25 million) is lost consumers' surplus that is neither gained by the Government or the alcohol industry over the ten year period. For an excise increase of 133%, 10% of this (or $885 million) is lost consumers' surplus over a ten year period.

Impact on low risk and harmful drinkers

Figure 18 illustrates the impact on the consumers' surplus for low risk and harmful drinkers. The reduction in consumers' surplus for low risk drinkers ranges from $31 million to $341 million depending on the pricing option. The reduction in consumers' surplus for harmful drinkers is slightly lower than for low risk drinkers for the minimum price options, but is much higher for the excise increase options, resulting in lost consumers' surplus of $431 million for an excise increase of 133%.

Figure 18: Impact on consumers' surplus for low risk drinkers and harmful drinkers (Population Level)



Source: Estimated by the Ministry of Justice and The Treasury

Impact on consumer benefits at an individual level

Based on the modelling undertaken, it is estimated that on average, an alcohol consumer in New Zealand purchased 837 standard drinks of alcohol in 2011, spending $1,852 on alcohol products. However, this varies widely by drinker type. For a minimum price of $1.00 per standard drink, at a total population level, each alcohol consumer in New Zealand would reduce the number of standard drinks purchased by 16 drinks but would increase their expenditure on alcohol by $22 per annum. Off-licence wine consumers would be most impacted, spending on average an extra $10.70 per annum.

For a minimum price of $1.00 per standard drink, a low risk drinker is estimated to reduce the number of standard drinks purchased by 8 drinks per annum, but would increase the amount spent on alcohol by $12 per annum, with lost consumer surplus valued at $18. A harmful consumer is estimated to reduce their standard drinks by 47 drinks but increase the amount they spend on alcohol by $66 per annum, with lost consumer surplus valued at $92.

For an excise increase of 82%, each alcohol consumer in New Zealand would reduce the number of standard drinks purchased by 76 drinks but increase the amount spent on alcohol by $209. Consumers who purchase beer and wine at on- and off-licences would be most impacted. Low risk drinkers are predicted to reduce their consumption by 31 standard drinks per annum, but would increase the amount they spend on alcohol by $92, with lost consumer surplus valued at $120. A harmful consumer is estimated to reduce their standard drinks by 274 drinks and increase the amount they spend by $710 with lost consumer surplus valued at $938.

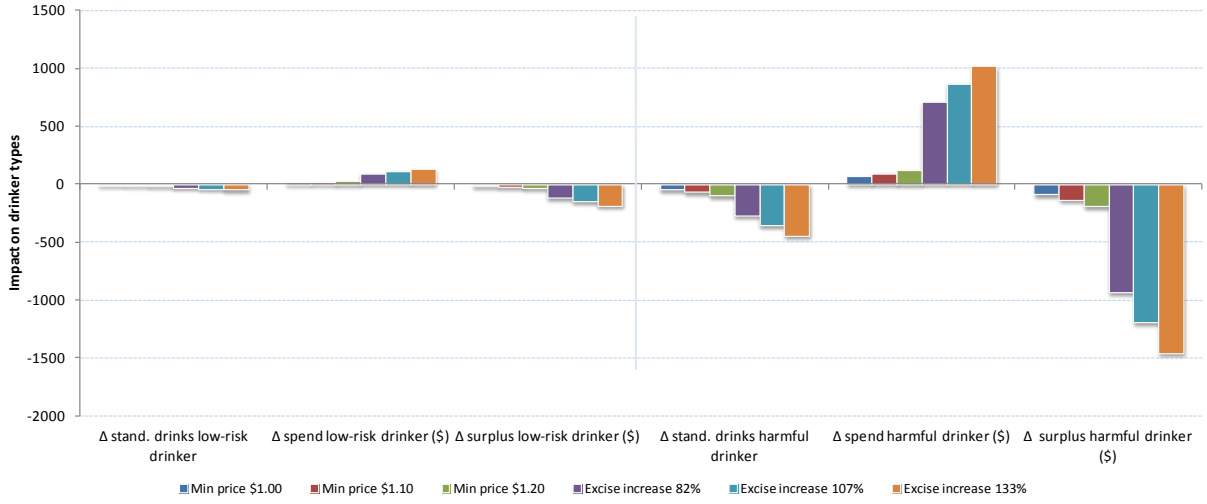
Table 33: Impact of the pricing options on the amount of alcohol purchased and the amount of expenditure on alcohol for all drinker types

Pricing Option	Low risk drinkers				Increased risk drinkers				Harmful drinkers			
	Δ Cons	Δ Stand. Drinks	Δ Spend ($)	Δ Surplus ($)	Δ Cons	Δ Stand. Drinks	Δ Spend ($)	Δ Surplus ($)	Δ Cons	Δ Stand. Drinks	Δ Spend ($)	Δ Surplus ($)
Min price $1.00	-2.6%	-8	$12	-$17	-2.3%	-25	$30	-$46	-2.1%	-48	$65	-$92
Min price $1.10	-3.7%	-11	$16	-$24	-3.2%	-36	$41	-$66	-3.1%	-71	$91	-$135
Min price $1.20	-5.1%	-15	$21	-$33	-4.5%	-50	$54	-$91	-4.3%	-101	$122	-$192
Excise increase of 82%	-11.7%	-31	$92	-$120	-11.8%	-108	$305	-$387	-13.0%	-274	$710	-$935
Excise increase of 107%	-15.2%	-41	$112	-$152	-15.2%	-141	$374	-$493	-16.9%	-360	$868	-$1,195
Excise increase of 133%	-18.9%	-51	$131	-$186	-18.8%	-175	$441	-$603	-20.9%	-446	$1,016	-$1,460

Source: Estimated by the Ministry of Justice and The Treasury

Harmful drinkers are less responsive to a minimum price than low risk drinkers. However, Figure 19 below highlights that because a harmful drinker consumes more than a low risk drinker and typically drinks more cheap alcohol, the impact on the amount of alcohol harmful drinkers' buy and the amount they spend on alcohol is considerably greater for all pricing options compared to low risk drinkers.

Figure 19: Impact of the pricing options on the amount of alcohol purchased and the amount of expenditure on alcohol for a typical low risk drinker and harmful drinker



Source: Estimated by the Ministry of Justice and The Treasury

10.4 Estimated effects of alcohol pricing policies on the alcohol industry

Impact of a minimum price on the alcohol industry

Although a minimum price regime would increase the minimum price per standard drink of alcohol, reduce consumer demand and in turn sales volumes, the alcohol industry as a whole would benefit from increased revenue.[26] For a minimum price of $1.00 and $1.20 per standard drink, industry revenue is estimated to increase by $69 million and $131 million respectively, primarily gained by the off-licence retail sector.[27]

As highlighted in Section 8.4, total industry revenue is equal to:

- 1.Transfer of consumers' surplus to industry revenue – (2.Lost industry revenue due to the fall in quantity demanded + 3.Increased revenue resulting from substitution effects).

The increase in industry revenue resulting from a transfer of consumers' surplus or expenditure to the alcohol industry from an increase in the price of low price products is estimated to be $86 million and $166 million respectively for a minimum price of $1.00 and $1.20 per standard drink. [28]

The lost industry revenue due to the fall in quantity demanded is estimated to be $16 million and $36 million respectively for a minimum price of $1.00 and $1.20 per standard drink.

Increased revenue from substitution effects somewhat offsets the lost revenue. On-licence sales are estimated to increase, as although prices remain the same, quantity demanded increases as a result of the reduced price differential between off-licence and on-licence sales, encouraging consumers to switch or substitute from off-licence to on-licence premises. Figure 20 shows the impact of the pricing options on the alcohol industry. The increase in revenue is primarily gained by the off-licence sector (88%), as the price of all products priced below the minimum price level increase, offsetting the fall in quantity demanded.

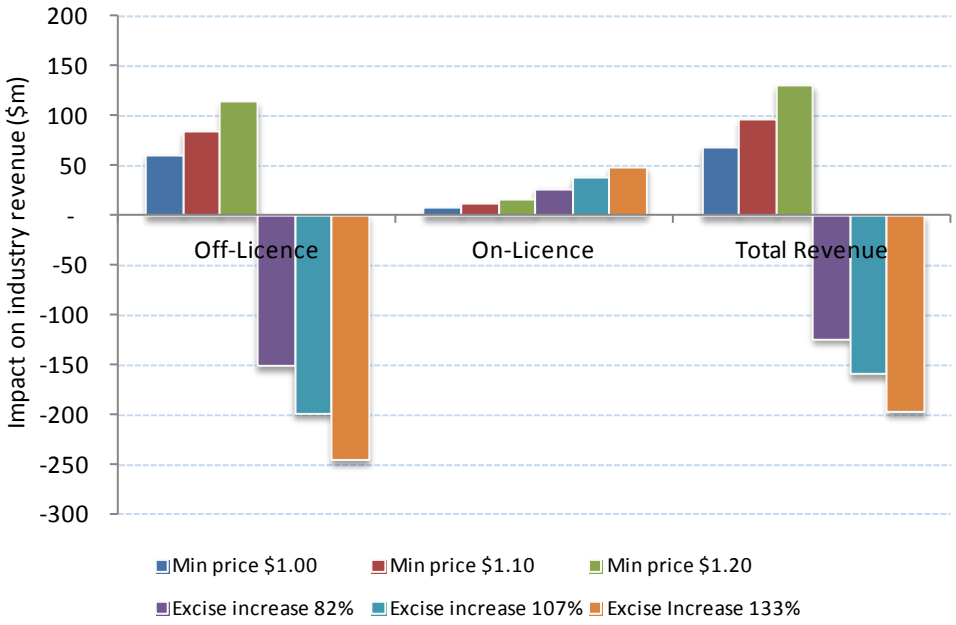
The segment of the alcohol industry that the additional revenue accrues to will depend on the relative market share and market power of the retailers, wholesalers and producers along the supply chain (Hunt, Rabinovich and Baumberg, 2010). Due to limited information, we could not estimate how the increased revenue from a minimum price would be distributed along the supply chain or the direct impact on alcohol producers. However, an overview of potential impacts on and responses of the key players in the supply chain is discussed in Section 13 below.

[26] This is because the aggregated elasticity of demand for alcohol is inelastic and consumers will consequently spend more on alcohol products.

[27] Industry revenue for a minimum price is greater than the increase in total spend, as a proportion of consumer surplus is transferred to the industry.

[28] This is a static rather than dynamic analysis. It is possible that some or all of this surplus is "competed away" through non-price competition.

Figure 20: Impact of the pricing options on the alcohol industry



Source: Estimated by the Ministry of Justice and The Treasury

Impact of an excise increase on the alcohol industry

An excise increase would increase prices across all beverage types. As a proportion of the loss of consumers' surplus would be transferred to the Government, the alcohol industry would not gain from the increase in price, and consequently would be more heavily impacted by the reduced quantity demanded than with the imposition of a minimum price. The off-licence sector would be negatively impacted by excise tax increases, due to the fall in quantity demanded, as increased consumer expenditure is transferred to the Government as revenue. Off-licence industry revenue reduces by $150 million and $244 million respectively for excise increases of 82% and 133%.

However, on-licence trade is predicted to benefit, increasing by $27 million and $48 million respectively for an excise increase of 82% and 133% as the price differential between products in off-licences and on-licences reduce, encouraging consumers to switch from purchasing at off-licences to purchasing high price products at on-licences.

Table 34: Total gain or loss to industry based on pricing options ($000)

Pricing Option	Transfer of consumers' surplus to industry revenue ($000)	Lost industry revenue from fall in quantity demanded ($000)	Total gain / loss industry ($000)	Impact on off-licence revenue ($000)	Impact on on-licence revenue ($000)
Min price $1.00	$86,226	-$16,841	$69,385	$61,204	$8,181
Min price $1.10	$122,442	-$25,155	$97,287	$85,514	$11,773
Min price $1.20	$166,808	-$35,713	$131,094	$114,594	$16,501
Excise increase of 82%	$0	-$122,604	-$122,604	-$150,055	$27,451
Excise increase of 107%	$0	-$158,347	-$158,347	-$197,227	$38,881
Excise increase of 133%	$0	-$196,153	-$196,153	-$244,303	$48,150

Source: Estimated by the Ministry of Justice and The Treasury

Over a ten year period, the cumulative discounted industry revenue ranges from a gain of $502 million for a minimum price of $1.00 per standard drink to a loss of $1.4 billion for an excise increase of 133%.

Lost industry asset value

The loss of industry revenue due to reduced demand does not result in a net loss to society as the lost industry revenue is a gain to consumers who can now spend their income on other goods. The loss to society is the lost consumers' surplus that not transferred to either the industry or the Government, which is discussed above. However, as there is reduced demand, a proportion of industry fixed assets would lose value as they would no longer be used in the production of alcohol. The value of these assets would decrease, and this decrease would not be offset by a benefit that accrues elsewhere.

This amount is difficult to measure or estimate, but would be a function of the lost industry revenue due to the fall in demand. It also depends on how limited the assets are to the alcohol industry or how valuable the assets are to other industries, and the ability of producers to export their excess product, or for the cost to be borne by foreign exporters who reduce the amount exported to New Zealand. For the purposes of the modelling work, we have assumed that producers would earn 90% of the revenue by exporting the amounts that were previously consumed in New Zealand. We have attributed the 10% reduction in revenue to the value of a capital asset with a ten year life and discounted it over a ten year period.

The lost industry asset value is estimated to be $0.8 million and $1.8 million for a minimum price of $1.00 and $1.20 per standard drink respectively. The lost asset value is estimated to be $6 million and $10 million for an excise increase of 82% and 133% respectively.

Over a ten year period, the cumulative discounted loss of asset value ranges from $6 million for a minimum price of $1.00 per standard drink to $71 million for an excise increase of 133%.

Impact on beverage sectors

A minimum price per standard drink results in reduced demand for low price beverages at off-licences and increased demand for high price beverages at on-licences as consumers switch from off-licence to on-licence purchases. Quantity demanded for low cost beer, wine, spirits and RTDs currently priced below the proposed minimum price levels decrease with a minimum price, which

would impact producers and importers who supply to this low price market, although industry revenue increases overall.[29]

Demand for high price alcohol at off-licences increases for all beverage types as does the quantity demanded for low and high price alcohol at on-licences. Although low price wine experiences the largest consumption decrease, the large increase in price results in the greatest revenue gained by off-licence low price wine sales, followed by spirits. Data is not available to determine the impacts on particular products or brands. If retailers use their bargaining power and profits do not flow back to producers, producers would be negatively impacted by the increased average costs of production, which may squeeze some producers out of the market. However, if increased revenue flows back to producers, producers may maintain profits.[30]

An increase in excise would increase alcohol prices across the board. With an excise increase, demand for most alcohol products is estimated to fall, with the exception of high price beer, wine and spirits at on-licences. Increased excise duties result in much greater changes to the price and quantity demanded of alcohol products compared to a minimum price, with the greatest reduction in demand estimated for low cost spirits, followed by low cost wine, high cost spirits, and low cost RTDs sold at off-licences. High cost alcohol is also impacted by excise increases.

As excise is levied at the producer level, producers would face further impacts if the excise is not passed through to the consumer. For the purposes of modelling the price effects, a pass through rate of 100% is assumed.[31]

[29] Low price wine and spirit producers are likely to be most negatively impacted by reduced demand, due to the large increases in price and decreases in consumption.

[30] Ibid.

[31] It is recognised that in the short term, it is unlikely that there will be a 100% pass through rate to the consumer. However this will be achieved in the long term, as it would be unsustainable for producers to continue to absorb the costs into the future.

Table 35: Impact of pricing options on beverage sectors

Pricing Option	Minimum Prices $1.00					Excise 82%				
Beverage Type	Δ Price	Δ Demand	Δ Sd. drinks (000)	Δ Industry Revenue ($000)	Δ Govt Revenue ($000)	Δ Price	Δ Demand	Δ Sd. Drinks (000)	Δ Industry Revenue ($000)	Δ Govt Revenue ($000)
Beer Low Off	1.2%	-0.3%	(2,149)	$6,477	-$731	25.3%	-9.7%	-61,478	-$47,937	$140,533
Beer Low On	0.0%	0.6%	3	$3	$1	21.5%	-7.5%	-37	-$35	$113
Beer High Off	0.0%	0.3%	318	$397	$108	18.3%	-5.9%	-5,535	-$6,920	$23,913
Beer High On	0.0%	0.6%	2,001	$7,165	$680	7.9%	2.3%	7,229	$25,886	$101,006
Wine Low Off	12.6%	-6.3%	(29,654)	$31,881	-$7,757	32.1%	-12.6%	-59,469	-$39,927	$107,631
Wine Low On	15.0%	0.0%	0	$208	$0	44.7%	-14.7%	-239	-$141	$466
Wine High Off	0.0%	0.4%	1,206	$1,755	$316	19.5%	-5.6%	-15,276	-$22,229	$82,266
Wine High On	0.0%	0.0%	59	$253	$15	8.5%	0.9%	1,198	$5,174	$51,853
Spirit Low Off	16.8%	-9.8%	(15,705)	$17,521	-$9,727	63.1%	-36.5%	-58,747	-$16,323	$21,527
Spirit Low On	n/a	n/a	n/a	$0	n/a	n/a	n/a	n/a	n/a	n/a
Spirit High Off	0.0%	0.1%	28	$32	$18	31.1%	-18.6%	-4,848	-$5,401	$8,451
Spirit High On	0.0%	0.1%	82	$453	$50	10.7%	0.1%	101	$561	$49,594
RTD Low Off	3.1%	-1.1%	(1,501)	$3,126	-$510	27.7%	-10.3%	-13,540	-$9,528	$29,569
RTD Low On	2.9%	0.0%	0	$9	$0	27.5%	-8.2%	-32	-$23	$69
RTD High Off	0.0%	0.1%	11	$15	$4	17.1%	-6.4%	-1,334	-$1,790	$5,153
RTD High On	0.0%	0.1%	24	$90	$8	8.5%	-3.1%	-1,040	-$3,971	$10,959
Total			-45,277	$69,385	-$17,525			-213,045	-$122,604	$633,102

Source: Estimated by the Ministry of Justice and The Treasury

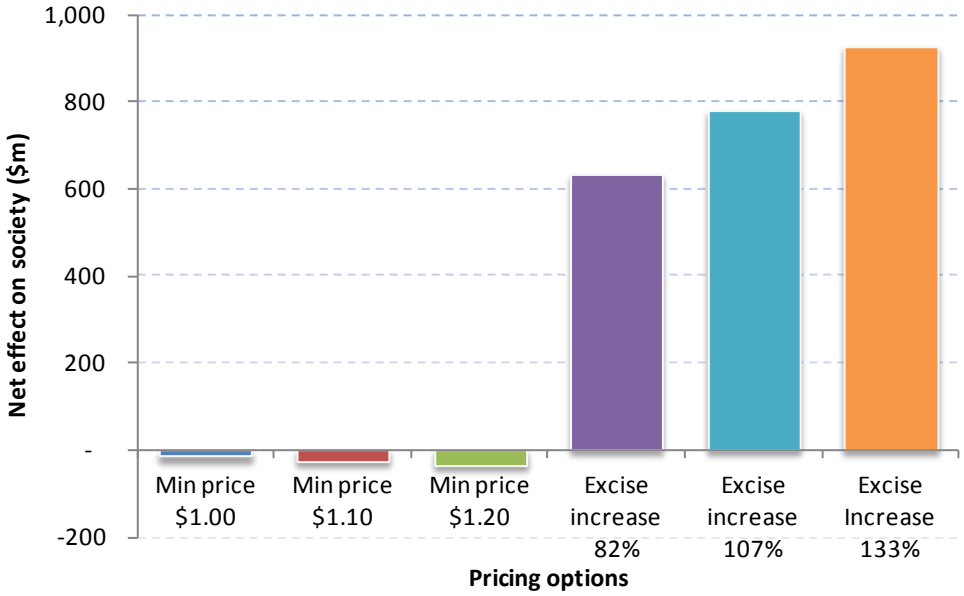
10.5 Estimated effects of alcohol pricing policies on Government revenue

Figure 21 shows the impact of the pricing options on Government revenue. As a proportion of the loss of consumers' surplus is transferred to the alcohol industry for a minimum price, the Government is negatively impacted by reduced demand. Although this is offset slightly by increased excise revenue from consumers switching to other alcoholic products, overall alcohol excise duties are estimated to fall by 2% if a minimum price of $1.00 per standard drink is imposed and by 4% if a minimum price of $1.20 per standard drink is imposed (a decrease of $18 million and $35 million respectively) due to a reduction in the amount of alcohol purchased.

As highlighted in Section 8.5, total industry revenue is equal to:

- Transfer of consumers' surplus to Government revenue – Lost excise revenue due to reduced quantity demanded.

Figure 21: Impact of the pricing options on Government revenue



Source: Estimated by the Ministry of Justice and The Treasury

In terms of an excise increase, Government excise revenue would decrease due to the reduced quantity of alcohol purchased as prices increase across all alcohol products. However, a proportion of the reduction in consumers' surplus would be transferred to the Government in the form of an increase in excise revenue (as consumer expenditure on alcohol increases), offsetting the reduction in excise from reduced demand.

For an excise increase of 82% and 133%, Government revenue is estimated to increase by 78% and 85% respectively ($633 million and $929 million) because of the significant increase in excise rates.[32]

The lost excise from the imposition of a minimum price is included when estimating the net societal or welfare effects of a pricing policy.

Table 36: Impact of the pricing options on Government revenue ($000)

Pricing Option	Transfer of consumers' surplus to Government revenue	Lost excise revenue from fall in quantity demanded	Total gain/loss Government revenue
Min price $1.00	$0	-$17,525	-$17,525
Min price $1.10	$0	-$25,019	-$25,019
Min price $1.20	$0	-$35,074	-$35,074
Excise increase of 82%	$717,497	-$84,395	$633,102
Excise increase of 107%	$892,526	-$110,648	$781,878
Excise increase of 133%	$1,066,364	-$137,157	$929,207

Source: Estimated by the Ministry of Justice and The Treasury

Over a ten year period, the cumulative discounted total Government revenue ranges from a loss of $127 million for a minimum price of $1.00 per standard drink to a gain of $6.8 billion for an excise

[32] Such large numbers should be treated with caution, but it is clear that such substantial rises in excise would increase Government revenue by hundreds of millions of dollars because of the relatively inelastic demand for alcohol. Percentage changes are based on estimated baseline excise revenue as opposed to actual baseline revenue.

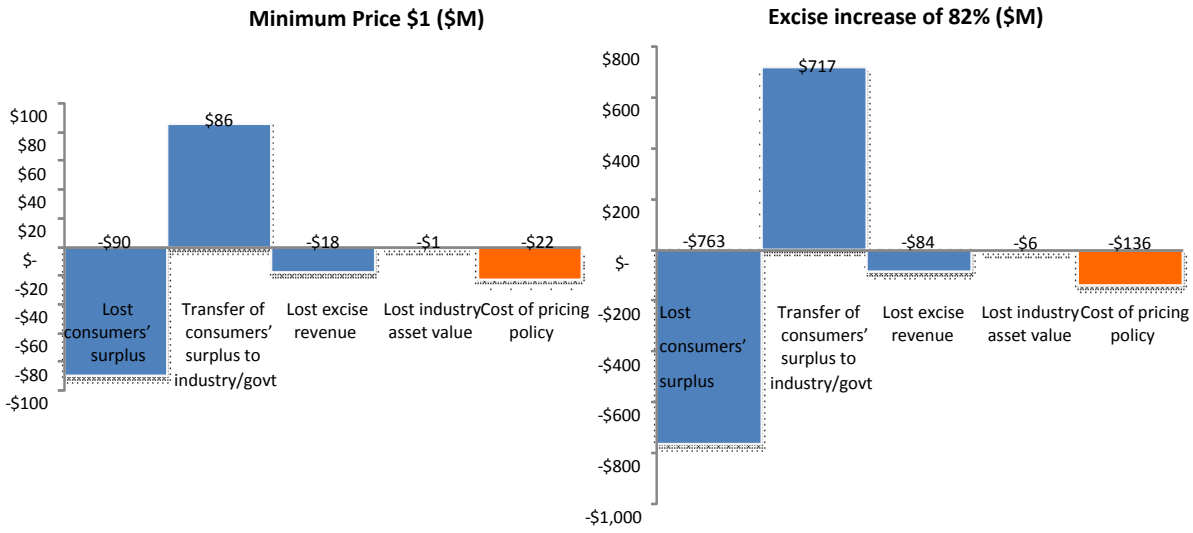
increase of 133%. Of this, about 14% is lost Government revenue due to a fall in the quantity demanded. This ranges from $127 million for a minimum price of $1.00 per standard drink to $1 billion for an excise increase of 133%.

10.6 The costs of an alcohol pricing policy

The costs of a pricing policy include the lost consumers' surplus, the lost excise revenue, and the lost value of industry assets due to the increased prices and consequent reductions in demand. The costs of a pricing policy range from $22 million for a minimum price of $1.00 per standard drink to $268 million for an excise increase of 133%.

These costs must be weighed up against the benefits of the pricing policy, that is, the reduction in alcohol-related harms, to determine the overall net effect on society.

Figure 22: Costs of a pricing policy (note different axes ranges)



Source: Estimated by the Ministry of Justice and The Treasury

Table 37: Costs of a pricing policy ($000)

Pricing Option	Loss to consumers	Transfer of consumers' surplus to industry/govt	Lost excise revenue	Lost industry asset value	Cost of pricing policy
Min price $1.00	-$89,630	$86,226	-$17,525	-$842	-$21,771
Min price $1.10	-$129,332	$122,442	-$25,019	-$1,258	-$33,167
Min price $1.20	-$179,919	$166,808	-$35,074	-$1,786	-$49,970
Excise increase of 82%	-$763,392	$717,497	-$84,395	-$6,130	-$136,420
Excise increase of 107%	-$971,367	$892,526	-$110,648	-$7,917	-$197,407
Excise increase of 133%	-$1,187,584	$1,066,364	-$137,157	-$9,808	-$268,185

Source: Estimated by the Ministry of Justice and the Treasury

11.Overall net effect on society

Table 38 and Figure 23 show the overall impact on society for each of the pricing options in year one. Table 39 shows the net effect on society cumulatively discounted over a ten year period. The net societal effect of the pricing policies weighs up the harm savings from reduced alcohol consumption against the costs of the pricing policies to the economy in terms of lost consumers' surplus, lost excise revenue from reduced consumption, and the lost value of industry assets due to reduced demand and production.[33]

Net savings range from $44 million for a minimum price of $1.00 per standard drink to $472 million for an excise increase of 133% in year 1. Over a ten-year period, a minimum price of $1.00 or $1.20 per standard drink results in net benefits to society of $318 million and $624 million respectively, while excise increases of 82% and 133% result in net benefits to society of $2.5 billion and $3.4 billion respectively cumulatively discounted over a ten year period. The estimated savings are likely to be conservative as they are based on international estimates of price responsiveness that are much more conservative than New Zealand estimates generated as part of this analysis, and only include some of the harms alcohol imposes upon others.

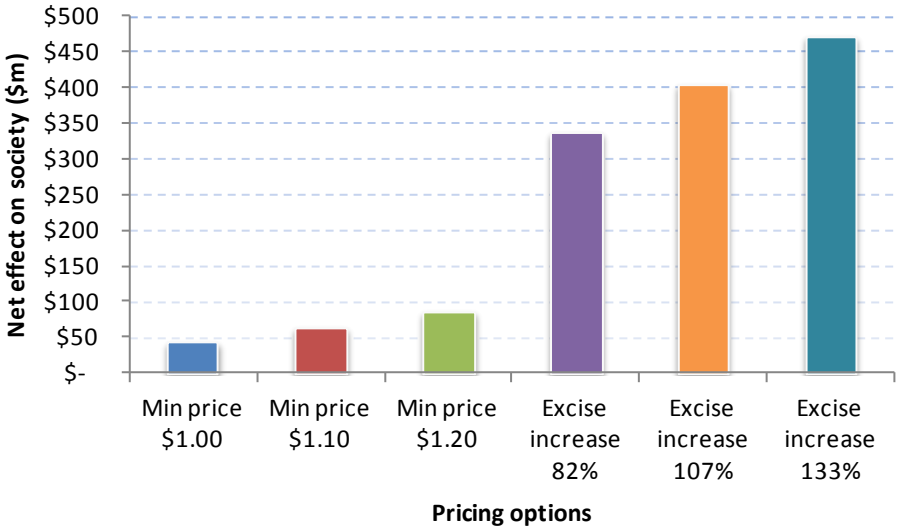
Table 38: Overall net effect on society of each pricing option in year 1 ($000)

Pricing option	Savings in alcohol-related harm	Lost economic efficiency	Net savings to society
Minimum price of $1.00	65,618	21,771	43,847
Minimum price of $1.10	95,802	33,167	62,636
Minimum price of $1.20	136,104	49,970	86,134
Excise increase of 82%	475,096	136,420	338,676
Excise increase of 107%	601,276	197,407	403,869
Excise increase of 133%	740,344	268,185	472,159

Source: Estimated by the Ministry of Justice

[33] The loss of industry revenue due to reduced demand is not included in the net effect on society as consumers no longer spend the value of the lost revenue. However, as there is reduced demand, a proportion of industry fixed assets lose value as they will no longer be used in the production of alcohol. The value of these assets will decrease, and this decrease is not offset by a benefit that accrues elsewhere.

Figure 23: Overall net effect on society of each pricing option in year 1



Source: Estimated by the Ministry of Justice

Table 39: Overall net effect on society of each pricing option discounted over a ten year period ($000s)

Pricing option	Savings in alcohol-related harm	Lost economic efficiency	Net savings to society
Minimum price of $1.00	475,966	157,990	**317,976**
Minimum price of $1.10	694,900	240,800	**454,101**
Minimum price of $1.20	987,208	362,970	**624,239**
Excise increase of 82%	3,443,607	991,266	**2,452,340**
Excise increase of 107%	4,358,507	1,435,129	**2,923,378**
Excise increase of 133%	5,366,697	1,950,490	**3,416,207**

Source: Estimated by the Ministry of Justice

Our analysis concludes that all pricing options are effective, with an excise increase up to 133% generating positive savings for society. Excise increases up to 133% result in much larger benefits to society compared with a minimum price. This is because an excise increase affects the price of all alcohol (not just low price alcohol) and therefore more significantly impacts consumer behaviour.

12.Sensitivity analysis

A series of sensitivity analyses were undertaken on key model parameters and underlying assumptions. Pricing option 4 (an excise increase of 82% to achieve an average price of $1.00 on the lowest priced beverages) was chosen as a base case scenario as it generates reasonably large results.

12.1 The impact of the sensitivity analysis on consumption effects

Table 40 shows the effects on excise, consumers' surplus, lost industry asset value, and deadweight loss based on changes in the some of the model parameters and underlying assumptions. For the consumption effects model, the results are not sensitive to the scenarios tested, with the exception of changing the discount rate. This suggests that the consumption results are not driven by the inputs varied in the sensitivity analysis.

12.2 The impact of the sensitivity analysis on harm effects

Table 41 shows the results of the sensitivity analysis on the harm models. The impact of changing model parameters and assumptions was considered for the health, crime, unemployment, absenteeism and impaired productivity models. Sensitivity analysis was not performed on the pre-mature mortality model as the results generated in this model are so small and do not have a significant impact on the overall results. Key points to note from this sensitivity analysis are outlined below.

Assuming a smaller proportion of harmful drinkers does not change crime savings

The crime savings estimated do not change if we assume a smaller proportion of the population drinks at a harmful level. This is because we assume that all alcohol-attributable crime is committed by harmful drinkers. So changing the baseline proportion of harmful drinkers will not affect the outcomes of the model, it simply reduces the number of individuals responsible for committing alcohol-attributable crime. The number of crimes saved following a reduction in consumption remains the same.

Assuming harmful drinkers consume one standard deviation less than given in the base sample results in greater savings

The savings in the crime model and across all three productivity models under scenario 2 are larger than for the base model, even though scenario 2 assumes that the number of standard drinks consumed by harmful drinkers is one standard deviation lower than the value calculated from the *International Alcohol Control* survey. Intrinsically this does not make sense. However, as the AAF has not changed for any of the age/gender groups in any of the models, and the PIF is calculated from both the AAF and the difference between the median consumption of the harmful drinker and the threshold for non-harmful drinkers, lowering the value of median consumption for the harmful drinker means that the value of the PIF will increase for each age/gender group. The net implication of this is that a greater proportion of harm from alcohol will be reduced under scenario 2, leading to greater cost savings.

Assuming only own-price elasticity effects results in greater harm savings

If we assume there are no cross-price or substitution effects then harm savings increase by around 27% as there is a much greater reduction in overall alcohol consumption as individuals are not assumed to switch to other beverage types.

Changing the population projections has little impact on the harm models

Changing the assumptions for population projections by assuming a low projection or a high projection rather than a median projection has very little impact on the harm models. Assuming a low projection only slightly reduces harm savings, while assuming a high projection slightly increases savings (by 1%).

Changing the discount rate does have a substantial effect on savings over a ten year period

Assuming a 0% discount rate (i.e. not discounting the model over a ten year period) results in an increase in harm savings of 39% over the base model. A discount rate of 5% results in increased harm savings of 13%. Estimated harm savings over a ten year period are very sensitive to the discount rate chosen. Applying an adjustment for health inflation costs increases health savings over a ten year period.

The crime results are only moderately sensitive to assumptions made about crime projections

Assuming a flat crime rate results in an increase in crime savings of 4% compared to the base model, while assuming that crime decreases by 2% per annum results in a reduction in crime savings of 4% compared to the base model.

The unemployment model is sensitive to the length of the friction period

Assuming a friction period of 20 weeks rather than 11 weeks results in an increase in employment savings of 36% compared to the base model. Therefore the length of friction period chosen has a significant effect on employment savings estimated.

The employment model also assumes that harmful drinkers are 16.6% more likely to be unemployed compared to non-harmful drinkers based on findings in MacDonalds and Shields (2004). If we use an alternative percentage of 6.9% (the lower percentage presented in the MacDonalds and Shields paper) then employment savings reduce by 59%. Therefore, the employment model is highly sensitive to assumptions made about the length of the friction period and the proportion of harmful drinkers likely to be unemployed compared to non-harmful drinkers.

Using Australian data for alcohol attributable absenteeism and impaired productivity results in much greater savings

There are very large differences in savings in the absenteeism models, between those estimated in the base model using data from a study by Jones et al (1995), and that estimated in the alternative model using UK Labour Force Survey Data and AAFs from Roche et al (2008). The savings estimated through the alternative model are 78% higher. One reason for this is that the total number of days absent through alcohol is estimated to be approximately twice as large in the alternative model compared with the base model. The other main reason is due to the differences in the distribution of absenteeism that were estimated by the two models. In the base model, the vast majority (81%) of absenteeism due to alcohol is assumed to be for males aged 18 to 34 years. In the alternative

model, however, the distribution of absenteeism due to alcohol is spread more evenly across all age and gender groups, with only 37% assumed to be for males aged 18 to 34 years.

There are similar differences in the magnitude of savings estimated through the base and alternative impaired productivity models, with the savings from the alternative model being 99% higher. The base model uses data from a study by Jones et al (1995), while the alternative model uses aggregate impaired productivity data from Jones et al and the age/gender distribution of absences due to alcohol to apportion the aggregate impaired productivity data by age group and gender. This approach was chosen given the strong correlation between days absent and reduced productivity on the job. As with the absenteeism model, the total number of days lost through impaired productivity due to alcohol is estimated to be considerably higher (85%) in the alternative model compared with the base model. In addition, there are substantial differences in the age/gender distribution of alcohol-related impaired productivity, with the distribution considerably more evenly spread across all age/gender groups in the alternative model.

Table 40: Parameter sensitivity analysis – effects on consumption results

		Difference in cumulative 10 year financial value estimate				% difference from base model			
Scenario	**Description**	**Impact on excise**	**Impact on lost consumers' surplus**	**Impact on deadweight loss (not including lost industry asset value)**	**Impact on lost industry asset value**	**Impact on excise**	**Impact on lost consumers' surplus**	**Impact on deadweight loss (not including lost industry asset value)**	**Impact on lost industry asset value**
	Base model (excise increase of 82%)	4,630,624	-5,583,587	-335,683	-44,837				
1	Assumes proportion of harmful drinkers is one standard deviation lower than the sample proportions	-215,224	269,628	18,292	2,153	-4.65%	-4.83%	-5.45%	-4.80%
2	Assume number of standard drinks consumed by harmful drinkers is one standard deviation lower than the sample numbers	8,922	-7,733	155	-69	0.19%	0.14%	-0.05%	0.15%
3	Assume only the diagonals of the price elasticities matrices would be non-zero	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	Use low population projections	-5,795	6,987	420	56	-0.13%	-0.13%	-0.13%	-0.13%
5	Use high population projections	904	-1,090	-66	-9	0.02%	0.02%	0.02%	0.02%
6	Use a discount rate of 0%	1,761,157	-2,123,596	-127,670	-17,053	38.03%	38.03%	38.03%	38.03%
7	Use a discount rate of 5%	550,747	-664,089	-39,925	-5,333	11.89%	11.89%	11.89%	11.89%

Table 41: Parameter sensitivity analysis – effects on harm results

		Difference in cumulative 10 year financial value estimate					% difference from baseline				
Scenario	**Description**	**Health savings**	**Crime savings**	**Unemployment savings**	**Absenteeism savings**	**Impaired productivity savings**	**Health savings**	**Crime savings**	**Unemployment savings**	**Absenteeism savings**	**Impaired productivity savings**
	Base Model (excise increase of 82%)	615,307	2,380,815	338,219	44,593	60,299					
1	Assumes proportion of harmful drinkers is one standard deviation lower than the sample proportions	-85,955	0	-92,224	-4,477	-4,657	-14%	0%	-27%	-10%	-8%
2	Assume number of standard drinks consumed by harmful drinkers is one standard deviation lower than the sample numbers	-10,602	221,457	107,570	9,379	11,293	-2%	9%	32%	21%	19%
3	Assume only the diagonals of the price elasticities matrices would be non-zero	183,562	653,588	83,931	12,288	17,005	30%	27%	25%	28%	28%
4	Use low population projections	n/a	-4,399	-536	-25	-30	n/a	0%	0%	0%	0%
5	Use high population projections	n/a	15,959	2,214	45	58	n/a	1%	1%	0%	0%
6	Use a discount rate of 0%	236,356	938,738	130,410	17,519	23,664	38%	39%	39%	39%	39%
7	Use a discount rate of 5%	73,862	310,619	40,741	5,468	7,386	12%	13%	12%	12%	12%
8	Health inflation rate of 5%	134,405	n/a	n/a	n/a	n/a	22%	n/a	n/a	n/a	n/a
9	calculate impact of crime rate remaining flat	n/a	97,270	n/a	n/a	n/a	n/a	4%	n/a	n/a	n/a
10	calculate impact of crime rate decreasing by 2% per annum	n/a	-97,270	n/a	n/a	n/a	n/a	-4%	n/a	n/a	n/a
11	Use a friction period of 20 weeks instead of 11 weeks in the Unemployment model	n/a	n/a	122,210	n/a	n/a	n/a	n/a	36%	n/a	n/a
12	Use a reduction in unemployment of 6.9% instead of 16.6% in the Unemployment model	n/a	n/a	-199,271	n/a	n/a	n/a	n/a	-59%	n/a	n/a
13	Use Australian data for the Absenteeism model	n/a	n/a	n/a	34,735	n/a	n/a	n/a	n/a	78%	n/a
14	Use Australian data for the Impaired Productivity model	n/a	n/a	n/a	n/a	59,772	n/a	n/a	n/a	n/a	99%

13.Discussion

This section summarises the key findings from the analysis. It also discusses some of the possible broader impacts on the alcohol industry and the potential unintended consequences that could result from a pricing increase in general. It sets out some implementation issues Government would need to consider if it was to impose a minimum alcohol price. Finally it discusses the limitations of the analysis and possible areas of future research.

13.1 Summary of the key findings

The Ministry of Justice, in conjunction with the Treasury, has undertaken extensive analysis to assess the impact of a minimum price on alcohol, and has compared its effectiveness to an excise increase. This is the first analysis of this kind in New Zealand. It integrates several models to determine the overall effect on society of an alcohol price increase in terms of savings in alcohol-related harms and lost economic benefits to consumers, the industry and to Government.

The models integrate aspects of price, purchasing and consumption patterns, elasticities, alcohol-related health conditions, alcohol-related crimes, alcohol-related unemployment, absenteeism and impaired productivity, and alcohol industry revenue and Government excise estimates.

The following pricing options were analysed:

- A minimum price of $1.00 per standard drink.
- A minimum price of $1.10 per standard drink.
- A minimum price of $1.20 per standard drink.
- An excise increase to achieve an average price of $1.00 on the lowest priced alcohol (an excise increase of 82%).
- An excise increase to achieve an average price of $1.10 on the lowest priced alcohol (an excise increase of 107%).
- An excise increase to achieve an average price of $1.20 on the lowest priced alcohol (an excise increase of 133%).

A minimum price above $1.20 per standard drink would affect over a quarter of alcohol sales and significantly impact the alcohol industry and low risk drinkers. Therefore a minimum price above $1.20 per standard drink was not considered in this analysis.

All pricing options result in net benefits for society, with the excise options resulting in much larger benefits to society compared with a minimum price. This is because an excise increase affects the price of all alcohol (not just low price alcohol) and therefore more significantly impacts consumer behaviour. Overall the minimum price options result in net benefits to society ranging from $44 million to $86 million in year 1 (or $318 million to $624 million discounted over a ten year period). The net benefits to society from excise increases range from $339 million to $472 million in year 1 for an excise increase of 82% or 133% respectively (or $2.5 billion to $3.4 billion discounted over a ten year period).

The alcohol industry as a whole would benefit from a minimum price as the increase in price of alcohol is greater than the reduction in consumption, with revenue estimated to increase by $69 million to $131 million per annum for a minimum price of $1.00 and $1.20 respectively. The increase in revenue is greatest for the off-licence sector, although on-licence sales are estimated to increase

due to the reduced price differential between alcohol available at off-licence and on-licence premises.

Excise increases would result in reduced industry revenue for off-licences and increased revenue for on-licences. However, the decline in revenue for off-licences outweighs the increase for on-licences, resulting in a loss of revenue to the alcohol industry of $123 million and $196 million per annum overall for excise increases of 82% and 133% respectively.

It is not possible to determine how the increased industry revenue from the imposition of a minimum price would be distributed along the supply chain. Demand for low cost alcohol currently priced below the proposed minimum price levels is predicted to decrease, which could impact producers and importers who supply to this low price market. If the increased revenue from a minimum price does not flow back to alcohol producers, average costs of production could increase, which may squeeze some producers out of the alcohol market.

Government excise revenue reduces for the minimum price options (by $18 million to $35 million per annum for a minimum price of $1.00 and $1.20 per standard drink respectively), but increases significantly for the excise increase options (by $633 million to $929 million per annum for excise increases of 82% and 133% respectively). This increase in revenue could be used to offset the costs of alcohol-related harms or to provide a partial shift away from income taxation.

There are also significant reductions in consumer benefits for all pricing options. For example, a minimum price of $1.00 per standard drink is estimated to result in lost consumer benefits valued at $90 million per annum, while an excise increase of 133% is estimated to result in lost consumer benefits valued at $1.2 billion per annum.[34]

The minimum price options are likely to result in savings in alcohol-related health, crime and productivity harms ranging from $66 million to $136 million in year 1 for a minimum price of $.100 and $1.20 per standard drink respectively (or $476 million to $987 million cumulatively discounted over ten years). The savings in alcohol-related harm are about three times greater for the excise options.

Overall, any price increase will effectively reduce harmful alcohol consumption and alcohol-related harm. A minimum price or excise increase would negatively impact low risk drinkers, but the savings to society significantly outweigh the lost benefits to consumers. Although we have modelled behaviour based on substantial excise increases, smaller excise increases would also have net benefits.

However, the distribution of the impacts must be considered when determining the optimal pricing policy. A minimum price is estimated to have a greater impact on low risk drinkers compared to harmful drinkers, while an excise increase is estimated to have a greater impact on harmful drinkers. The minimum price options benefit the alcohol industry, but reduce Government revenue, while the excise options have a negative impact on the alcohol industry but significantly increase Government revenue.

Trade-offs need to be made when determining what pricing option to implement and variations of the options analysed could also be considered. One possibility is to increase excise and impose a minimum price, which would primarily raise revenue for the Government and set a price floor for the alcohol industry. Such an option could lessen the negative impact of an excise increase on the alcohol industry as a portion of the revenue generated from a price increase on low price products below the minimum price level would be transferred to the alcohol industry.

[34] Consumer benefits are defined as the difference between the maximum amount a person is willing to pay for a good and its current market price.

Table 42 provides a summary of the key advantages and disadvantages of a minimum price and excise tax. The remainder of this section discusses in more detail the potential impacts of a minimum price regime or excise tax increase on the alcohol industry, outlines some of the implementation issues associated with a minimum price, and discusses the potential unintended consequences that could result from an alcohol price increase. The limitations of this research are also outlined, along with a discussion about possible further research.

Table 42: Advantages and disadvantages of a minimum price and excise

Minimum Price vs. Excise Duty		
Minimum Price		
A minimum price per standard unit is a pricing policy where the Government sets a mandatory price of alcohol, under which alcohol cannot be sold. Minimum pricing increases the price of low price alcohol products and prevents pricing strategies such as discounting and loss-leading below a price floor. This price floor does not impact the prices of all products, just those products that are currently priced below the proposed minimum price.		
Advantages	**versus**	**Disadvantages**
International research concludes that a minimum price scheme is a targeted and effective approach to alcohol related harm as it impacts youth and harmful drinkers who have been found to consume the highest quantities of low cost, high alcohol volume products.		Although there is empirical evidence internationally to support a minimum price scheme, there is little concrete evidence of its effectiveness in a competitive market environment.
MOJ research found that harmful drinkers are less responsive to a minimum price than low-risk drinkers. However, because a harmful drinker consumes more than a low-risk drinker and typically drinks more low priced alcohol, the impact on the amount of alcohol harmful drinker's buy and the amount they spend on alcohol is considerably greater for all pricing options.		MOJ research found low-risk drinkers of low priced alcohol are more responsive than harmful drinkers to a minimum price. Futhermore, given that harmful consumers do not limit their consumption to low-price products, there is a risk of substitution to other products, limiting the reduction in harmful consumption. Consumers may substitute cheaper brands with premium brands, which often have higher alcohol by volume (ABV).
Households may reduce their spending on alcohol and therefore have an increased proportion of their income to spend on other goods and services. Thus, other sectors of the economy may benefit to a small degree.		May impact low income households and increase poverty within households with harmful alcohol consumers who would have to spend a greater proportion of their income to maintain consumption levels of low priced alcohol products, significantly impacting their budgets.
MOJ found that there are economic benefits in terms of savings in health, crime and workplace productivity costs. However, the savings are lower than savings resulting from excise options.		MOJ found that for all pricing options, there is a significant reduction in the value of benefits that people gain from consuming alcohol due to the increased prices. However reduction of consumer surplus due to a minimum price is less than an excise increase.
Minimum pricing increases the price of low priced alcohol products and prevents pricing strategies such as discounting and loss-leading below a price floor. This price floor does not impact the prices of all products, just those products that are currently priced below the proposed minimum price. Therefore, price changes reach and impact youth and harmful drinkers.		A minimum price results in lost consumer surplus which is not gained by the alcohol industry and results in deadweight loss (i.e. lost consumer benefits at a pure cost to the economy). A minimum floor price could also distort the role price plays in signalling quality.
The alcohol industry as a whole would benefit from a minimum price as the increase in price of alcohol is greater than the reduction in consumption. A minimum price targets low priced off-licence sales associated with a higher proportion of alcohol related harms, relative to on-licence sales. Yet the increase in revenue is greatest for the off-licence sector, as the increased price offsets the fall in consumption.		As a proportion of the loss of consumer surplus is transferred to the industry for the minimum price, government excise revenue is negatively impacted by reduced demand. There is a risk that industry players could spend increased revenue on non-price strategies such as advertising, which may counteract the primary aim of reducing consumption.
On-licence sales are estimated to increase resulting from the reduced price differential between off-licence and on-licence sales. On-licence consumption is associated with more supervised and safe consumption in comparision to off-licence consumption.		There is uncertainty about which industry players will benefit from increased revenue or how it will be distributed along the supply chain. Producers would be negatively impacted by reduced demand if retailers use their bargaining power to pressurise producers to maintain wholesale prices.
Smaller retailers will be able to engage in competition with non-price strategies such as convenience and customer service.		Potentially an anti-competitive approach. Since demand in New Zealand is price inelastic, the scheme will result in higher profits for industry players, as opposed to the government, which would not be possible in business as usual competitive situations.
Excise Duty		
Excise duty aims to increase the price of alcohol, thereby reducing alcohol consumption and harm, and offsetting costs to society by excessive consumption. The revenue gained allows the government to cover the net costs of external alcohol related harm, such as health, crime and employment impacts . If excise is set at the right rate, health impacts, crimes and social costs are "internalised" by the drinker.		
Advantages	**versus**	**Disadvantages**
The principal benefit to government of an increased excise option is that it will result in increased government excise revenue. To the extent that it reduces alcohol-related harm that other taxpayers pay the costs of, it reduces this cost to taxpayers.		It is argued that an excise increases are not as effective or as targeted as the minimum price in reducing alcohol related harms by youth and hazardous drinkers as it results in increased prices across all alcoholic beverages impacting all alcohol consumers, including low-risk drinkers. However, harmful drinkers drink across the spectrum.
MOJ research found that overall it appears that excise increases have a greater impact on harmful drinkers than low-risk drinkers, based on University of Sheffield elasticity estimates. This is driven by the greater own-price elasticities, particularly for spirits. As harmful drinkers consume products across the quality range and consume the highest proportion of alcohol, excise increases target harmful consumption as it increases the price of all alcohol products and disproportionately affects the pocket of harmful consumers.		Reductions in consumer surplus are significantly higher for an excise increase than for the minimum price options. Excise increases have a much larger effect on alcohol consumption compared to the minimum price options as the price increases are greater and affect all beverages (both on-licence and off-licence), not just those beverages that were purchased below the minimum price. Generally, the excise increases result in consumption decreases about six times greater than the decrease estimated for the minimum price options.
Excise increases result in much greater savings in health, crime and workplace productivity costs relative to a minimum price.		If retailers offset the excise increase against non-alcohol products, consumers would pay increased prices for other goods, hence subsidising alcohol consumption.
It can be argued that, relative to a minimum price on low priced alcohol, an excise increase would increase prices across all products and price ranges and therefore price differentials would be maintained, allowing for the continued differentiation in the quality of products based on price .		Low income groups are likely to be disproportionately impacted by the price increases.
As lower priced alcohol products have lower profit margins, increased excise will have a greater impact on the price of cheaper products as it is more difficult to absorb the increase. As the excise system is two-tiered, excise effectively impacts on the retail price of stronger alcoholic products compared to lower strength alcoholic products.		Excise increases would result in reduced industry revenue for off-licences and increased revenue for on-licence premises as the price differential between products in off- and on-licences would reduce, encouraging consumers to switch from purchasing at off-licences to purchasing high priced products at on-licences. However, the decline in revenue for off-licences outweighs the increase for on-licences. This may result in heavy lobbying against an excise over a minimum price.
MOJ analysis assumes that in the long run, the majority of excise tax will be passed through to consumers. If producers leave the market as it is unsustainable to continue to absorb the costs, remaining producers will be able to pass through the excise increase as their bargaining power will increase.		It is argued that the taxation of alcohol may not result in a proportionate increase in the price of alcohol as the excise increase may be absorbed by producers and retailers in their margins in the short run, and not be passed through to consumers.
An increase in excise duties does not favour on-licence drinking as it impacts the price of all alcohol (including on-licence), rather than simply the bottom end of the price spectrum.		Bargaining power of large retailers could be used to pressure manufacturers and wholesalers to absorb the excise increases, which may result in producers finding it uneconomic to continue production.

13.2 Potential impacts of pricing increases on the alcohol industry

Both a minimum price per standard drink and excise increases would impact the alcohol industry. However, since the minimum price options only impact low price alcohol products, and the price increase results in a transfer of consumers' surplus to the alcohol industry, the alcohol industry benefits overall.

On the other hand, since an excise increase impacts all alcohol products across all price ranges, and the price increase results in a transfer of consumers' surplus to the Government, the alcohol industry is negatively impacted overall.

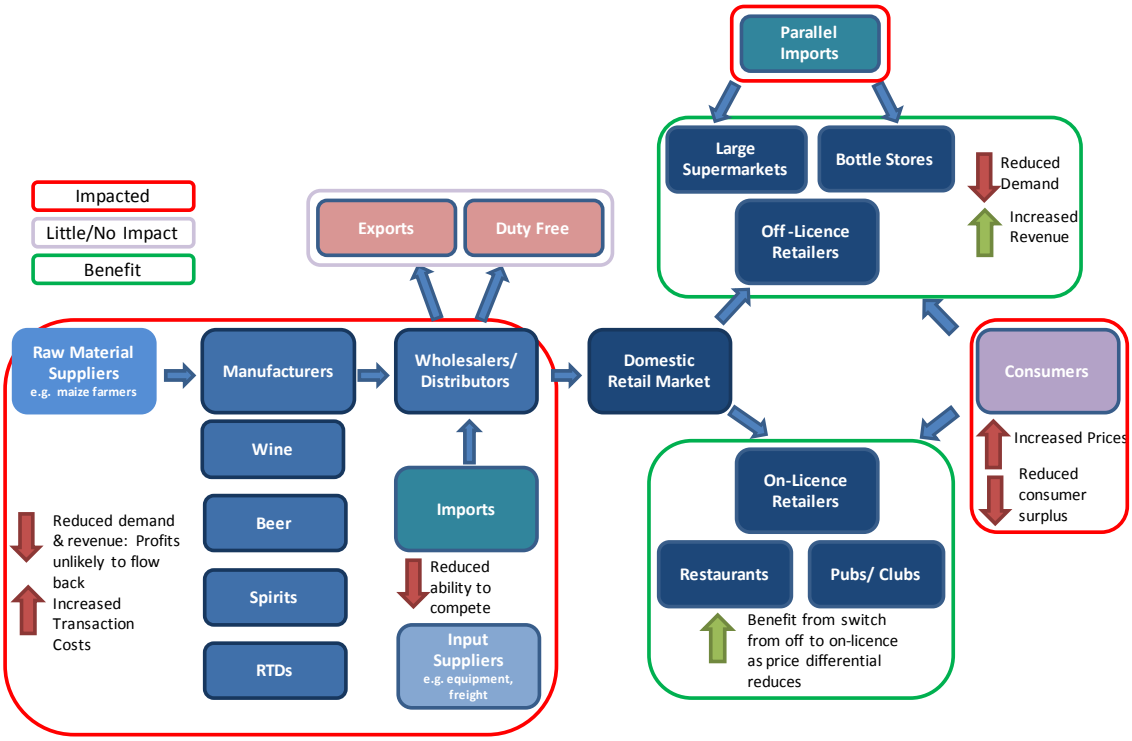
Imposing a minimum price per standard drink is expected to increase the amount spent on alcohol, resulting in increased revenue for the industry. For a minimum price of $1.00 and $1.20, industry revenue is estimated to increase by $69 million and $131 million respectively, primarily gained by the off-licence retail sector. The segment of the alcohol industry that the additional revenue would accrue to depends on the market share and market power of the retailers, wholesalers and producers along the supply chain (Hunt, Rabinovich and Baumberg, 2010). Due to limited information, we could not determine how the increased revenue from a minimum price would be distributed along the supply chain.

An excise increase is also expected to increase the amount consumers spend on alcohol, resulting in increased excise revenue for the Government. The off-licence retail sector would be negatively impacted by excise tax increases, with a reduction in revenue of $150 million and $244 million respectively for excise increases of 82% and 133%.

The following sections discuss the impact of the pricing options on the alcohol industry supply chain. As explained in Section 8, the modelling of the impacts assumed a perfectly elastic supply curve in the long run. That is, the industry will be able to adjust production to maximise long-run profit. This section discusses the potential short-run impacts on the alcohol industry of the pricing policies, primarily the minimum price impacts. It also discusses how producers and retailers could potentially respond in order to mitigate these impacts.

Figure 24 below illustrates the potential impacts of a minimum price regime on the New Zealand alcohol supply chain.

Figure 24: Potential impacts of a minimum price on the alcohol supply chain



13.3 Potential impacts of alcohol pricing policies on producers and importers

Potential impact of a minimum price on producers and importers

DEMAND AND PROFITABILITY

Quantity demanded for low price beer, wine, spirits and RTDs at off-licences, currently priced below the proposed minimum price levels, would decrease with the imposition of a minimum price, which would impact producers and importers who supply products for this low price market. Overall, however, industry revenue is estimated to increase, as the increase in the price of these products is greater than the reduction in their consumption.[35]

Evidence from stakeholder consultation in the UK indicates that retailers are unlikely to share increased revenue with their suppliers, and if it is shared, it would be a commercial agreement between retailers and suppliers (Scottish Government, 2011). The alcohol industry in New Zealand appears to be oligopolistic, with off-licence retailers (most notably, the two supermarket chains) having stronger bargaining power and larger economies of scale than producers. Off-licence retailers are also strongly positioned to negotiate prices with producers. Therefore producers are likely to be price takers and may not benefit from increased revenue if a minimum price is imposed (Hunt, Rabinovich and Baumberg, 2010, p.67). Larger retailers may use their power to capitalise on increased margins and pressurise suppliers to maintain wholesale prices.

Since one of the leading supermarket chains as well as eight out of the top ten companies in New Zealand's alcohol industry are foreign-owned, a proportion of the increased revenue would go to

[35] Low price wine and spirit producers are likely to be most negatively impacted by reduced demand, due to large increases in price and decreases in consumption.

overseas shareholders. Further consultation is required to determine impacts on specific producer groups, companies and brands in New Zealand.

If retailers use their bargaining power and profits do not flow back to producers, producers would be negatively impacted by the increased average costs of production, which may squeeze some producers out of the market. However, if increased revenue flows back to producers, they could maintain profits (Hunt, Rabinovich and Baumberg, 2010). Larger producers who are linked to foreign-owned global companies and own retail outlets are less likely to be impacted relative to smaller domestic companies based on their ability to diversify.

With reduced domestic demand and sales for a proportion of low price products, some producers would face reduced quantity demanded for their products and may respond by reducing production. Reduced quantity demanded could also result in a surplus of alcohol on the market in the short-run, as producers may be encouraged to increase production to gain from the increased prices. However, in the long-run, if producers do not reduce production and quantity demanded decreases, the costs of production would outweigh revenue and result in a negative impact on producers.

POTENTIAL RESPONSES OF PRODUCERS TO A MINIMUM PRICE - PRICE AND NON-PRICE STRATEGIES

In general, the price of a product or commodity indicates its value. The lower the price of an alcohol product, the lower the perceived value to the consumer. As low price alcohol products would be pushed into the medium price band, price differentials between low quality and medium quality products would decrease and consumers may no longer be able to distinguish quality with sales price. Thus:

"a minimum price could distort the role price plays in signalling quality, as all cheap products will be pushed up the price ladder, resulting in a clustering of goods at the price point that previously signalled medium quality" (The Law Commission, 2010, p. 308).

Consumers may substitute cheaper brands with premium brands. As premium beers typically have a higher alcohol content than mainstream beer (5% vs. 4%), an unintended consequence may be that consumers trade up to higher strength beers[36].

"In the long-run, there may be implications on the sorts of alcohol manufactured and offered for sale. If consumers stop buying very cheap alcohol brands, because they can no longer compete in price terms with more expensive brands, then manufacturers may be encouraged to switch production into higher quality alcohol instead" (Griffith and Leicester, 2010, p. 26).

At higher minimum price levels, demand for some low price drinks could disappear entirely, as the price differential between low price and premium brands may drive low price products out of the market. Thus, some producers may exit from the market.

Producers manufacturing medium quality alcohol products may also be impacted by a minimum price per standard drink. Consumers may switch to higher price, premium products. In turn, retailers may reduce the prices of marginally higher price products, and use perceived value to spur demand. Thus, producers of higher priced alcohol products may be pressured to reduce prices to a lower price range. Depending on how producers and retailers react, there may also be an oversupply of medium price alcohol in the market, thus indirectly impacting a greater proportion of producers.

Producers may be able to mitigate the impact of a minimum price by reducing the alcohol content of low price products. For example, in the UK demand for no-alcohol and low alcohol beers increased by 40% in 2011, with increased availability of new products with improved tastes. The demand is "attributed to health-consciousness, drink-driving awareness and lower tax" (Ball, 2012). Thus, a

[36] Although we note that individual bottles of beer with different alcohol contents would have different minimum prices as the hypothetical minimum price is based on standard drinks.

minimum price may encourage new product development. However, the introduction of new products could be constrained as retailers would not be able to promote new products with lower prices.

Producers may respond by increasing prices so that they both maintain brand value as well as benefit from increased revenue, but this will depend on their market power. Producers may also increase the amount they export, which would mitigate the impact of reduced domestic demand and lost industry asset value as well as contribute to export revenue. Producers could also respond by acquiring another point in the supply chain, such as a retail outlet, to benefit from increased prices.

Potential impact of an excise increase on producers

An excise increase results in reduced demand for most alcohol products, with the exception of high price beer, wine and spirits sold at on-licences[37]. Off-licence low price beer is most impacted, followed by wine and spirit sales. The excise options result in much larger reductions in demand than the minimum price options. For example, an excise increase of 82% reduces demand for low price beer at off-licences by 9.7% (compared to a reduction of 0.3% for a minimum price of $1.00 per standard drink).

Thus, almost all industry players along the supply chain would experience reduced revenue, apart from some on-licence retailers. A larger number of producers would face similar but greater impacts of reduced demand with an excise increase, and therefore would have similar responses to those outlined above for a minimum price.

It could be argued that, relative to the imposition of a minimum price on low price alcohol, an excise increase would increase prices across all products and price ranges and therefore price differentials between low and high price products would be maintained, allowing for the continued differentiation in the quality of products based on price (The Law Commission, 2010, p.318). However, as excise makes up a larger proportion of cheap beer, producers may switch to manufacturing higher quality products as the price differential decreases, and higher quality beer becomes relatively cheaper (Crampton, 2012). On the other hand, consumers may trade down to lower price brands. This would result in a reduced demand for premium brands and could reduce the market share of producers and suppliers focused on such brands.

As excise is collected at the wholesale point in the supply chain, if excise duties are not passed onto the consumer, retailers may pressurise producers to absorb the excise costs, reducing producer margins and profitability and pushing some producers out of the market. However, as producers leave the market, the bargaining power of those who remain would increase so that, in the long term, the excise increase should be fully passed through to the consumer.

The wine sector is most vulnerable to the imposition of a minimum price

Sixty-seven percent of alcohol produced in New Zealand is produced for the domestic market. In 2011, 10% of domestic off-licence alcohol sales were below $1.00 per standard drink (24% below $1.20 per standard drink). Table 43 shows that a minimum price regime preventing alcohol sales below $1.00 per standard drink could potentially impact: 25% of domestic wine sales; 21% of domestic spirit sales; 16% of domestic RTD sales; and 3% of domestic beer sales. Of total alcohol

[37] In the modelling results, this is due to consumers substituting to these higher priced products (as their price increases by a lower percentage).

produced in New Zealand, this would impact 8.2% of wine produced (20 million litres), 9% of spirits (0.63 million litres), 13.6% of RTDs (9 million litres), and 2.8% of beer (8.1 million litres).[38]

Low price spirits and wine experience the greatest fall in consumption, falling by 9.8% and 6.1% respectively for a minimum price of $1.00 per standard drink. This translates to a fall in quantity demanded of 28.4 million standard drinks of wine and 15.6 million standard drinks of spirits. As spirits are primarily imported, domestic wine producers are the most vulnerable to a minimum price. Table 43 shows the impact of a minimum price of $1.00 per standard drink on domestic beverage production.

Table 43: Impact of a minimum price of $1.00 per standard drink on domestic beverage production

Beverage Type	Impact on domestic volume sales	Impact on total domestic production volumes	Impact on total domestic production volumes (litres)
Wine	25%	8.2%	20.2
Beer	3%	2.8%	8.1
Spirits	21%	9.1%	0.6
RTDs	16%	13.6%	9.3

Sources: Statistics New Zealand and Customs New Zealand

In 2011, 67% of wine produced in New Zealand was produced for the export market. This was valued at $1.1 billion in 2011 and ranked ninth in New Zealand's export products (New Zealand Wine, 2011, p. 4). The domestic market is often framed as an incubator for start-up companies to test their products before accessing the export market.

"The domestic market is the single largest market for New Zealand wine. It is the sole market for many smaller wineries. It is the market where the sector evolves and experiments. It is where tourists from home and abroad can most truly appreciate the things that make New Zealand wine special. Yet it is also one of the least profitable markets for New Zealand wine" (New Zealand Wine, 2011, p.5).

The Ministry of Economic Development highlighted that the challenges faced by the wine industry include rising excise duties, increased competition, oversupply, rising indebtedness and low crop yields, and are causing the sector to become unprofitable, and in some cases, unviable (Ministry of Economic Development, 2010).

In 2011, 33% of wine was produced for the domestic market, and therefore was subject to excise duties, which are implemented at the wholesale point of the supply chain. According to the Ministry of Economic Development, supermarket dominance and bargaining power forces producers to reduce prices, reducing winery margins and profitability and pushing some producers out of the market. Producers who sell only in the domestic market are impacted more severely. Consequently winegrowers are struggling to recover their costs of production (Ministry of Economic Development, 2010).

The number of wine producers in New Zealand grew by a compound annual growth rate (CAGR) of 10% from 2000 to 2010, which has resulted in an oversupply of wine in the domestic market. This has been compounded by reduced international demand due to the global economic downturn as well as the oversupply of wine in Australia, reducing opportunities to expand sales.

Thus, wine producers who produce and supply the low price wine market would face reduced demand for their products as a result of a pricing policy. This would add to these other challenges and the viability of wine production would become even more uncertain.

[38] Estimation based on data from Statistics New Zealand and Customs New Zealand

Potential costs to producers of implementing a pricing policy

As explained in the modelling section, the costs of a pricing policy to producers would be the lost value of fixed assets that become obsolete due to reduced production and which cannot be substituted into other areas of the economy. Furthermore, other transition costs, such as investing in machinery to modify production lines, would be incurred in switching production. Producers who manufacture alcohol for the domestic market would be most affected as there would be a fall in the quantity demanded for their product.

Potential impact of a minimum price on raw material and input suppliers

Raw material suppliers and input suppliers may also be impacted by pricing policies, such as farmers supplying barley, maize and wheat, freight companies, logistics and storage companies, capital equipment, bottling, packaging and labelling companies (Scottish Government, 2011, p.45).

13.4 Potential impact of alcohol pricing policies on retailers

Both a minimum price per standard drink and excise increases would impact the volume of sales at on-licences and off-licences. Although a minimum price would reduce the quantity demanded by consumers and in turn sales volumes, the alcohol industry as a whole would benefit from increased revenue as the increase in the price of low price products currently priced below the proposed minimum price level would be greater than the reduction in quantity demanded.[39] For a minimum price of $1.00 and $1.20 per standard drink, industry revenue is estimated to increase by $69 million and $131 million respectively, primarily gained by the off-licence retail sector.

Potential impact of a minimum price on off-licence retailers – demand and profitability

The increase in revenue from a minimum price is primarily gained by the off-licence sector and is most likely to benefit large off-licence retailers as a result of the oligopolistic market structure that exists in the alcohol industry in New Zealand. Larger retailers, such as supermarkets, have stronger bargaining power than producers, and therefore are able to negotiate prices and volumes to their advantage (Hunt, 2010).

The quantity demanded of low price beer, wine, spirits and RTDs currently priced below the proposed minimum price levels decreases with a minimum price. However, the increased prices offset the fall in consumption. Demand for high price alcohol at off-licences increases for all beverage types as does demand for low and high price alcohol at on-licences. Although low price wine experiences the largest consumption decrease, the large increase in price results in the greatest revenue gained from off-licence low price wine sales, followed by spirits sales. Data is not available to determine the impacts on particular products or brands.

In terms of market structure, it is likely that larger retailers would continue to acquire and integrate, increase their market share and dominate the retail market. A minimum price regime may have a large negative impact on the trade and livelihoods of smaller local retailers, who base their trade on low price alcohol products. Retailers which are less dependent on alcohol sales could benefit from alternative spending on non-alcohol substitutes.

[39] This is because the aggregated elasticity of demand for alcohol is inelastic and consumers will consequently spend more on alcohol products.

Potential responses of off-licence retailers to a minimum price - price and non-price strategies

Due to the large economies of scale of supermarkets, strategies such as loss leading may be used to attract consumers and to sell large volumes of a diverse range of alcohol products. Consequently, smaller retailers may be forced to maintain low prices in order to compete. However, with a minimum price regime, large supermarkets would no longer be able to undercut smaller retailers with below cost strategies, which would allow smaller retailers and specialist retailers to compete with both price and non-price strategies such as convenience and better customer service (Scottish Government, 2011, p.46). The price floor prevents retailers from the absorbing price increases and results in higher prices to consumers.

To maintain their current pricing structures, retailers may increase the price of all alcohol proportionately in order to maintain the price differentials between premium products and the more cheaper products (The Law Commission, 2010, p. 308). This could negatively impact low risk consumers who may be forced to switch to consuming other beverage types, depending on their cross-price elasticities, consequently impacting consumer choice.

Based on industry consultation in Scotland, it was found that where below cost sales exist, non-drinkers or low risk drinkers subsidise harmful drinkers who purchase low price alcohol. Since a minimum price would create a price floor, it is suggested that retailers may lower prices on other non-alcoholic consumer goods, which are currently cross-subsidising low price alcohol (Scottish Government, 2011, p.38). If retailers lower the price of other goods available to consumers, such as food, in order to mitigate the increased price of alcohol, increased disposable income may be available for alcohol purchasing, which would be adverse to the aims of a minimum pricing policy.

Currently, the alcohol industry spends $150 million on advertising and marketing per year (NZ Drug Foundation, Year unknown). These marketing strategies influence preferences for a high risk product. This contributes to alcohol-related harms such as disease, injury and social problems (Babor et al, 2010, p.72). For example, in 2006:

- Heineken spent 12.6% of net sales on marketing.
- Diageo spent 15.5% of net sales on marketing.
- Pernod Richard spent 17% of net sales on marketing.

As a minimum price would inhibit price competition, retailers may adopt non-price strategies such as increased advertising to mitigate the fall in demand for alcohol products, which could counteract the objective of the minimum price regime to reduce harmful alcohol consumption.

"The higher margin on low cost alcohol could give retailers an additional incentive to sell more rather than less of these products, for example, through advertising or changing the mix of products on the shelves" (Robson, 2012, p.17).

Industry consultation suggests that without a ban on price-based promotions, retailers may continue to use advertising and discounts if a minimum price is introduced, just at a marginally higher level.

Potential impact of a minimum price on on-licence retailers

Since the lowest on-licence price per standard drink of alcohol is $1.60, a minimum price of $1.00 or $1.20 will not directly impact demand and profitability or result in price increases or costs to on-licence retailers. In fact, for both a minimum price and excise increase, on-licence trade is predicted to benefit, as the price differential between products in off-licences and on-licences would reduce, encouraging consumers to switch from purchasing at off-licences to on-licences (where alcohol consumption can take place in a more "supervised" environment). On-licence consumption of all beverage types is estimated to increase for both high and low price beverages. For example, if a

minimum price of $1.00 per standard drink is implemented, the price differential between off-licences and on-licences:

- Remains the same for low and high cost RTDs, high cost spirits, high cost beer and high cost wine.
- Decreases for low cost beer and low cost wine.
- Increases for low cost spirits.

On-licence retailers may maintain current pricing structures to benefit from the potential increase in quantity demanded, or increase on-licence prices marginally to increase revenue. Industry consultation suggests that on-licence retailers have less bargaining power relative to off-licence retailers, and will respond according to the responses and behaviours of other players along the supply chain.

Potential impact of an excise increase on off-licence retailers

It is argued that the taxation of alcohol may not result in a proportionate increase in the price of alcohol as the excise increase may be absorbed by producers and retailers in their margins in the short run, and not be passed through to consumers. For example, larger supermarkets employing below cost selling pricing strategies may absorb the tax increases or offset the taxes against other products. If retailers offset taxes against non-alcohol products, consumers will consequently pay increased prices for other goods, hence subsidising alcohol consumption (Scottish Government, 2011, p.26). Thus, the price paid by consumers may not increase, and in some cases may reduce, which would undermine the aim of reduced harmful alcohol consumption and alcohol-related harm.

Furthermore, the alcohol industry does not benefit from an increase in excise, and in most cases would experience a fall in demand and sales revenue. This may result in heavy lobbying against an excise over a minimum price. Bargaining power of large retailers could be used to pressure producers and wholesalers to absorb the excise increases, which may result in producers finding it uneconomic to continue production.

Industry revenue is significantly impacted by an excise increase, falling by $123 million for an excise increase of 82% and by $196 million for an excise increase of 133%. Retailers are likely to use non-price strategies such as advertising in an attempt to mitigate the fall in consumption due to an increase in excise duty. The Scottish Government has found that while on-licence retailers tend to pass on the higher excise rates to consumers, off-licence retailers are more inclined to absorb the costs. If the increased tax is passed on to consumers, retailers may invest in advertising or other non-price strategies to maintain consumer demand (Hunt, Rabinovich and Baumberg, 2010, pp. 67-68). Retailers may also be incentivised to increase prices as opposed to paying increased taxes.

"One of the perceived advantages of taxation is that it increases revenue for the State rather than for the alcohol industry, however if a taxation scheme provided an incentive to raise prices to avoid paying tax then this would not be as effective in increasing revenue to the State" (Scottish Government, 2011, p.27).

For an excise increase, if excise duties are not passed through to alcohol consumers they will be borne earlier in the supply chain. Some producers have expressed the view that they are unable to pass on excise to the final consumer. This may be true in the short-term, but if producers leave the market as it is unsustainable to continue to absorb the costs, remaining producers will be able to pass through the excise increase as their bargaining power will increase. In economic terms, this is represented by the long-run perfectly elastic supply curve. The long term view is much more relevant for a policy intervention like an excise increase, and therefore modelling a 100% pass through rate is appropriate.

Potential impact of an excise increase on on-licence retailers

Industry consultation indicates that on-licences are negatively impacted by increases in excise. Supermarkets use their bargaining power to force producers to absorb the excise increases, while producers pass on the increase to on-licence premises. This could increase the price differential between on-licences and off-licences further, exacerbating the consumption shifts to off-licences, with consequent impacts on harmful consumption. However, our modelling estimates that, in the long-run, on-licence revenue would increase by $27 million (2%) for an excise increase of 82% and $48 million (4%) for an excise increase of 133%, as a result of the reduced price differentials between off-licences and on-licences and consumers substituting to high price beer, wine and spirits.

Costs to retailers of implementing a pricing policy

The costs of implementation for retailers may include switching suppliers, re-pricing and re-labelling products, changing bar codes and display names. However, these are short run costs and since revenue is estimated to increase, retailers would be able to absorb these costs over time (Hunt, Rabinovich and Baumberg, 2010, p.46).

An excise increase would result in minor implementation and compliance costs for the alcohol industry as the excise system is already in place.

Impact of pricing policies on the Government

Historically there have been three main reasons for taxing alcohol: revenue, correcting negative externalities, and achieving social policy objectives. An excise duty aims to increase the price of alcohol, thereby reducing alcohol consumption and harm. The revenue gained allows the Government to cover a portion of the costs of external alcohol-related harm, such as health, crime and employment impacts (The Law Commission, 2010, p. 294). If excise is set at the right rate, the health impacts, crimes and social costs would be "internalised" by the drinker.

The principal benefit to Government of an increased excise duty is that it will result in increased excise revenue. Greater Government excise revenue allows either increased Government spending or the lowering of more distortionary or less efficient taxes. Marsden Jacob Associates (2009) indicate that the New Zealand economy would particularly benefit if the increased excise was rebated with lower income taxes, which would reduce the deadweight burden of the tax system in New Zealand. In contrast to an excise increase, a minimum price decreases Government excise revenue as the Government no longer collects as much excise due to a reduction in alcohol consumption.

13.5 Other potential impacts of alcohol pricing policies

As well as the impacts on the alcohol industry supply chain, there are a number of potential unintended consequences that may result from each of the pricing policies.

Change in product range and consumer choice

In the long term, producers and retailers may alter the range of products available in the market as producers may reduce the variety of products manufactured or retailers may reduce the variety of products marketed. At higher minimum prices, demand for some low price drinks could disappear entirely, as the price differential between low price and premium brands may increase demand for premium products and drive low price products out of the market.

As discussed earlier, there may be an increase in low strength alcohol products or premium products available, which would both influence and be determined by a shift in consumer preferences. However, the introduction and promotion of new products may be limited as low price strategies would not be an option to promote new products.

Greater impact on low income households

A recent report by the Scottish Government highlights that a minimum price regime is likely to be regressive unless there is also an increase in income, as it would impact low income households who purchase alcohol, as the cost of alcohol would constitute a higher proportion of their income (Scottish Government, 2011, p.43).

Low income families comprise a high proportion of those who consume mainstream beer and low price wine as they are at an affordable price for such families. If such families decide to continue consuming alcohol, a minimum price could have a significant impact on their budget.

Increased poverty in families with harmful consumers

Increased prices may result in increased poverty within families with harmful drinkers. An increase in price leads to a less than proportionate reduction in consumption overall. Harmful drinkers are responsive to price changes but are less responsive relative to low and increased risk drinkers. Thus, the families of harmful drinkers would be adversely impacted, as drinkers spend more of the family disposable income on alcohol to maintain the harmful drinker's consumption levels (Rabinovich et al, 2008, p.26).

Increased home brewing and illicit sales

New Zealand is one of a few countries where home brewing and distillation is legal without a licence or any restrictions. The sale of home brewed and distilled beverages without a licence is illegal in New Zealand, however, it is difficult to monitor and control. A minimum price regime could promote an increase in home brewing activity, which would be unregulated, unmonitored, and would avoid Government excise duties. This could result in a burgeoning black market for alcohol that is both cheap and of varying (potentially harmful) strengths. In the UK, sales of home brewing kits in Tesco increased by 70% in 2011 as a result of increased alcohol prices in on-licences and off-licences (Lucas, 2012).

Counterfeit production may also increase. This is particularly a problem with spirits that are subject to a higher excise duty. The Distilled Spirits Association of New Zealand highlights that over $250,000 has been spent in monitoring counterfeit production of spirits in the past few years (Distilled Spirits Association, Year Unknown).

Substitution to other drugs

Substitution to other drugs is another potential unintended consequence of an alcohol pricing policy, as increased alcohol prices may encourage consumers to switch to other substances. However, this depends on whether the other drugs are substitutes or complements to alcohol consumption.[40] International research is inconclusive, with some studies finding that alcohol and cannabis are substitutes and others finding that they are complements.

[40] Complementary goods "go together", that is, a decrease in the price of one good results in an increase in the demand for another good and vice versa. Substitutes are good that serve as replacements for one another; when the price of one good increases, demand for the other good increases.

For example, Crost and Guerrero (2012) found that when people reached the minimum legal age of 21 years, consumption of alcohol increased and consumption of cannabis decreased, indicating that cannabis and alcohol are substitutes. A study by Cameron and Williams (2001) on the relationship between alcohol, cannabis and tobacco use in Australia also concluded that cannabis and alcohol are substitutes. A study by Pape, Rossow and Storvoll (2009, p.69) on adolescents found that cannabis and alcohol are complements and concluded that:

"Because adolescents most often combine cannabis with alcohol, their use of the drug may be more harmful than assumed. The results also indicate that cannabis is a complement rather than a substitute for alcohol, suggesting that policies that reduce adolescent drinking may reduce the use of cannabis as well".

Further research is required to investigate the relationship between alcohol and illicit drug use in New Zealand. If alcohol and cannabis or other drugs are complements, and the consumption of other drugs change with a change in alcohol consumption, there could be positive knock-on effects from the pricing policies through reduced consumption of other potentially harmful substances (Hunt, Rabinovich and Baumberg, 2010).

Impact on employment in the alcohol industry

Both a minimum price and excise increase reduce the quantity of alcohol demanded, and in turn reduce the production of alcohol. This may impact on employment in the production and retail sectors of the alcohol market. However, it is argued that if the price of alcohol rises resulting from a pricing policy, consumers may save their money or spend it in other sectors, which could drive increased employment in these sectors, thus potentially counterbalancing reduced employment in the alcohol industry (Baumberg and Anderson, 2012, p.6) and (Scottish Government, 2011, p.53).

Furthermore, Anderson and Baumberg (2006) found that in the European alcohol industry there is a weak relationship between employment and quantity demanded in on-licences (hotels, restaurants and catering, including bars), as the quantity demanded of alcohol is not the only factor influencing employment. Consumer preferences for domestic versus foreign goods, consumer preferences for on-licence versus off-licence consumption, as well as other factors such labour productivity, wage rates and the cost of capital also influence employment in the alcohol industry.

A minimum price and international competition

From a trade law perspective, the most important element in the design of a minimum price regime is non-discrimination between imported and domestic products (known as national treatment). Non-discrimination between 'like' products is a basic obligation in the WTO GATT and all of New Zealand's free trade agreements. Discrimination can be de jure or de facto. De jure discrimination occurs when regulations impose different rules for imported and domestic products (for example, if the minimum price regime only applied to imported alcohol or the minimum price differed depending on whether it is imported or domestic). De facto discrimination occurs when regulations are 'neutral' on their face, but their impact on importers is in fact greater (for example an excise duty that imposes higher taxes on alcohol typically imported and lower taxes on alcohol typically produced domestically). As a general rule, the less differentiation between products and producers, the greater the likelihood of consistency with New Zealand's national treatment obligations.

The proposed minimum prices would not differentiate between imported and domestic products, and the proposal to apply a minimum price on a standard drink of alcohol across all alcoholic products without differentiation, and for the minimum price to be set at the retail level, greatly reduces the risk of discrimination.

Foreign producers and wholesalers who export to the New Zealand market and currently sell at very low margins to compete with domestic products may be impacted as their retail prices would also

increase with a minimum price per unit. This could result in reduced demand for their products (Scottish Government, 2011).

Increased parallel imports

According to the Ministry of Business, Innovation and Employment:

"Parallel importing allows retailers, wholesalers and other parties to obtain goods subject to intellectual property rights directly from licensed or authorised overseas sources, rather than dealing with local suppliers, licensees or agents. In doing so, parallel importing allows for competition between sources of the same or similar goods" (Ministry of Business Innovation and Employment, 2012).

According to Euromonitor, the spirits market experiences the highest levels of parallel importation. Parallel imports of other alcoholic beverages are hindered by compliance costs associated with legislation, such as the Consumer Guarantees Act and the Fair Trading Act, which outweigh the benefits of parallel importing (Euromonitor International, 2012).

Parallel imports of alcohol products purchased at lower prices than the same products supplied domestically currently impacts on the brand shares of domestic manufacturers. With a minimum price, parallel imports of cheaper products may increase as retailers may aim to increase margins, which would increase pressure on producers and wholesalers to reduce the prices offered to retailers.

Increase in overseas internet purchases

Although domestic internet purchases would be subject to pricing policies, consumers may respond by increasing their internet purchases from overseas suppliers. However, since there is a time delay between purchasing and receiving the alcohol, it would not be related to impulse purchases (Scottish Government, 2011, pp.76-77).

Increase in duty free purchases

If duty free products are not included in a minimum price regime, consumers may simply increase their purchasing of duty free beer, wine and spirits, which would negatively impact local retailers. If duty free products are included in a minimum price regime, it is quite likely that selling alcohol duty free would no longer be a viable business model (as the price difference between dutiable and duty free products would narrow considerably).

Increased illicit cross border trade

Illicit cross border trade is another potential unintended consequence of a price increase, particularly in the UK and Europe, where countries border one another and alcohol can be smuggled from one country with an imposed pricing policy. This would adversely impact the aim of reduced harmful alcohol consumption as well as reduce the excise revenue received by Government. However, this is not perceived as a great threat for New Zealand because of its remoteness from other countries.

13.6 Implementation issues associated with a minimum price

There are a number of implementation issues that need to be considered if a minimum price regime is to be imposed.

Determining where in the supply chain a minimum price should be set

A minimum price at the retail level would set a mandatory requirement that licensees must not sell alcohol for less than a specified price per standard drink. Setting a minimum price at the retail level would prevent retailers competing by discounting prices of cheap alcoholic beverages. Since retail is the point of purchase by the consumer, consumption would be directly targeted.

However, the industry profits gained by the retailers may not flow back along the supply chain to alcohol producers. Instead, larger retailers, such as supermarkets, may use their bargaining power to capitalise on the increased margins and put pressure on suppliers to maintain wholesale prices.

A minimum wholesale price, on the other hand, would set a specified price per standard drink for alcohol producers and importers to sell to retailers. The benefit of setting a minimum price at the wholesale point is that it would allow producers to maintain financial gains and bargaining power. However, supermarkets would still be able to use price promotions to maintain demand, thereby counteracting the objective of reducing harmful alcohol consumption and alcohol-related harm. To manage this, a minimum wholesale price would have to be set in conjunction with a minimum retail price, to ensure that price increases are passed onto alcohol consumers.

Monitoring and enforcement

A minimum price at the retail level could be relatively easily monitored as alcohol retailers undergo regular inspections by liquor licensing inspectors and police through the existing licence enforcement system. However, there is a risk that setting the minimum price at the retail level may result in collusive behaviour by retailers.

The World Health Organisation (WHO) outlines how the alcohol produced and imported at the wholesale level can be monitored if wholesalers are required to submit pricing schedules when quantities are submitted for taxation purposes (Hill, Clarke and Casswell, 2011). The Ministry of Business, Innovation and Employment has noted that a minimum price at the wholesale point would be difficult to enforce due to the contractual nature and privacy arrangements between producers and retailers, and the difficulty in determining that supply is in trade and who is covered in terms of information disclosure regulation. Furthermore, Commerce Commission Law does not allow suppliers to control minimum retail prices.

A minimum price and the Commerce Act 1986

The Commerce Act prohibits arrangements between market participants that substantially lessen competition. If the Government decided to set a minimum price, there is a generic provision within the Commerce Act that is relevant. Section 43 of the Act allows for statutory exceptions from Part 2 of the Act (restrictive trade practices). This provision recognises that there are other economic or social goals that are being pursued by the Government that should be implemented, free from the constraints of the Act.

A minimum price and the Sale and Supply of Alcohol Act

The analysis of the impact of different alcohol pricing policies does not take into account the potential changes in purchasing and consumption patterns that may result from the changes

implementation of the Sale and Supply of Alcohol Act. There is a possibility that the estimated societal impacts of a price increase outlined in this paper could be over-estimated if the Sale and Supply of Alcohol Act results in a reduction in the number of harmful drinkers.

13.7 Limitations of the analysis

Despite being considered state-of-the art, there are many limitations to the sorts of methods employed in this study. Most of the limitations are outlined below, and some are also discussed elsewhere in the report. In particular, the limitations encountered when attempting to estimate price elasticities for New Zealand consumers are outlined in Section 3.4 above.

Limitations of the International Alcohol Control survey

The *International Alcohol Control (*IAC) survey does not have data for people aged over 65 years. In an earlier survey, the SHORE and Whariki Research Centre found that overall consumption among people aged 65 years and older was 78.5% of that for the population aged 40 to 65 years, and that maximum consumption per occasion was 69.9% of that for the population aged 40 to 65 years. It was assumed that the same proportions of the 65 plus population were in each consumption group (low risk, increased risk and harmful) as for the 45 to 64 year age group, but that in each subgroup the average daily and maximum per occasion volumes were 78.5% and 69.9% (respectively) of the volumes observed for the equivalent group in the 45 to 64 year age group.

Suitable data was not available for 16 and 17 year olds, so this group was excluded from the analysis. As this group is unlikely to be purchasing alcohol, excluding this group is not considered to be a significant problem, although there is abundant evidence that this group does suffer alcohol-related harms and their exclusion will therefore have the effect of underestimating the harms from alcohol.

Another concern about the IAC survey is its size. When divided into age and gender subgroups, the sample numbers are very small. The confidence intervals for the proportions of different types of drinker and the amount consumed are very large. Given that these are critical inputs to the analysis, the results are very sensitive to the proportions of different types of drinker and the amount they consume.

The IAC survey does not appear to under-report alcohol consumption, which is usually a problem with such surveys, but this may raise concerns given that the consumption data are combined with relative risk data that are based on reported, and therefore likely underestimated, consumption.

Low price spirits at on-licences

The excise increases resulted in negative purchase results for low price spirits at on-licences, that is, purchases reduced beyond zero standard drinks. Therefore purchase decreases were capped at zero purchases so that there was a 100% reduction in the purchase of low price spirits at on-licences for the excise options. As only a very small proportion of beverages sold are low price spirits, this does not have a significant effect on overall purchase changes.

For the analysis of impacts on consumer benefits, industry revenue and Government revenue low price spirits at on-licences were removed due to the low absolute volumes and because some drinks appeared to be being sold below the cost of the excise tax on them (which suggests maybe data collection issues). Also the consumption change analysis seems unrealistic due to the very large price changes that would occur (that is, modelling extremely large price changes is problematic because the elasticities used are point elasticities that become less reliable the larger the price change).

Specification

Despite being a relatively standard approach to a cost-benefit analysis, from an econometrics perspective the health model has misspecification problems. It has omitted variables, endogeneity problems because it is a partial equilibrium model in which we are modelling demand and not supply, autocorrelation, and correlation between the regressors and the error term.

For all the harm models there is the possibility that the functional form and slope of the relative risk functions are mis-specified (for example, most functions are assumed to be linear). The savings in alcohol-related harm generated are highly sensitive to the form and specification of the relative risk function.

Alcohol consumption and outcomes such as crime and health are affected by factors such as macroeconomic variables, addiction/habit, other policy changes, technology, and epidemiological and demographic changes (some of which are included in the model) and there could be interactions among these. The models assume these are held constant where it is not possible to address them explicitly in the calculations.

Omissions

Data for several cost components were not available. The most significant of these is missing data on harms to others (which are discussed elsewhere in this report), but data are also unavailable for alcohol-related primary care, outpatient visits, ambulances, and treatment in prisons.

- Some ambulance costs are included in the ACC data but ambulance costs for non-accident causes are excluded.
- There is some evidence that primary care costs do not differ depending on the level of alcohol consumption (BERL, 2009). However, had data been available it would have been preferable to model this explicitly.
- Hospital events must be counted in the discharge datasets only if the patient was admitted for more than four hours. Other hospital or specialist activity is recorded in the National Non-Admitted Patient Collection. However, this dataset does not include diagnostic information so it is impossible to attribute some portion of it to alcohol consumption. This could be a significant limitation because, in addition to increasing numbers of surgical procedures, there are costly medical procedures such as renal dialysis and radiotherapy that are performed exclusively in outpatient settings.
- A significant portion of prison inmates arrive with alcohol use disorders. Programs to treat these disorders are funded by the Department of Corrections and are not included in the other treatment figures.

As noted in Section 6 above, it was not possible to derive marginal cost estimates for Police and Courts costs. Based on the ratio of the Department of Corrections' marginal costs to average costs, a factor of 0.23 was applied to the Police and Courts average costs estimates to derive estimated marginal cost savings.

Small numbers

The New Zealand population is significantly smaller than the English and Scottish populations, so there are fewer events in the health model. This results in some discontinuities, such as large fluctuations in event probabilities or costs across years that are a result of small numbers rather than real changes. For example, because actual mortality data was used to calculate probabilities of death, some age/sex groups will have zero probability of dying from some conditions, whereas the true probability is non-zero. This has been mitigated to some extent by taking the averages of mortality and morbidity data across five years to create a smoother dataset, but there remain

instances where, for example, there is an unrealistic zero probability of an event for some age/sex subgroup.

Injury

The best set of relative risks for injuries would be a new set that are being developed specifically for New Zealand using improved methodology. These were not available in time to be included in the model, leaving three suboptimal options that presented a trade-off among confidence in the validity of the results (by applying relative risks whose calculation and sources are not sufficiently transparent to be confident in their validity), specificity in the model (by applying a single relative risk for all injuries, calculated from a good quality systematic review), and accurate calculation (by attempting to apply a method for which the requisite data are not available). Faced with this decision, the method that produced the most conservative results (i.e. the lowest attributable fractions) was selected.

Relative risks

There is some uncertainty inherent in applying all estimates of relative risk for the health model. Although human biology is considered comparable across countries, relative risks from overseas may not be generalisable to New Zealand where there is a significant behavioural or environmental component to the condition (for example, alcohol may have a different contribution to death from accidental excessive cold in countries with colder climates). Also, despite the rigorous methods used to select the best studies in the systematic reviews that identified the relative risks, there may yet be problems in the research base such as publication bias (for example, the tendency for studies that find interesting effects to be published more than studies with findings of no effect). Finally, most of the relative risks are from reviews that were conducted several years ago, drawing from studies that may be much older, so the evidence base is somewhat outdated.

Misclassification in administrative data

The health model relies heavily on administrative datasets based on death registrations, claims, and hospital records. These datasets are not designed for the purpose of modelling health effects of alcohol so are likely to contain random or systematic errors that may affect our results. For example, cirrhosis deaths may be misclassified as having some other cause because alcoholic liver disease can be confirmed as the cause of death only through autopsy, which is not always performed. Similarly, doctors may be biased against recording alcohol in the cause of death in order to avoid stigma for the family.

Assignment of cost weights

Due to the small numbers of hospitalisations and deaths in some age/sex groups per year, it was necessary to take average rates and cost-weights across five years of data. Cost-weight methodology changed across those five years. From 2006/07, the cost-weight calculation includes the blood costs involved in treating the patient. The cost-weight of surgical events (which use a lot of blood) increased by a large amount whereas medical events (less likely to use much blood) decreased because the average event is standardised at a cost-weight around 1. Applying the price per cost-weight from a later year to the average cost-weight for the earlier years is therefore inconsistent.

Limited population model

The population model is somewhat limited in that it does not incorporate immigration and emigration, it makes assumptions about the proportion of people in each age group dying and moving to the next age group in each year, and assumes life expectancies and the number of births

will remain constant over the next ten years. These assumptions are designed to avoid complicating factors relating to the unknown drinking habits of migrants and to make the model more transparent. For example, if the same number of people enter the model each year it is easier to see the effects of a change in policy over time. However, this means the model results are very unlikely to approximate observed population trends or more sophisticated population projections over the next ten years.

Extrapolation

For the health model, the methods required extrapolation of estimates beyond available data in some cases, which can increase the risk of error. Relative risk data were not available for very high levels of alcohol consumption so risk functions needed to be extrapolated beyond the bounds of the original data in order to estimate risks for groups drinking at these levels. Rather than extrapolating functions beyond known levels, risk functions were assumed to be flat above the maximum for which relative risks were reported. For example, if published relative risks increased linearly from 0 alcohol consumption up to 75 grams of alcohol per day, people who consumed more than 75 grams per day were assumed to have the same relative risk as people who consumed 75 grams per day. This is likely to produce a relative underestimate of risk for people with high levels of alcohol consumption.

Under 18s

The model assumes there are no alcohol-related deaths or morbidity among people under 18 years of age. A significant number of alcohol-related hospital admissions and deaths are known to occur among people under 18 years of age (Kypri et al, 2009); (Humphrey, Casswell and Han, 2003); (Everitt and Jones, 2002); (Child and Youth Mortality Review Committee Te Rōpū Arotake Auau Mate o te Hunga Tamariki, 2009). However, because of a lack of data on consumption and elasticity for underage consumers, it was not possible to model alcohol-related events for this age group, so all deaths under 18 years are assumed to be non-alcohol-related. It is acknowledged that these events are important for public policy but had to be excluded for practical reasons.

This will have the effect of underestimating the harms from alcohol and, if this group is more price sensitive than older drinkers, it will underestimate the effects of price changes.

Purchasing and consumption data

The estimated percentage change in consumption from the pricing policies is based on purchasing data from the *International Alcohol Control* (IAC) survey. This enables an analysis by low price and high price beverages. The percentage change in purchases was then applied to baseline consumption data from the IAC survey to obtain new estimates of consumption after the price increases. It is likely that alcohol purchases do not match consumption, with consumption levels being lower than the amount purchased. It is therefore possible that the percentage change in consumption may have been over-estimated. This is most likely to be for off-licences where a greater amount is often purchased than is consumed.

Furthermore, estimates used in determining the proportions of baseline value of sales and volume of sales (litres, standard drinks) by beverage type at off-licences and on-licences are based on consumption data, not purchase data, from the *International Alcohol Control* (IAC) survey. However, the consumption proportions are closely similar to the sales proportions estimated by Euromonitor International, a market intelligence firm, in their report “Alcoholic Drinks in New Zealand” (Euromonitor International, 2012). It was decided that consumption proportions would be used instead of purchasing proportions to estimate the effects on sales volumes, consumers’ surplus, and

Government and industry revenue from a price increase, as consumption proportions are more reflective of the actual alcohol market.

Price relativities

It was not possible to estimate the relative impact of each of the price changes on the quantity of beverages demanded. The price increase of each beverage was analysed separately. Therefore it is possible that the effects on consumption may have been under-estimated if the relative price changes were smaller than the absolute price change. This is because consumers are less likely to substitute between products if the price of all beverages increases.

Responsiveness of harmful drinkers to price changes

Our finding that excise increases have a greater impact on harmful drinkers than low risk drinkers is inconsistent with findings in studies such as Wagenaar et al (2009), which found that heavy drinkers are much less responsive to price changes. The University of Sheffield also found that harmful drinkers are much less price responsive than low risk drinkers when total alcohol consumption was considered, rather than consumption by beverage type. We cannot, therefore, conclude with confidence that excise increases will have a greater impact on harmful drinkers compared to low risk drinkers. More research is needed to confirm this, which could be done once revised University of Sheffield elasticity estimates are available next year.

Estimates of the responsiveness of per occasion drinkers to price changes

We also do not have separate price elasticity estimates for per occasion drinking. Recent evidence indicates that people are much less responsive to price increases during drinking occasions (Byrnes et al, 2012). Therefore, it is possible the effects on per occasion consumption could have been over-estimated.

Not all costs and benefits can be quantified

It has not been possible to take into account the impact of alcohol pricing policies on all alcohol-related costs and benefits. In particular, we have not been able to quantify all of the more intangible, psychological and emotional harm alcohol consumption imposes on others. We have also not been able to quantify all of the positive externalities alcohol consumption may generate, such as social networking effects and the building of social capital.

Industry impact – producer surplus

Producer surplus quantifies the difference between what price a producer is willing to accept for an alcohol product, and the price received for the product. Producers would be impacted by a pricing policy. However, as suitable data was not available, it was not possible to quantity the elasticity of supply for the purposes of this study. In order to determine the impact of a minimum price or excise increase on industry revenue, a long run perfectly elastic supply curve is modelled, assuming 100% pass through rates to consumers and no deadweight loss of producer surplus.[41]

[41] A long run perfectly elastic supply curve indicates that the quantity supplied is very responsive to price changes. With a percentage increase in price, the percentage change in quantity supplied is infinitely large. Producer surplus is zero as the price the producer is willing to supply good for is equal to the market price.

Sensitivity of the results to the underlying assumptions

As outlined in Section 12 above, the results are sensitive to a range of assumptions made in the models. Most importantly, the results are sensitive to the elasticity estimates used as these determine the overall impact of a price increase on consumption, alcohol-related harms and other costs and savings estimated in this report.

13.8 Possible further research

This is the first study of its kind in New Zealand, where various models are integrated to determine the overall welfare effect on society of different alcohol pricing options. The models link aspects of price, drinking patterns, purchase patterns, elasticities, and various types of alcohol-related harms. The analysis was undertaken with limited resources in a limited timeframe. The analysis could be refined and enhanced as new information comes to hand, but it would require a team of people who are dedicated to this work to keep refining and improving the analysis.

In undertaking this research, we attempted to obtain New Zealand price elasticities to determine how responsive different types of New Zealand consumers are to changes in the price of alcohol. Unfortunately, due to limitations with the data available, it was not possible to derive plausible elasticity estimates and the University of Sheffield estimates were used instead. If more time had been available it may have been possible to explore other survey options or to undertake a specific survey over an extended period of time that collected the data necessary to derive robust elasticity estimates. This is something the Government could consider doing in the future.

The University of Sheffield will be releasing new elasticity estimates next year. The modelling undertaken as part of this research could be redone with these new elasticities if time and resources are available.

The development of methods to estimate relative risks or attributable fractions for outpatient events in New Zealand would be useful. Consumption data with sufficient power in all age groups using measures that are appropriate or the application of relative risk data and development of an accurate set of relative risks for acute causes would also be useful. Future work should also identify the impact of policy changes on years of life and/or quality adjusted life years lost due to alcohol in order to understand the relative impact of interventions that affect the consumption patterns of younger or older drinkers.

An important advance will be the development of methods to model the cost of harm from other people's drinking using a similar relative risk function approach. This research is needed not just for New Zealand, but internationally, and New Zealand is now well-placed to lead this research given its early experience with alcohol policy modelling and surveying harms from other people's drinking.

Further research and analysis to develop marginal estimates of the costs of crime would be useful as would more up to date New Zealand studies on the impact of harmful alcohol consumption on workplace productivity.

This study has produced results that will be useful in informing policy decisions. Studies of such an ambitious nature have been conducted in few countries, usually well supported by large academic teams and multi-year funding arrangements, and methods are still new and evolving. Despite its limitations, these results represent an evidence base more thorough than any previously available to alcohol policy decision makers in New Zealand.

14.References

1. AC Nielsen (2012) *Price sensitivity study for the Ministry of Justice*. April 2012. Auckland: AC Nielsen,.
2. Albertson, J (2012) *The retail market in New Zealand - an analysis 2011/2012*. April 2012. Wellington: New Zealand Retailers Association. Accessed from www.retailers.org.
3. Anderson, P and Baumberg, B (2006) *Alcohol in Europe. A public health perspective*. A report for the European Commission. June 2006. UK: Institute of Alcohol Studies.
4. Ashton, T and Casswell, S (1984) Estimated cost of alcohol to the New Zealand public hospital system. *New Zealand Medical Journal* 97(765): 683-686.
5. Babor, TF, Caetano, R, Casswell, S, Edwards, G, Giesbrecht, N, Graham, K, Grube, J, Hill, L, Holder, H, Homel, R, Livingston, M, Österberg, E, Rehm, J, Room, R and Rossow, I (2010) *Alcohol: No ordinary commodity, a summary of the book*. 2nd Edition. Oxford: Oxford University Press.
6. Ball, J (2012) *How will a minimum price for alcohol affect supermarket deals?* News article. 23 March 2012: The Guardian. Retrieved from guardian.co.uk.
7. Ballingall, J and Schilling, C (2009) *Economic impact if the New Zealand wine industry*. April 2009. Wellington: NZIER.
8. Baumberg, B and Anderson, P (2012) *Cost benefit analyses of alcohol policy - a primer*. November 2010: Executive Agency for Health and Consumers.
9. BERL (2009) *Costs of harmful alcohol and other drug use: Final report*. Wellington: Business and Economic Research Limited.
10. Booth, A, Meier, P, Stockwell, T, Sutton, A, Wilkinson, A, Wong, R, Brennan, A, O'Reilly, D, Purshouse, R and Taylor, K (2008) *Independent review of the effects of alcohol pricing and promotion: Part A*. Project Report for the Department of Health. September 2008. Sheffield: The University of Sheffield.
11. Brennan, A, Purshouse, R, Taylor, K, Rafia, R, Meier, P, Booth, A, O'Reilly, D, Stockwell, T, Sutton, A, Wilkinson, A and Wong, R (2008) *Independent review of the effects of alcohol pricing and promotion: Part B. Modelling the potential impact of pricing and promotion policies for alcohol in England: Results from the Sheffield alcohol policy model version 2008(1-1)*. Sheffield: The University of Sheffield.
12. Brouwer, WB, Niessen, LW, Potsma, MJ and Rutten, FF (2005) Need for differential discounting of costs and health effects in cost effectiveness analyses. *British Medical Journal* 331(7514): 446-448.
13. Byrnes, J, Shakeshaft, A, Petrie, D and Doran, C (2012) Can harms associated with high-intensity drinking be reduced by increasing the price of alcohol? *Drug and Alcohol Review* Early View (Online Version of Record published before inclusion in an issue).
14. Cameron, L and Williams, J (2001) Cannabis, alcohol and cigarettes: Substitutes or complements? *The Economic Record* 77(236): 19-34.
15. Casswell, S, Huckle, T and Pledger, M (2002) Survey data need not underestimate alcohol consumption. *Alcoholism: Clinical and Experimental Research* 26(10): 1561-1567.

16. Casswell, S and Wall, M *Affordability of alcohol: A key driver of alcohol demand in New Zealand*. Auckland, New Zealand: SHORE & Whariki Research Centre, Massey University.

17. Casswell, S, You, HQ and Huckle, T (2011) Alcohol's harm to others: Reduced wellbeing and health status for those with heavy drinkers in their lives. *Addiction* 106.

18. CEBR (2009) *Minimum alcohol pricing: A targeted measure?* London: Centre for Economics and Business Research Ltd.

19. Chetwynd, J and Rayner, T (1985) The economic costs to New Zealand of lost production due to alcohol abuse. *New Zealand Medical Journal* 98(785): 694-697.

20. Child and Youth Mortality Review Committee Te Rōpū Arotake Auau Mate o te Hunga Tamariki, T (2009) *Special report: The involvement of alcohol consumption in the deaths of children and young people in New Zealand during the years 2005-2007*. Wellington: Child and Youth Mortality Review Commiittee.

21. Collis, J, Grayson, A and Johal, S (2010) *Econometric analysis of alcohol consumption in the UK*. London: HM Revenue and Customs.

22. Commerce Commission (24 August 2006) *Decision no. 586. Determination pursuant to the Commerce Act 1986 in the matter of an application for clearance of a business acquisition involving: Lion Nathan Limited and Independent Liquor (NZ) limited*: Commerce Commission.

23. Connor, J, Broad, J, Jackson, R, Vander Hoorn, S and Rehm, J (2005) *The burden of death, disease and disability due to alcohol in New Zealand*. Wellington: Alcohol Advisory Council of New Zealand.

24. Connor, J, Broad, J, Rehm, J, Vander Hoorn, S and Jackson, R (2005) The burden of death, disease, and disability due to alcohol in New Zealand. *New Zealand Medical Journal* 118(1213): U1412.

25. Connor, J and Casswell, S (2012) Alcohol-related harm to others in New Zealand: Evidence of the burden and gaps in knowledge. *New Zealand Medical Journal* 125(1360): 11-27.

26. Coriolis (2011) *Food & beverage information project 2011 final report*. October 2011. Wellington: Coriolis.

27. Coriolis (2012) *Investment opportunities in the New Zealand alcoholic spirits industry*. February 2012. Auckland: Coriolis.

28. Corrao, G, Bagnardi, V, Zambon, A and Arico, S (1999) Exploring the dose-response relationship between alcohol consumption and the risk of several alcohol-related conditions: A meta-analysis. *Addiction* 94(10): 1551-1573.

29. Corrao, G, Bagnardi, V, Zambon, A and La Vecchia, C (2004) A meta-analysis of alcohol consumption and the risk of 15 diseases. *Preventive Medicine* 38: 613-619.

30. Corrao, G, Rubbiati, L, Bagnardi, V, Zambon, A and Poikolainen, K (2000) Alcohol and coronary heart disease: A meta-analysis. *Addiction* 95(10): 1505-1523.

31. Crampton, E (2012) *Alcohol taxes and effects on producers* Obtained from http://offsettingbehaviour.blogspot.co.nz/2009/05/alcohol-taxes-and-effects-on-producers.html

32. Crost, B and Guerrero, S (2012) The effect of alcohol availability on marijuana use: Evidence from the minimum legal drinking age. *Journal of Health Economics* 31(1): 112-121.

33. Devlin, N, Scuffham, P and Bunt, L (1997a) The social costs of alcohol abuse in New Zealand. *Addiction* 92(11): 1491-1505.

34. Devlin, N, Scuffham, P and Bunt, L (1997b) The social costs of alcohol abuse in New Zealand. *Addiction* 92(11): 1491-1505.

35. Distilled Spirits Association (Year Unknown) *Distilled Spirits Association submission on the Trade Marks (International Treaties and Enforcement) Amendment Bill*: Distilled Spirits Association.

36. Dodgson, J, Bramley-Harker, E, Spackman, M, Aslam, S and Barham, L (2003) *Alcohol in London: A cost-benefit analysis - a final report for the greater London authority*. January 2003. London: NERA Economic Consulting.

37. Doll, R, Peto, R, Hall, E, Wheatley, K and Gray, R (1997) Alcohol and coronary heart disease reduction among British doctors: Confounding or causality? *European Heart Journal* 18(1): 23-25.

38. Drummond, M, Sculpher, M, Torrance, G, O'Brien, B and Stoddart, G (2005) *Methods for the economic evaluation of health care programmes, third edition*. Oxford: Oxford University Press.

39. Easton, B (1997a) *The social costs of tobacco use and alcohol misuse*. Wellington: Wellington School of Medicine, Department of Public Health.

40. Easton, B (1997b) *The social costs of tobacco use and alcohol misuse*. April 1997. Wellington: Wellington School of Medicine.

41. Easton, B (2002) *Taxing harm: Modernising alcohol excise duties*. November 2002.

42. Easton, B (2012) *Dealing with no ordinary commodity: Alcohol*. 14 to 16 February 2012: Paper for the Global Alcohol Policy Conference: Thailand

43. Euromonitor International (2012) *Alcoholic drinks in New Zealand*. January 2012: Euromonitor International.

44. Everitt, R and Jones, P (2002) Changing the minimum legal drinking age - its effect on a central city emergency department. *New Zealand Medical Journal*(115): 9-11.

45. Fanshel, S and Bush, JW (1970) A health-status index and its application to health-services outcomes. *Operations Research* 18(6): 1021-1066.

46. Fillmore, KM, Stockwell, T, Chikritzhs, T, Bostrom, A and Kerr, W (2007) Moderate alcohol use and reduced mortality risk: Systematic error in prospective studies and new hypotheses. *Annals of Epidemiology* 17(5 Suppl): S16-23.

47. Gallet, CM (2007) The demand for alcohol: A meta-analysis of elasticities. *The Australian Journal of Agricultural and Resource Economics* 51(2): 121-135.

48. Gravelle, H and Smith, D (2001) Discounting for health effects in cost-benefit and cost-effectiveness analysis. *Health Economics* 10(7): 587-599.

49. Griffith, R and Leicester, A (2010) *The impact of introducing a minimum price on alcohol in Britain*. Study Report. 2010: (UK) Institute for Fiscal Studies.

50. Gunning-Schepers, L (1989) The health benefits of prevention: A simulation approach. *Health Policy* 12(1-2): 1-255.

51. Gutjahr, E, Gmel, G and Rehm, J (2001) Relation between average alcohol consumption and disease: An overview. *European Addiction Research* 7: 117-127.

52. Hill, L, Clarke, D and Casswell, S (2011) *Addressing the harmful use of alcohol: A guide to developing effective alcohol legislation*. Manila: WHO Regional Office for the Western Pacific, World Health Organization.

53. Huckle, T, You, RQ, Fu, J and Casswell, S (2011) *Alcohol policy in New Zealand: Results from the General Population Survey, 2011* November 2011. Auckland: SHORE & Whariki Research Centre.

54. Humphrey, G, Casswell, S and Han, D (2003) Alcohol and injury among attendees at a New Zealand emergency department. *New Zealand Medical Journal* 116(1168): U298.

55. Hunt, P, Rabinovich, L and Baumberg, B (2010) *Preliminary assessment of the economic impacts of alcohol pricing policy options in the UK*. Brussels: RAND.

56. Jackson, R, Broad, J, Connnor, J and Wells, S (2005) Alcohol and ischaemic heart disease: Probably no free lunch. *Lancet* 366(9501): 1911-1912.

57. Jones, S, Casswell, S and Zhang, J-F (1995) The economic costs of alcohol-related absenteeism and reduced productivity among the working population of New Zealand. *Addiction* 90(11): 1455-1461.

58. Klarman, HE, Francis, JO and Rosenthal, GD (1968) Cost-effectiveness analysis applied to the treatment of chronic renal disease. *Medical Care* 6(1): 48-54.

59. Knapp, M (1999) Economic evaluation and mental health: Sparse past . . . Fertile future? *The Journal of Mental Health Policy and Economics* 2: 163-167.

60. Koopmanschap, MA, Rutten, FFH, van Ineveld, MB and van Roijen, L (1995) The friction cost method for measuring indirect costs of disease. *Journal of Health Economics* 14(2): 171-189.

61. Kypri, K, Davie, G, Langley, J, Voas, R and Begg, D (2009) The utility of routinely collected data in evaluating important policy changes: The New Zealand alcohol purchasing age limit example. *American Journal of Public Health* 99(7): 121-1215.

62. Lazaro, A (2002) Theoretical arguments for the discounting of health consequences: Where do we go from here? *Pharmacoeconomics* 20(14): 1943-1961.

63. Leicester, A (2011) *Alcohol pricing and taxation policies*. IFS Briefing Notes. 2011: Institute for Fiscal Studies.

64. Lucas, L (2012) *Minimum alcohol pricing poses problems*. March 2012: Accessed from http://www.ft.com/intl/cms/s/0/d94f3538-6936-11e1-9618-00144feabdc0.html#axzz28pfbNVJQ on 11 October 2012.

65. MacDonald, Z and Shields, MA (2004) Does problem drinking affect employment? Evidence from England. *Health Economics* 13(2): 139-155.

66. Marsden Jacob Associates (2009) *The benefits, costs and taxation of alcohol: Towards an analytical framework. A report prepared for the New Zealand law commission*. December 2009. Melbourne: Marsden Jacob Associates.

67. Miller, T and Blewden, M (2001) Costs of alcohol-related crashes: New Zealand estimates and suggested measures for use internationally. *Accident Analysis and Prevention* 33(6): 783-791.

68. Milne, R (2005) Valuing prevention: Discounting health benefits and costs in New Zealand. *New Zealand Medical Journal* 118(1214): U1443.

69. Ministry of Business Innovation and Employment (2012) *Frequently asked questions*. In: http://www.med.govt.nz/business/intellectual-property/parallel-importing-in-new-zealand/frequently-asked-questions on 2 October 2012.

70. Ministry of Economic Development (2010) *Wine excise: The issues for the New Zealand wine industry*. 2 December 2010. Wellington: Ministry of Economic Development.

71. Ministry of Health (2009) *Discharges from publicly funded hospitals – 1 July 2003 to 30 June 2004.* Wellington: Ministry of Health.

72. Ministry of Health (2010a) *Discharges from publicly funded hospitals – 1 July 2004 to 30 June 2005*. Wellington: Ministry of Health.

73. Ministry of Health (2010b) *Publicly funded hospital discharges – 1 July 2005 to 30 June 2006.* . Wellington: Ministry of Health.

74. Ministry of Health (2010c) *Publicly funded hospital discharges – 1 July 2006 to 30 June 2007.* . Wellington: Ministry of Health.

75. Ministry of Health (2011a) *Publicly funded hospital discharges - 1 July 2008 to 30 June 2009.* . Wellington: Ministry of Health.

76. Ministry of Health (2011b) *Publicly funded hospital discharges – 1 July 2007 to 30 June 2008*. Wellington: Ministry of Health.

77. Mukamal, KJ and Rimm, EB (2001) Alcohol's effects on the risk for coronary heart disease. *Alcohol Research and Health* 25(4): 255-261.

78. Murray, CJ and Lopez, AD (1996) *The global burden of disease: A comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Cambridge: Harvard University Press.

79. National Health and Medical Research Council (2009) *Australian guidelines to reduce health risks from drinking alcohol*. February 2009: Commonwealth of Australia.

80. National Research Bureau (NRB) (2012) *The alcohol purchasing patterns of heavy drinkers in NZ*. Research report. February 2012. Auckland: A report prepared for the Ministry of Health.

81. Navarro, H, Doran, C and Shakeshaft, A (2011) Measuring costs of alcohol harm to others: A review of the literature. . *Drug and Alcohol Dependence* 114(2-3): 87-99.

82. New Zealand Wine (2011) *New Zealand Wine Annual Report*: New Zealand Wine.

83. NZ Drug Foundation (Year unknown) *What you need to know about the Alcohol Reform Bill*: NZ Drug Foundation.

84. Pape, H, Rossow, I and Storvoll, EE (2009) Under double influence: Assessment of simultaneous alcohol and cannabis use in general youth populations. *Drug and Alcohol Dependence* 101(1-2): 69-73.

85. Paton, N (2008) Employees admit to drinking on the job. *Occupational Health* 60(6): 7.

86. PHARMAC (2007) *Prescription for pharmacoeconomic analysis: Methods for cost utility analysis* Wellington: PHARMAC.

87. Polak, MA and Conner, TS (2012) Impairments in daily functioning after heavy and extreme episodic drinking in university students. *Drug and Alcohol Review*.

88. Purshouse, R, Brennan, A, Latimer, N, Rafia, R, Meier, P and Jackson, R (2009) *Modelling to assess the effectiveness and cost-effectiveness of public health related strategies and interventions to reduce alcohol attributable harm in England using the Sheffield Alcohol Policy Model version 2.0*. 31 July 2009. Sheffield: University of Sheffield.

89. Purshouse, R, Meng, Y, Rafia, R, Brennan, A and Meier, P (2009) *Model-based appraisal of alcohol minimum pricing and off-licence discount trade bans in Scotland*. Sheffield: University of Sheffield.

90. Rabinovich, L, Tiessen, J, Janta, B, Conklin, A, Krapels, J and van Stolk, C (2008) *Reducing alcohol harm: International benchmark*. 2008. Cambridge, United Kingdom: RAND Corporation.

91. Rayner, T and Chetwynd, J (1987) The economic cost of alcohol-related health care in New Zealand. *British Journal of Addiction* 82(1): 59-65.

92. Rayner, T, Chetwynd, J and Alexander, T (1984) *Costs of alcohol abuse in New Zealand - a preliminary study.*: Report to ALAC.

93. Rehm, J, Room, R, Monteiro, M, Gmel, G and Graham, K (2004) Alcohol use. In Ezzati, M, Lopez, A, Rodgers, A and Murray, C (eds) *Comparative quantification of health risks global and regional burden of disease attributable*. Geneva: World Health Organization.

94. Robson, K (2012) *Alcohol (Minimum Pricing) (Scotland) Bill*. 5 January 2012. Edinburgh: SPICe.

95. Roche, A, et al. (2008) Workers' drinking patters: The impact on absenteeism in the Australian work-place. *Addiction* 103(5): 738-748.

96. Roerecke, M and Rehm, J (2012) The cardioprotective association of average alcohol consumption and ischaemic heart disease: A systematic review and meta-analysis. *Addiction* 107(7): 1246-1260.

97. Scottish Government (2011) *Framework for action: Changing Scotland's relationship with alcohol*. A Business and Regulatory Impact Assessment for Minimum Price per Unit of Alcohol as Contained in Alcohol (Minimum Pricing) (Scotland) Bill. 2011. Edinburgh: Scottish Government.

98. Sellman, D, Connor, J, Robinson, G and Jackson, R (2009) Alcohol cardio-protection has been talked up. *New Zealand Medical Journal* 122(1303): 97-101.

99. Stockwell, T (2012) Does minimum pricing reduce alcohol consumption? The experience of a Canadian province. *Addiction* 107(5): 912 - 920.

100. Stockwell, T, Zhao, J, Giesbrecht, N, Macdonald, S, Thomas, G and Wettlaufer, A (2012) The raising of minimum alcohol prices in Saskatchewan, Canada: Impacts on consumption and implications for public health. *American Journal of Public Health* Published ahead of print 18 October 2012.

101. Taylor, B, Shield, K and Rehm, J (2011) Combining best evidence: A novel method to calculate the alcohol-attributable fraction and its variance for injury mortality. *BMC Public Health* 11(265).

102. The Law Commission (2010) *Alcohol in our lives: Curbing the harm*. April 2010. Wellington: The Law Commission.

103. Wagenaar, AC, Salois, MJ and Komro, KA (2009) Effects of beverage alcohol price and tax levels on drinking: A meta-analysis of 1003 estimates from 112 studies. *Addiction* 104(2).

104. Weinstein, MC and Stason, WB (1977) Foundations of cost-effectiveness analysis for health and medical practices. *New England Journal of Medicine* 296(13): 716-721.

105. Wiese, JG, Shilpak, MG and Browner, WS (2000) The alcohol hangover. *Annals of Internal Medicine* 132(11).

106. Wyllie, A, Zhang, JF and Casswell, S (1994) Comparison of six alcohol consumption measures from survey data. *Addiction* 89(4): 425-430.

107. Zakhari, S (1997) Alcohol and the cardiovascular system: Molecular mechanisms for beneficial and harmful action. *Alcohol Health and Research World* 21(1): 21-29.

15.Appendices

Appendix 1 – The New Zealand alcohol market

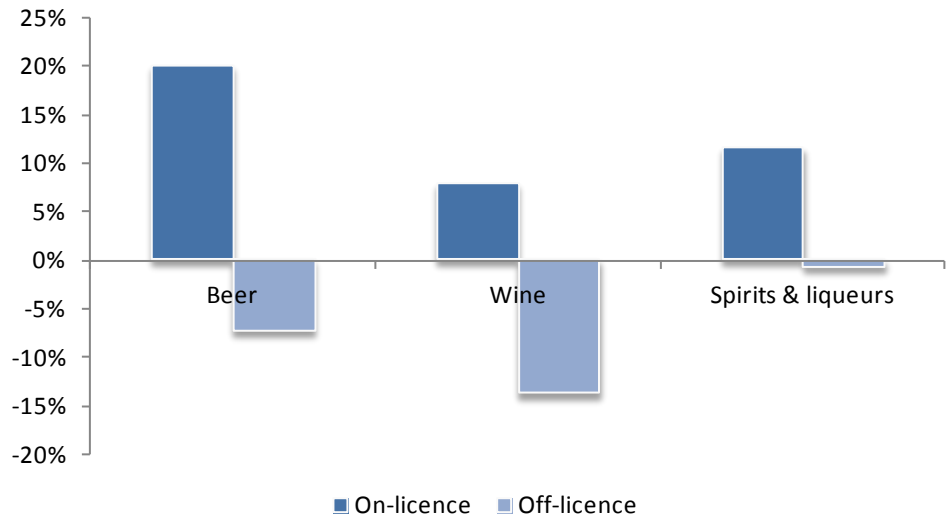
New Zealand's alcohol industry is vast; spanning grape growers, distillers, ethanol producers and brewers, to brand representatives, distributors, bars, clubs, supermarkets, bottle stores and various national and international industry groups. Over 80% of the adult population in New Zealand drink alcohol at least occasionally. This Appendix provides an overview of the price of alcohol and the demand for and supply of alcohol in New Zealand.

The price of alcohol

Recent evidence suggests that affordability of alcohol is a key driver of consumption rather than the real price of alcohol. A higher rate of increase in incomes compared to liquor prices has effectively lowered the price of alcohol over time. This may have facilitated an increase in drinking (Casswell and Wall, year unknown).

Between 2002 and 2011, the real price of alcohol increased significantly at on-licence premises, while the real price of alcohol at off-licence premises decreased. During this period the real price of beer decreased by 7% at an off-licence but increased by 20% at an on-licence. The real price of wine decreased by 14% at off-licences and increased by 8% at on-licences while the real price of spirits and liqueurs decreased by 1% at off-licences and increased by 12% at on-licences.

Figure 25: Percentage changes in the real price of alcohol by beverage type, 2002 to 2011

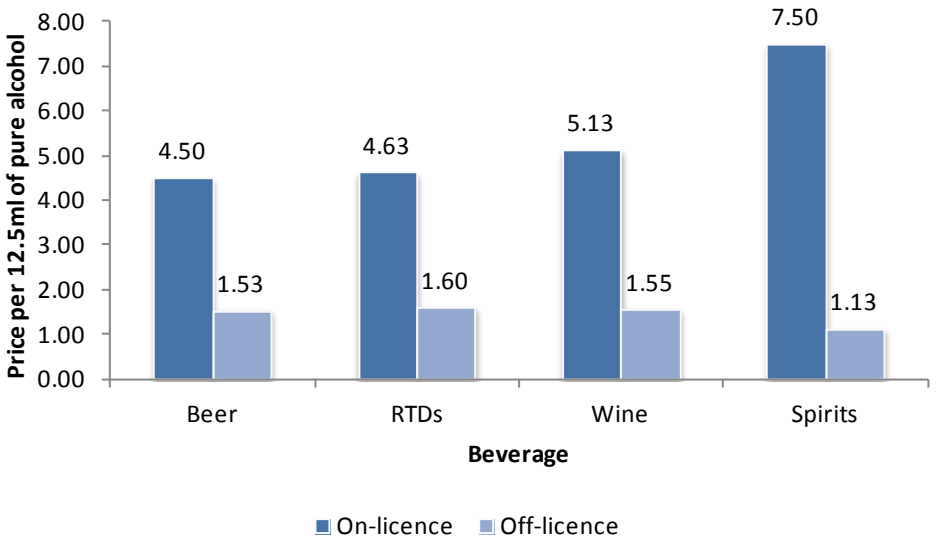


Source: Statistics New Zealand

The proportion of the population purchasing their alcohol from off-licences increased from 64% in 1995 to 76% in 2011, while the proportion purchased at on-licences decreased from 36% in 1995 to 24% in 2011. Industry consultation suggests the decline in consumption at on-licences is due to rapidly falling prices at off-licences as a result of the growing number of outlets and increased competition.

The price of a standard drink (defined as 10g or 12.5ml of pure alcohol) varies depending upon the drink itself and the outlet it was purchased from. The SHORE and Whariki Research Centre at Massey University provided data on the average price paid per ml of pure alcohol in its results from the *General Population Survey 2011*. Figure 26 shows the average price paid per 12.5ml of pure alcohol at on-licence and off-licence premises by beverage type.

Figure 26: The average price paid per 12.5 ml of pure alcohol at on-licence and off-licence premises by beverage type



Source: Huckle et al 2011, pp. 38 and 47

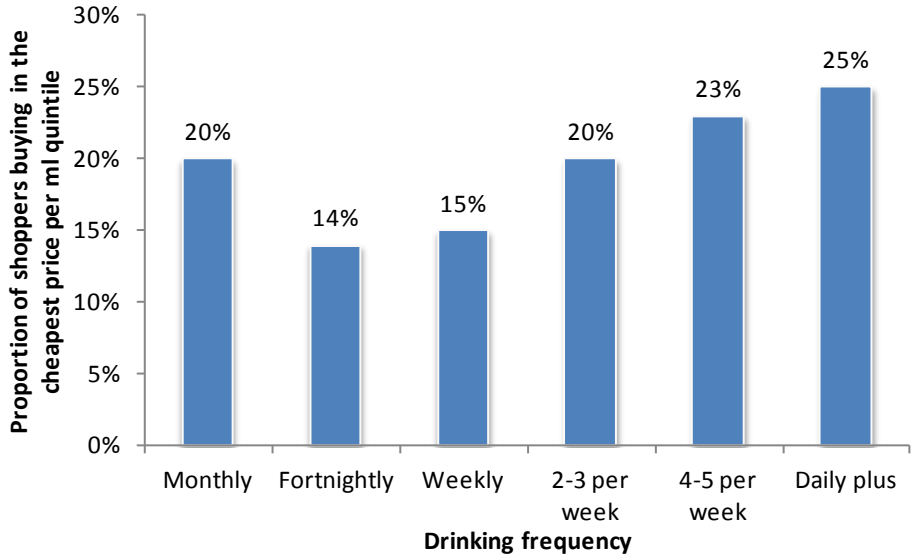
The average price of on-licence beverages are higher than the average price of off-licences, averaging three times the average price of beer, RTDs and wine, and seven times the average price of spirits. This may be attributable to higher overheads and the additional service provided in on-licensed premises. On-licence premises, particularly fully-licensed premises, are able to charge a higher mark-up because those who want to purchase alcohol with their meal have no other option but to purchase from the on-licensed premises. Off-licences may be able to take advantage of a large customer base and a quick rate of turnover by offering price discounts and engaging in loss-leading behaviour. The proportion of alcohol consumed in on-licences was 24% in 2011 compared with 35% in 2004. Industry consultation suggests this decline in consumption at on-licences is due to the rapidly falling prices in off-licences as a result of increased competition and the growing number of liquor outlets.

The growing differential in prices between off-licence and on-licence premises has led to the phenomenon of preloading; drinking alcohol before going to on-licensed premises. According to the SHORE and Whariki *General Population Survey 2011*, approximately 54% of respondents said that they had preloaded in the previous six months. Around 12% of respondents reported that they preloaded all the time and almost 15% did so most of the time. Preloading is more common among the younger age groups. Over 60% of 18 and 19 year olds preload, whereas around 10% of respondents aged 45 to 54 years preload (Huckle et al, 2011).

Harmful drinkers are more likely to purchase cheap alcohol

A report produced by the National Research Bureau for the Ministry of Health in 2011 analysed the purchasing patterns of heavy drinkers. It found that those consuming alcohol at least daily were more inclined to buy in the cheapest quintile than moderate drinkers, but the great majority of heavy drinkers (75%) bought in the four dearer price quintiles. Heavy drinkers participated in all tiers of pricing albeit lesser in the dearest price bracket and greater in the cheapest (National Research Bureau (NRB), 2012).

Figure 27: The proportion of alcohol shoppers of each drinking frequency who purchase in the cheapest cost per ml alcohol quintile (figures rounded)



Source: NRB 2011, p.14

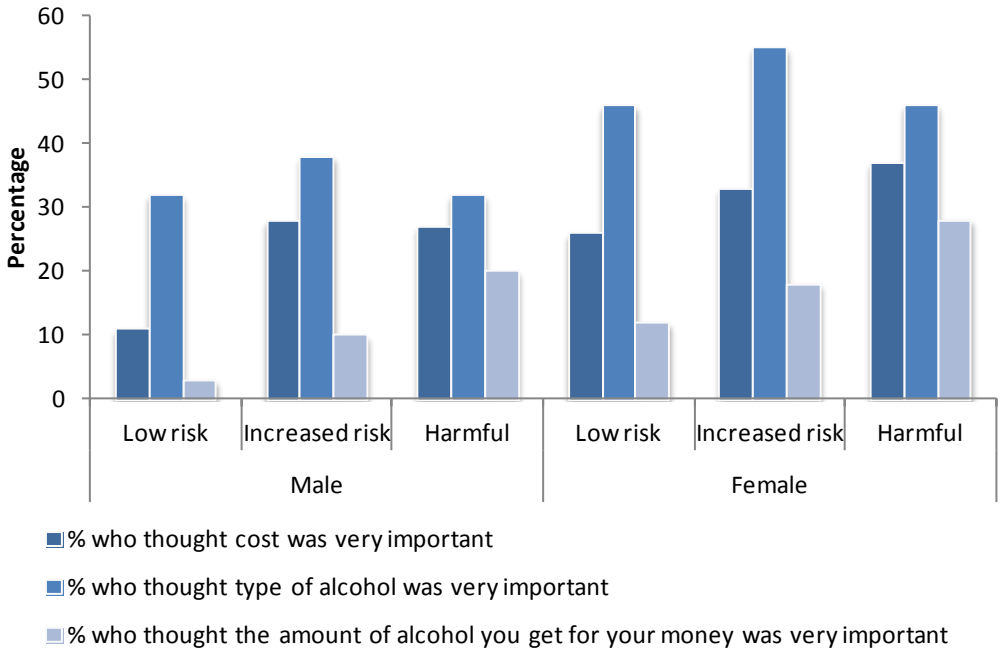
In terms of per occasion drinking, there was a clear tendency for those drinking five or more drinks per occasion to purchase alcohol in the cheapest price quintile. However, even for those who drink heavily per occasion on a daily basis, only 29% purchased alcohol in the cheapest price quintile.

Those who drink excessively most frequently (three or more times a week) favour the cheapest quintile in the price range at the expense of the dearest quintile to a perceptible extent (26% purchase in the cheapest price quintile compared to 16% in the dearest), but they still predominately buy relatively evenly across the price range.

The majority of people buy their alcohol on special. ALAC's 2011 *Attitudes and Behaviour Alcohol Survey* found that 55% of respondents bought their alcohol on special. This does not vary greatly by type of drinker, with 56% of low risk drinkers buying on special, compared with 55% of harmful drinkers. Seventy-eight percent of beer and wine sold at off-licences is sold on promotion (AC Nielsen, 2012).

The 2011 ALAC *Annual Attitudes and Behaviour Survey* found that cost and alcohol type are more important than the amount of alcohol you get for your money for all types of drinker. As Figure 28 shows, harmful drinkers are more concerned about the amount of alcohol you get for the money spent compared to low risk and increased risk drinkers.

Figure 28: Important Factors in Purchasing Decisions



Source: ALAC, 2011

The demand for alcohol in New Zealand

Households in New Zealand spent an average of $21.30 a week on alcoholic beverages in 2009/10 up 9.2% on 2006/07. Excise taxation on alcohol contributed $852 million to Government revenue in the financial year ending June 2011, less than 2% of total Government taxation revenue of $51 billion.

About 80% of New Zealanders drink alcohol. Most drink at moderate levels, but around 10% of the drinking population drink at levels on an average daily basis that are potentially harmful to themselves and others. About 20% of the population drink at harmful levels on a typical drinking occasion.

Male 18-24 year olds have the highest proportion of harmful drinkers (23%) compared to 15% of female 18-24 year olds. Overall, male drinkers are more likely to be classed as "increasingly risky" drinkers or "harmful" drinkers.[42]

In terms of the annual volume of alcohol purchased, harmful drinkers have a preference for beer (low and high price), followed by low-price wine and low-price spirits. Low risk drinkers prefer wine (low and high price), and low-price spirits. There are differences by gender. Male drinkers who are classed as harmful prefer beer and low-price spirits. Female harmful drinkers are much more likely to prefer low-price RTDs followed by low-price spirits.

In terms of alcohol purchased on a particular drinking occasion, harmful drinkers prefer low price RTDs, low-price wine, and low and high price beer. Low risk drinkers prefer low and high price wine.

The majority of alcohol (about 76%) is purchased from off-licence premises, with most alcohol purchased from bottle stores or supermarkets. Greater proportions of 18 to 24 year olds purchase

[42] Increased risk is defined as an average of 2 to 6 drinks per day for men and an average of 2 to 5 drinks per day for women; harmful risk is defined as an average of 6+ drinks per day for men and an average of 5+ drinks per day for women.

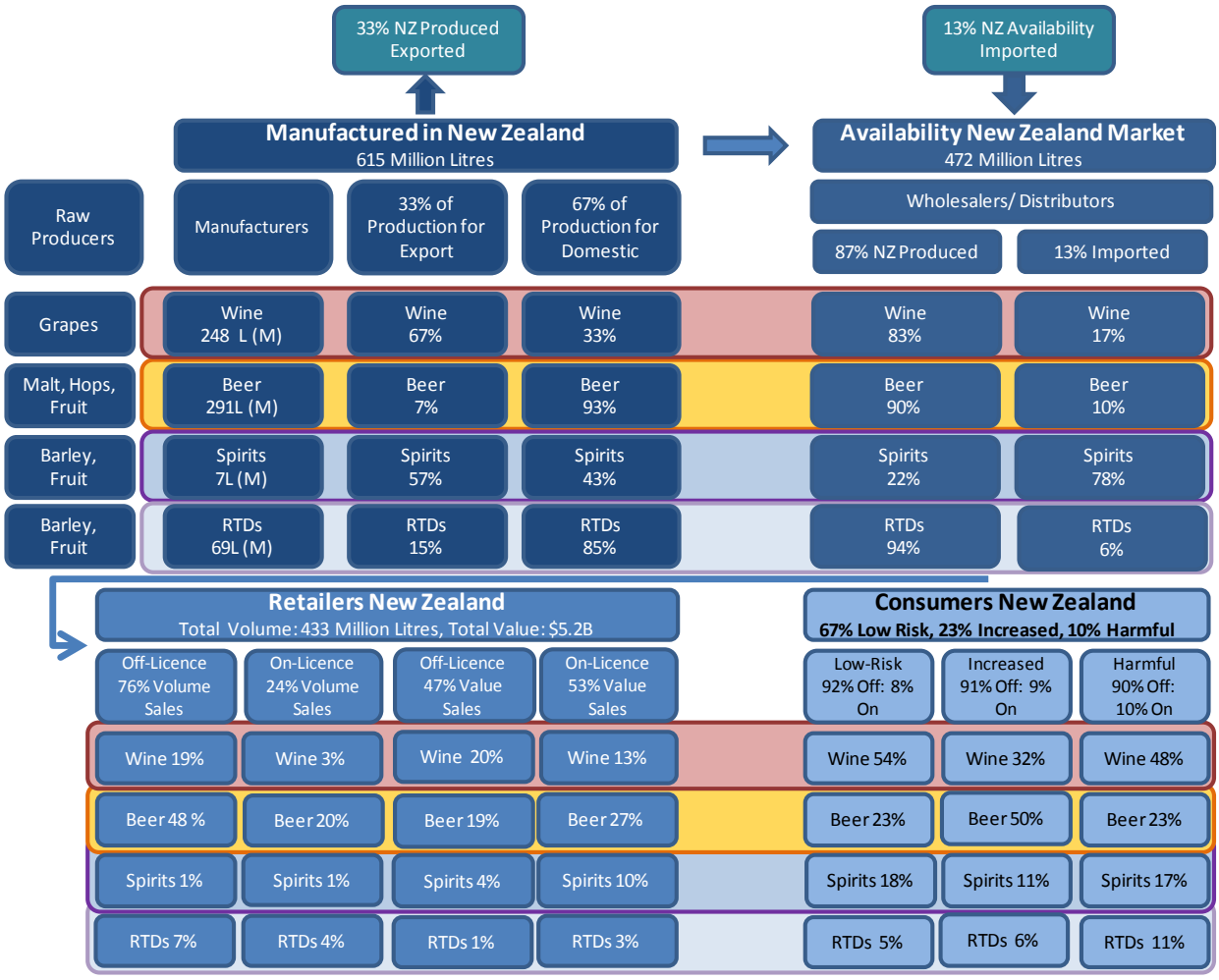
alcohol from bottle stores whereas higher proportions of older respondents purchase alcohol from supermarkets. Those classed as harmful drinkers are also more likely to purchase alcohol from a bottle store.

The supply of alcohol in New Zealand

Figure 29 depicts a high level overview of the availability of alcohol in New Zealand. In 2011, 615 million litres of alcohol was produced in New Zealand, with 68% produced for the domestic market. Thirty-three percent of alcohol was produced for the export market, most of which was wine exports (83%). Domestically, 472 million litres of alcohol was available for the New Zealand market. Eighty-seven percent of this was produced in New Zealand, while 13% was imported. The majority of beer (90%), wine (83%) and RTDs (94%) available in the domestic market are produced in New Zealand, while most of the spirits available are imported (78%).

Seventy-six percent of alcohol available in New Zealand is sold through off-licence retailers, with the highest demand for beer sales, followed by wine. However, on-licence sales account for 53% of the sales value, which is primarily driven by beer sales.

Figure 29: New Zealand domestic alcohol market

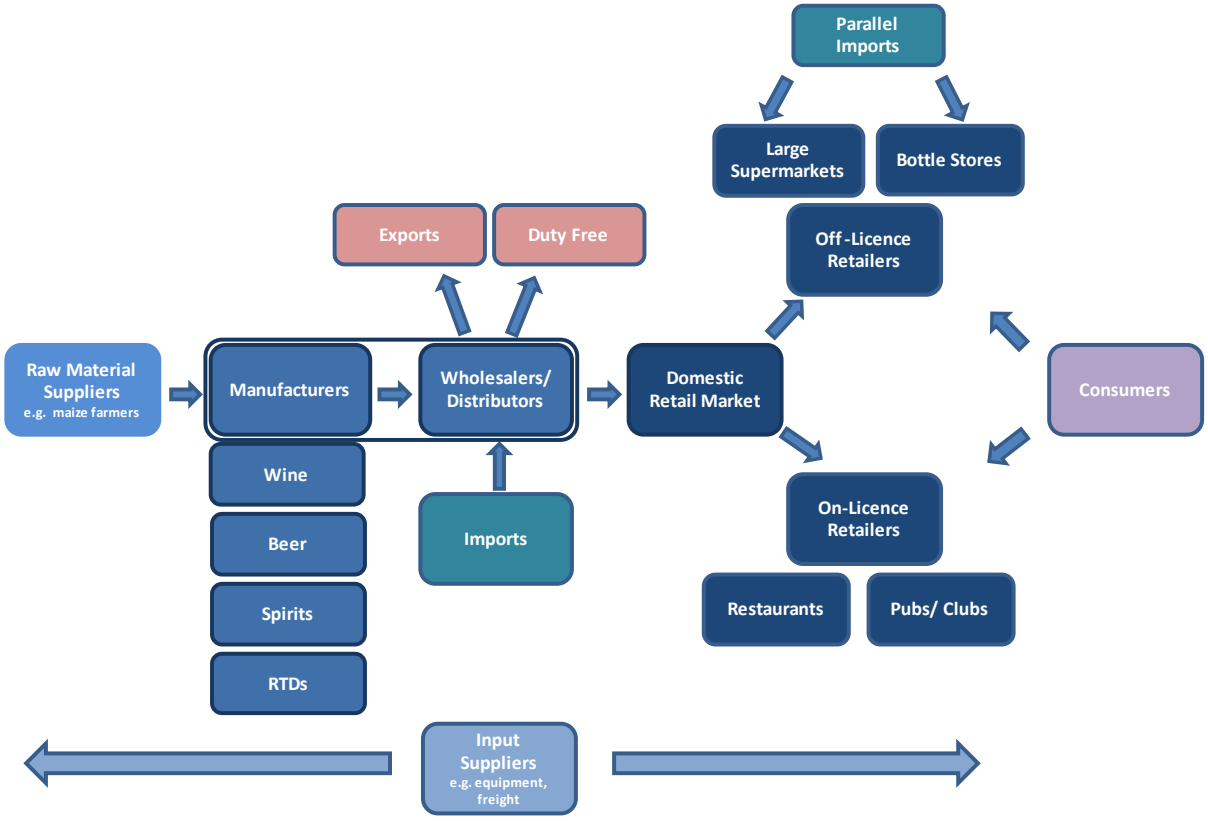


Sources: Statistics New Zealand, Customs New Zealand, AC Neilson, SHORE & Whariki Research Centre

New Zealand's alcohol industry and supply chain

The New Zealand alcohol industry is highly interconnected with links between all actors in the supply chain. Figure 30 depicts a high level view of the New Zealand alcohol supply chain.

Figure 30: High level alcohol supply chain, New Zealand



Source: Ministry of Justice

Alcohol manufacturers typically wholesale and distribute to the domestic market, that is, directly to off-licence and on-licence retailers, and there are very few independent wholesalers operating in the market. Licensing Trusts are still in operation; however, only four have the right to operate on- and off-licences in their districts, while the remaining Trusts compete with other licences (The Law Commission, 2010, p.247). Domestic manufacturers also supply duty-free trade, and parallel imports supply a proportion of off-licence volumes.

Off-licence retailers include supermarkets, trusts, independent specialists, banner retail chains, dairy and convenience stores and online retailers. On-licence retailers include cafés, trusts, restaurants, clubs, pubs and bars.

On-licences such as cafés, restaurants, clubs and bars also buy in bulk from supermarkets as supermarkets can use strategies such as loss-leading (selling alcohol for less than the cost price) to sell at lower prices than producers or wholesalers. This is due to strong market power and economies of scale. Some off-licences, such as dairies, are also buying from supermarkets as prices are lower than buying directly from the manufacturers. Consumers can also buy directly from the manufacturers online, or on-site at wineries or breweries, offering both on- and off-licence sales.

In recent years, the industry has been characterised by increased vertical integration, with companies owning manufacturing, distribution and retail points in the supply chain. Some manufacturers of alcohol also retail alcohol (for example, Liquor King is owned by Lion Nathan) or have a licence agreement with brand owners to distribute products. Others import alcohol products (Commerce Commission, 24 August 2006, pp. 10-11).

Furthermore, there is increased integration of products, with breweries buying wineries (The Law Commission, 2010, pp.18-19). Alcohol companies are growing both organically and by acquisition. While beer and spirits are consolidated markets, the wine sector is more fragmented. Large acquisitions in the New Zealand industry since 2010 include Lion's acquisition of the Pernod Richard

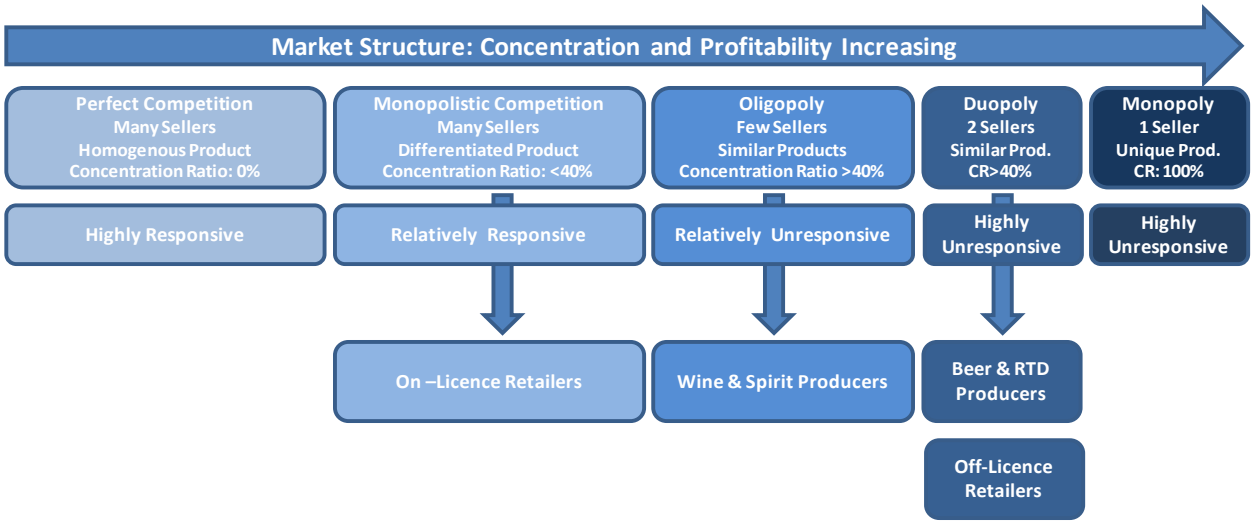
wine brands, Asahi Breweries acquisition of Independent Liquor and Delegat's Group acquisition of Oyster Bay wine (Coriolis, 2011).

Market structure

The segment of the alcohol industry that obtains revenue from alcohol sales depends on the market share and market power of the retailers, wholesalers and producers along the supply chain (Hunt, Rabinovich and Baumberg, 2010). The market structure influences how firms behave, in terms of pricing, supply, barriers to entry, efficiency, and competition.

A similar approach drawn from Hunt et al's analysis of the alcohol market in the UK is employed and adapted to provide an overview of the market structure of the alcohol industry in New Zealand. Figure 31 provides a high level overview of the four key types of market structure: perfect competition; monopolistic competition; oligopoly; and monopoly. Moving from left to right of the diagram, the concentration and profitability of the market increases and the responsiveness of the market to a pricing policy reduces.

Figure 31: New Zealand's alcohol industry market structure



Source: Ministry of Justice

The Firm Concentration Ratio suggests that any industry where the top five firms possess over 40% of the market share is considered an oligopoly. Less than 40% is classed as monopolistic competition. Based on the markets analysis, at a broad industry level, the alcohol industry in New Zealand appears to be moderately concentrated and predominately resembles an oligopolistic market, as the industry is dominated by a small number of large retail firms.

An oligopoly is a concentrated market dominated by a few sellers of homogeneous products. There are significant barriers to entry, which allows the larger sellers to dominate. Smaller sellers can also operate in the market, but with limited market power. Sellers compete with both price and non-price competition and consider the reactions of their competitors when making decisions about price and output.

In terms of each beverage segment, the market structures vary in terms of the number of organisations, barriers to entry and exit, product differentiation and branding. Market indicators suggest that major retailers have stronger bargaining power and larger economies of scale than producers of alcohol. Mergers are increasing market concentration, which is resulting in a more oligopolistic market with market power held by a small number of large players.

Thus, the market is less competitive, with certain retailers controlling the market. This market power is used to bargain down wholesale prices. This in turn affects the level of competition in the market and the responsiveness of the market to pricing policies.

Alcohol production in New Zealand

The number of alcohol producers is growing in New Zealand, driven primarily by wine production. According to Coriolis, in 2010 there were 358 wine manufacturers, 51 beer manufacturers and 27 spirit manufacturers operating in New Zealand. The number of wine and spirits producers has grown steadily between 2000 and 2010 at a compound annual growth rate (CAGR) of 8%. The number of beer producers fell by CAGR -1% between 2000 and 2010. However in 2010, the number of beer manufacturers grew from 39 to 51, with growth of 31% (Coriolis, 2011).

Key companies in the New Zealand alcohol manufacturing sector

The global alcohol industry is becoming increasingly consolidated and globalised with large global corporations dominating production, distribution and marketing at national, regional and global levels (Babor et al, 2010, pp. 71-75). Industry consolidation, both nationally and internationally, gives these large companies an increased capacity to influence policy and a greatly increased capacity to promote alcohol brands and a drinking lifestyle.

The top 10 alcohol companies in NZ make up 80% of the alcohol market in terms of annual turnover (Coriolis, 2011). Of the total revenue gained by beverage manufacturers in New Zealand, approximately 20% of revenue was gained by New Zealand wholly owned companies, and 68% of revenue was gained by foreign-owned parent companies in Japan (33%), Singapore (14%), France (10%), USA (7%) and Australia (3%). The remaining 12% is made up of other firms.[43]

[43] Other firms are likely to be mostly wine firms, but may include tobacco firms. The ownership of these companies is not specified in the Coriolis report.

Table 44: Top 10 alcohol manufacturers make up 80% of total turnover

Ranking	Company	Sector	Employees in New Zealand	Turnover ($NZ)	Ownership	Market Share (Turnover)
1	Lion	Beer, RTDs, spirits, wine	1,400	605	Japan	19%
2	DB	Beer, RTDs	500	461	Singapore	14%
3	Independent Liquor	Beer, RTDs, spirits, wine	300	414	Japan	13%
4	Pernod Ricard	Wine, spirits	750	337	France	10%
5	Delegat's Group Limited	Wine	219.7	220	NZ	7%
6	Constellation	Wine, beer, spirits	214.6	215	USA	7%
7	Villa Maria	Wine	141.3	141	NZ	4%
8	Treasury Wine Estates	Wine	46.8	106	Australia	3%
9	Wither Hills	Wine	52.7	53	Japan	2%
10	Yealands	Wine	50	50	NZ	2%
11	Giesen	Wine	50	45	NZ	1%
12	Saint Clair Family Estate	Wine	40	40	NZ	1%
13	Mud House Wines	Wine	39.4	39	NZ	1%
14	Sacred Hill	Wine	36	36	NZ	1%
15	Mount Riley	Wine	30	25	NZ	1%
16	Vavasour	Wine		22	NZ	1%
17	Harrington Breweries	Beer	70	20	NZ	1%
18	Foley Family Wines	Wine	22	15	USA	0%
19	Bacardi/ 42 Below	Spirits, RTDs		11	Bermuda	0%
20	VnC Cocktails	RTDs	25	2	NZ	0%
	Other 490 firms[44]	N/A	N/A	382	N/A	12%

Source: Coriolis (2011) Food & Beverage Information Project 2011. Wellington: Coriolis.

Wine production

New Zealand wine has experienced large growth in the past 40 years, and is now recognised internationally as premium source. In 2008, the wine industry was estimated to contribute $1.5 billion to GDP (The Law Commission, 2010, p.22). The wine market is fragmented with over 1000 growers and 700 winery members (Ballingall and Schilling, 2009), and resembles an oligopolistic market structure. Of the top 14 players in the wine market, the top five made up 76% of the revenue generated by these firms in 2010.

The number of wine producers grew by CAGR 8% between 2000 and 2010, and by 12% between 2009 and 2010. According to Coriolis (2011), the wine industry employs the largest number of employees in alcohol manufacturing, with 4,790 employees in 2010.

Of the $1.3 billion turnover generated by the top 14 companies in 2010, 46% was generated by New Zealand owned firms. Fifty-four percent of revenue was gained by foreign-owned parent companies in France (25%), USA (17%), Australia (8%) and Japan (4%). Acquisitions by foreign-owned companies are growing.

[44] "Other" is likely to be mostly wine firms, although it may include tobacco companies.

In 2011, 248 million litres of wine was produced in New Zealand, of which 67% was exported and 33% was available in the domestic market (Figure 29). Seventeen percent of domestic supply was imported, primarily from Australia, contributing to the challenge of oversupply in the domestic market as a result of cheap domestic and imported wine available throughout the country (Coriolis, 2011). In turn, consumers have shifted to low price wine, and the profitability of domestic wine companies have been impacted.

In 2011, wine made up 37% of total standard unit volume sales. Off-licence purchases accounted for 85% of total wine sales purchases and 60% of wine sales value. Consumers continue to switch to off-licence purchases with the average price of wine sold at off-licences almost four times cheaper than on-licence prices, as a result of an oversupply of wine and supermarket discounting.

Twenty-five percent of domestic wine sales were priced below $1.00 per standard drink in 2011 and consequently would be impacted by a minimum price of $1.00 per standard drink. However, since just 33% of wine produced in New Zealand is for the domestic market, in total 8% of wine produced would be impacted by a minimum price of $1.00 per standard drink.

Beer production

The beer brewing sector in New Zealand demonstrates a duopoly market structure and is dominated by two international companies, namely Lion and Dominion Breweries (DB), which were originally founded in New Zealand (Coriolis, 2011). In total, there are approximately 60 breweries in New Zealand.

The number of beer producers fell overall by CAGR -1% between 2000 and 2010, and grew by 31% between 2009 and 2010. Recent growth in the number of manufacturers is attributed to the growth of craft beer production.

There are a number of smaller independent microbreweries producing craft premium beers, which are growing in demand in the domestic market. These small and growing companies use the domestic market as an incubator to test their product viability, before expanding to the export market.

In 2010, 296 million litres of beer was produced in New Zealand, of which 7% was exported and 93% was available on the domestic market. Ten percent of the domestic supply was imported. Imports were 16% higher than exports, which suggests that exports have increased in 2011, as typically imports are at least 50% higher than exports. Smaller microbreweries are driving exports, which were typically driven by Lion and DB in the past (Coriolis, 2011).

The wine glut has also impacted on beer demand, as consumers are switching to low price wine. Beer is the preferred alcoholic beverage, making up 44% of standard unit volume sales in 2011. Off-licence volumes accounted for 70% of total volumes purchased and 41% of the total value of beer sales (Ministry of Justice estimation). Consumers continue to switch to off-licence beer purchases with the average price almost four times cheaper than on-licence prices.

Three percent of domestic beer sales were priced below $1.00 per standard drink in 2011 and consequently would be impacted by a minimum price of $1.00 per standard drink. And since 93% of beer produced in New Zealand is for the domestic market, in total almost 3% of beer produced would be impacted by a minimum price of $1.00 per standard drink.

Spirits production

Lion and Beam Global are the leading players in the spirits market. There are a number of smaller manufacturers, but the market is dominated by imported international brands.

According to Coriolis (2012), there were 27 enterprises involved in spirit manufacturing in 2010, employing 510 people. The number of spirit manufacturers grew by CAGR 8% overall between 2000 and 2010, and by 4% between 2009 and 2010 (Coriolis, 2011).

In 2011, seven million litres of spirits were produced in New Zealand, of which 57% was exported and 43% was available on the domestic market. Seventy-eight percent (10 million litres) of the domestic supply was imported in 2011. The amount imported was 60% greater than the amount exported (in terms of litres).[45]

Spirits make up 12% of standard unit volume sales. In 2011, off-licence purchases accounted for 68% of total volumes purchased and 29% of the total value of spirit sales. The average price of spirits is seven times cheaper than on-licence prices. Like beer, craft spirit brands are growing, and are largely focused on the export market.

Twenty-one percent of domestic spirit sales were priced below $1.00 per standard drink in 2011 and consequently would be impacted by a minimum price of $1.00 per standard drink. As 43% of spirits produced in New Zealand are for the domestic market, in total almost 9% of spirits produced would be impacted by a minimum price of $1.00 per standard drink.

RTDs production

RTDs are one of the fastest growing segments in the Australasian alcohol industry. Independent Liquor, owned by the Japanese company Asahi, controls 60% of the RTD market in New Zealand. Lion and DB are other significant players in this market (Coriolis, 2011).

In 2011, 69 million litres of RTDs were produced in New Zealand, of which 15% was exported and 85% was available on the domestic market. Six percent (4 million litres) of domestic supply was imported in 2011. RTDs make up 8% of standard unit volume sales. In 2011, off-licence purchases accounted for 82% of total purchases and 55% of the total value of beer sales. The average price of RTD's at off-licences is over three times cheaper than on-licence prices.

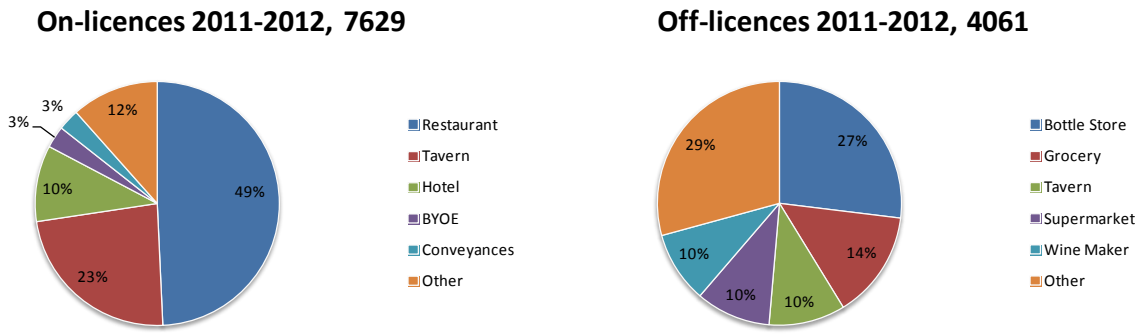
The New Zealand alcohol retail sector: on-licences and off-licences

As at September 2012, there were 14,031 licensed retailers in New Zealand, 51% of which were on-licensed retailers, 27% were off-licensed retailers, and 16% were club licences.[46] Since 2007, the number of alcohol licences has fallen by CAGR 1.3%. Bottle stores and grocery stores account for the largest number of off-licences at 27% and 14% respectively, while restaurants (49%) and taverns (23%) account for the largest proportion of on-licence retailers.

[45] Based on data from Statistics New Zealand and Customs NZ.

[46] Based on data provided by the Liquor Licensing Authority.

Figure 32: Off and On-Licence breakdown by seller type



Sources: Liquor Licensing Authority

Consumer trends indicate that supermarkets (75%) and bottle stores (51%) are the key channels of distribution for off-licence alcohol sales. Restaurants (72%) and bars (61%) are the key channels for on-licence alcohol sales (Huckle et al, 2011). Channel switching to off-licences continues to increase as the price differential between off-licences and on-licences widens due to falling prices offered by the large supermarkets.

New Zealand consumers have a preference for off-licence alcohol, which has grown by 16% since 2004. The proportion of the population purchasing their alcohol from off-licences increased from 64% in 1995 to 76% in 2011, while the proportion purchased at on-licences decreased from 36% in 1995 to 24% in 2011. The preference is driven by the lower prices of alcohol at off-licences. New Zealand consumers' preference for off-licence alcohol purchasing is similar at a total alcohol level to Scotland and England, however, beverage types differ, most notably in terms of New Zealand consumers' preferences for beer and RTDs at off-licences.

Off-licences

There are more than 4000 off-licences operating in New Zealand, which are dominated by two large supermarket chains. Forty-six percent of off-licences are owned by Progressive Enterprises (a New Zealand Co-operative) and Foodstuffs (an Australian owned company) spanning wholesalers, supermarkets, bottle stores and specialist retail stores. Other retailers include low price warehouses, boutiques and wine shops.

In February 2011, there were a total of 904 liquor retail outlets in New Zealand, having grown by 34% from 796 in 2000. The growing number of liquor retail outlets and increasing competition is resulting in decreasing alcohol prices at off-licences. There are approximately 31,000 people employed in liquor retail (Albertson, 2012).

Although supermarkets account for only 10% of off-licences, they are the most widely used channels for alcohol products, despite alcohol sales being limited to wine, beer and cider. The two primary supermarkets dominate the off-licence sector, which has led to the high levels of competition within the off-licence retail market, and the use of pricing strategies such as discount pricing and loss leading (The Law Commission, 2010, p.23). In total, Foodstuffs, Progressive Enterprises, Henry's Beer Wine and Spirits, Liquorland, Duffy & Fin, Liquor King & Super Liquor accounted for 70% of off-licence sales in 2011.[47] Since a proportion of the key retailers are owned by foreign parent companies, a proportion of their revenue goes to overseas shareholders.

Consolidation of the supermarket groups has increased the purchasing power and the number of liquor outlets and distributors that are now owned by supermarkets (Ministry of Economic

[47] Based on price distribution data provided by AC Nielsen.

Development, 2010, p.3). Liquor King is owned by Lion Nathan, while Foodstuffs owns Liquorland, Henry's Beer Wine and Spirits, and Duffy & Fins, and is the wholesale supplier to PAK'n'SAVE, New World and Four Square Supermarkets.

Smaller bottle stores, dairies and specialist retailers make up the remaining 30% of alcohol sales. Specialist retailers in New Zealand face intense competition from supermarkets in terms of marketing and pricing strategies. These include: Super Liquor; Duffy and Finn's; Henry's Beer, Wine and Spirits; King Dicks Liquor Mart; and Liquor Centre.

Due to the density of alcohol outlets regionally, there is strong competition, which encourages highly competitive promotional offers and results in increased consumption. However, the Sale and Supply of Alcohol Act will result in restrictions and bans on which retail outlets can be licensed to sell alcohol.

On-licences

Restaurants, taverns/pubs and hotels make up 81% of on-licences. The on-licence sector of the alcohol industry is much more fragmented than the off-licence sector and appears to be monopolistic, with many retailers selling differentiated products.

From 2001 to 2011, the number of cafés and restaurants grew by 38% to 12,395 and the number of pubs, taverns and bars grew by 24% to 1,639.[48] The "night time economy" has benefited from and grown since the Sale of Liquor Act 1989, as trading hours are less restricted, and bars and clubs are now permitted to remain open into the early hours of the morning (The Law Commission, 2010, p.23).

Market breakdown

In terms of total litre sales in 2011, 76% of domestic litres sales were through off-licences representing 47% of total expenditure on alcohol while 24% of litres sales were sold through on-licences, making up 53% of total expenditure on alcohol.

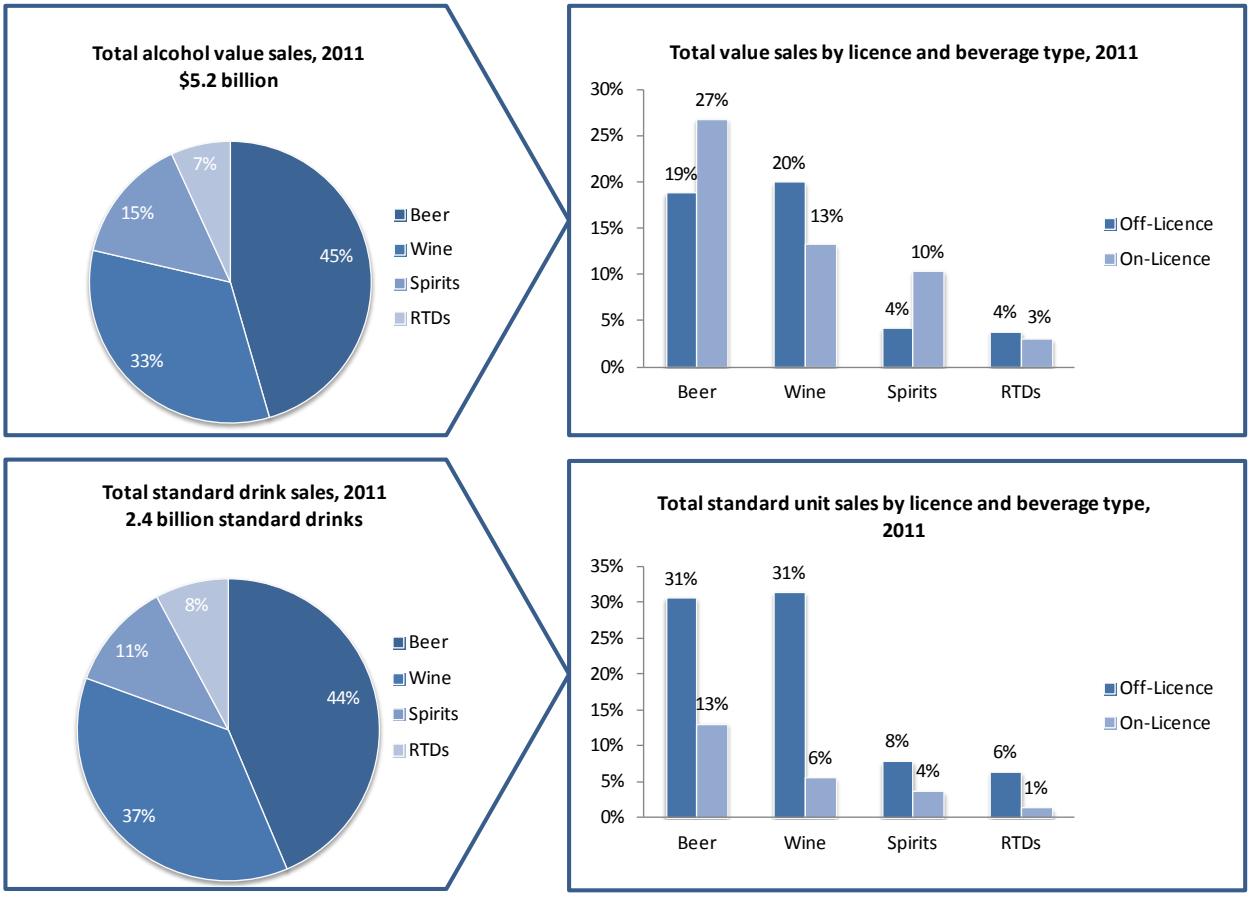
In 2011, the top five beverage types preferred by consumers in terms of the value of sales included: 1) high price beer at off-licences (27%), 2) high price beer at on-licences (16%), 3) low price wine at off-licences (13%), 4) high price spirits at on-licences (10%), and 5) high price wine at off-licences (10%).

The top five beverage types in terms of standard units sold included: 1) low price beer at off-licences (27%), 2) low price wine at off-licences (20%), 3) high price beer at on-licences (13%), 4) high price wine at off-licences (11%), and 5) low price spirits at off-licences (7%).

The top five beverage types in terms of total sales volumes included: 1) low price beer at on-licences (42%), 2) high price beer at on-licences (29%), 3) low price wine at off-licences (12%), 4) high price wine at off-licences (7%) and 5) high price beer at off-licences (6%). Figure 33 provides a comparison of off-licence and on-licence expenditure and volumes.

[48] Statistics New Zealand Business demography tables, accessed from http://www.stats.govt.nz/tools_and_services/tools/TableBuilder/business-statistics.aspx

Figure 33: Comparison of off- and on-licence spending and volumes



Source: Ministry of Justice estimation based on AC Neilson and SHORE and Whariki Centre data

Benefits of the alcohol industry to the economy

It is important to recognise the contribution of the alcohol industry to the national economy. According to a study conducted by NERA (Dodgson et al, 2003), aside from the satisfaction received by consumers of alcohol, the primary contributions of both alcohol consumption and the alcohol industry to the economy are:

- Employment and wages in the industry and associated industries.
- Profits to businesses in the supply chain of alcohol.
- Excise revenue for Government.

Other benefits to the economy include:

- Alcohol export revenue.
- The domestic market as an incubator for start up businesses with intentions to export.
- Moderate alcohol consumption as a social lubricant.
- The production of alcohol (wine, craft beer) is a tourist attraction.
- Complementary link between food and alcohol industries.
- Supports the late night economy and entertainment industry.
- Supports input suppliers and other forward and backward linkages along the supply chain (Hunt, Rabinovich and Baumberg, 2010).

Employment

It is estimated that 70,000 people are employed directly and indirectly in the alcohol industry in New Zealand, primarily in hospitality, but spanning production, distribution, retail and so on (The Law

Commission, 2010, p.58). According to a recent study by Coriolis, 6840 people were employed in the alcohol manufacturing industry in 2010. The wine sector employs the largest proportion of people in terms of production and manufacturing, employing 70% of total employees in this area (Coriolis, 2011).

Employment by beverage manufacturers grew by CAGR 3% between 2000 and 2010 but fell by 4% in 2010. The fall in employees was driven by the numbers employed by the wine sector falling by 8%. The number of employees in spirit production also fell by 2%, while the numbers in beer production increased by 3%. Coriolis highlights that in terms of employee numbers, large firms are significant contributors to employment in the industry, and these firms have been impacted in the past couple of years.

Profits to businesses in the alcohol industry supply chain

At each point in the supply chain, there are profit margins accruing to manufacturers, distributors and retailers, as well as to raw material providers and input suppliers. Thus, the alcohol industry contributes to both the local and national economy. Table 45 highlights that the largest margins for producers are gained by wine sales, followed by beer sales, and the largest margins for retailers are gained for spirit sales, followed by beer sales.

Table 45: Selling Margins of Typical Alcohol Brands

Selling Margin of a Typical Alcohol Brand 2011			
% retail value retail sales price	**Beer**	**Wine**	**Spirits**
GST	13%	13%	13%
Retailer	19%	13%	22%
Distributor	5%	4%	6%
Excise	17%	8%	26%
Manufacturer	46%	59%	34%
TOTAL	100%	100%	100%

Source: Euromonitor International

Government revenue

Alcohol excise duty contributes to Government revenue. Excise is paid by manufacturers and importers of alcoholic products. In 2011, $852 million was gained by the Government in the form of excise duties. The Government also receives revenue from GST paid on alcohol purchases. Companies in the alcohol industry also contribute to Government revenue by paying company tax on profits gained (28% in 2012) (Dodgson et al, 2003). New Zealand resident shareholders also pay their marginal tax rate on dividends from companies (with a credit for tax paid at the company level). Table 46 shows the amount of alcohol excise revenue collected from 2006 to 2011, broken down by domestic production and imports. Over this period, alcohol excise revenue had an annual compound growth rate of 2%.

Table 46: Alcohol excise revenue: 2006-2011

Year Ended	Domestic Production ($m)	Imports ($m)	Total ($m)	Growth Y/Y
30-Jun-11	623	229	852	3%
30-Jun-10	600	225	825	-3%
30-Jun-09	616	231	847	7%
30-Jun-08	573	222	795	4%
30-Jun-07	553	209	762	7%
30-Jun-06	516	197	713	

Source: The Treasury

Appendix 2 – Consumption statistics by age and gender

Figure 34: Median standard drinks per day by drinker type and age and gender

Male					Female				
Age Group	Drinker type	N	Prevalence	Median standard drinks per day	Age Group	Drinker type	N	Prevalence	Median standard drinks per day
18-24	Low risk	50	41.0%	0.5	18-24	Low risk	91	69.5%	0.5
	Increased risk	44	36.1%	3.3		Increased risk	21	16.0%	3.0
	Harmful	28	23.0%	13.3		Harmful	19	14.5%	7.7
25-34	Low risk	63	52.5%	0.8	25-34	Low risk	141	74.2%	0.5
	Increased risk	35	29.2%	3.6		Increased risk	33	17.4%	2.9
	Harmful	22	18.3%	14.2		Harmful	16	8.4%	8.1
35-44	Low risk	116	63.4%	0.7	35-44	Low risk	231	73.3%	0.5
	Increased risk	44	24.0%	2.8		Increased risk	69	21.9%	2.7
	Harmful	23	12.6%	9.7		Harmful	15	4.8%	8.0
45-64	Low risk	210	58.3%	0.7	45-64	Low risk	345	76.3%	0.6
	Increased risk	110	30.6%	3.2		Increased risk	87	19.2%	3.1
	Harmful	40	11.1%	8.3		Harmful	20	4.4%	6.3

Source: SHORE and Whariki Research Centre

Figure 35: Maximum consumption per occasion by drinker type and age and gender

Male					Female				
Age Group	Drinker type	N	Prevalence	Median max standard drinks per occasion	Age Group	Drinker type	N	Prevalence	Median max standard drinks per occasion
18-24	Low risk	18	14.8%	3.5	18-24	Low risk	44	33.6%	3.1
	Increased risk	34	27.9%	12.0		Increased risk	41	31.3%	8.4
	Harmful	70	57.4%	16.8		Harmful	46	35.1%	13.7
25-34	Low risk	39	32.5%	3.2	25-34	Low risk	97	51.1%	3.1
	Increased risk	32	26.7%	11.1		Increased risk	52	27.4%	7.8
	Harmful	49	40.8%	13.4		Harmful	41	21.6%	10.1
35-44	Low risk	84	45.9%	3.4	35-44	Low risk	185	58.7%	3.1
	Increased risk	55	30.1%	10.0		Increased risk	93	29.5%	6.7
	Harmful	44	24.0%	12.8		Harmful	37	11.7%	9.8
45-64	Low risk	182	50.6%	3.1	45-64	Low risk	335	74.1%	3.1
	Increased risk	94	26.1%	6.7		Increased risk	81	17.9%	5.8
	Harmful	84	23.3%	7.9		Harmful	36	8.0%	7.8

Source: SHORE and Whariki Research Centre

Appendix 3 – University of Sheffield elasticity estimates[49]

Table 47: University of Sheffield Price Elasticity Estimates for Low Risk Drinkers, from 5 years of EFS data for 16 Alcohol Categories

			OFF								ON							
			Beer		Wine		Spirit		RTD		Beer		Wine		Spirit		RTD	
Licence type	Alcohol type	Price level	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi
Off	Beer	Low	-0.422	0.004	0.002	0.008	0.001	0.006	0.000	0.004	0.013	0.016	0.000	0.002	0.003	0.005	0.000	0.005
		Hi	0.004	-0.422	0.003	0.010	0.001	0.004	0.000	0.003	0.013	0.017	0.000	0.003	0.003	0.006	0.001	0.006
	Wine	Low	0.005	0.006	-0.413	0.003	0.001	0.003	0.000	0.002	0.012	0.010	0.000	0.000	0.003	0.003	0.000	0.004
		Hi	0.004	0.006	0.001	-0.461	0.001	0.003	0.000	0.002	0.011	0.016	0.000	0.002	0.004	0.004	0.000	0.005
	Spirit	Low	0.003	0.010	0.002	0.010	-0.513	0.003	0.000	0.002	0.015	0.014	0.000	-0.001	0.002	0.003	0.000	0.003
		Hi	0.005	0.006	0.001	0.009	0.001	-0.524	0.000	0.002	0.012	0.016	0.000	0.002	0.003	0.004	0.000	0.004
	RTDs	Low	0.012	0.008	0.002	0.001	0.000	0.001	-0.315	0.001	0.012	0.007	0.000	-0.001	0.002	-0.008	0.000	0.004
		Hi	0.006	0.010	0.000	0.005	0.001	0.003	0.000	-0.329	0.008	0.010	0.000	0.002	0.002	0.003	0.000	0.004
On	Beer	Low	0.005	0.007	0.003	0.008	0.001	0.005	0.000	0.003	-0.378	0.026	0.000	0.004	0.004	0.008	0.001	0.006
		Hi	0.006	0.009	0.002	0.009	0.001	0.004	0.000	0.003	0.021	-0.406	0.000	0.000	0.005	0.012	0.001	0.008
	Wine	Low	0.001	-0.002	0.001	0.003	0.002	0.002	0.000	0.001	0.015	0.015	-0.233	0.001	0.001	0.007	0.000	0.006
		Hi	0.002	0.003	0.001	0.005	0.001	0.003	0.000	0.001	0.012	0.007	0.000	-0.291	0.002	0.005	0.001	0.004
	Spirit	Low	0.002	0.001	0.003	0.010	0.000	0.000	0.000	0.000	0.003	-0.011	0.000	0.019	-1.781	0.010	0.002	0.018
		Hi	0.002	0.001	0.001	0.002	0.000	0.000	0.000	0.001	-0.004	-0.006	-0.001	-0.010	-0.001	-0.189	0.000	-0.002
	RTDs	Low	0.002	0.002	0.000	-0.004	0.000	0.001	0.000	0.001	0.008	0.006	-0.002	0.009	0.041	-0.015	-0.330	0.007
		Hi	0.001	0.002	0.000	0.002	0.001	0.002	0.000	0.001	0.009	0.001	0.000	0.004	0.005	-0.009	0.001	-0.319

[49] Note at standard errors for the elasticity estimates are not provided in the University of Sheffield report.

Table 48: University of Sheffield Price Elasticity Estimates for Increased Risk and Harmful Drinkers, from 5 years of EFS data for 16 Alcohol Categories

			OFF								ON							
			Beer		Wine		Spirit		RTD		Beer		Wine		Spirit		RTD	
Licence type	Alcohol type	Price level	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi
Off	Beer	Low	-0.590	0.009	0.009	0.037	0.004	0.006	0.000	0.001	0.017	0.025	0.000	0.004	0.002	0.007	0.000	0.005
		Hi	0.009	-0.575	0.010	0.036	0.004	0.003	0.000	0.001	0.014	0.021	0.001	0.003	0.002	0.006	0.000	0.005
	Wine	Low	0.020	0.014	-0.560	0.012	0.002	0.007	0.000	0.004	0.025	0.028	0.000	0.001	0.001	0.005	0.001	0.004
		Hi	0.017	0.015	0.005	-0.626	0.005	0.006	0.000	0.001	0.028	0.039	0.000	0.003	0.000	0.009	0.001	0.004
	Spirit	Low	0.006	0.012	0.004	0.021	-0.627	0.002	0.000	0.000	0.018	0.021	0.001	0.004	0.000	-0.001	0.000	0.000
		Hi	0.006	0.004	0.004	0.018	0.002	-0.646	0.000	0.001	0.021	0.024	0.000	0.003	0.000	-0.001	0.000	0.001
	RTDs	Low	-0.005	-0.012	0.004	0.018	-0.005	-0.001	-0.382	-0.001	0.002	0.004	0.000	0.001	-0.001	0.021	0.000	-0.001
		Hi	0.000	-0.002	0.014	0.007	0.005	0.006	0.000	-0.416	0.002	0.008	0.000	0.000	-0.003	0.004	0.000	0.001
On	Beer	Low	0.020	0.018	0.013	0.046	0.005	0.006	0.000	0.002	-0.616	0.052	-0.001	0.003	0.004	0.006	-0.001	0.009
		Hi	0.020	0.019	0.011	0.042	0.005	0.006	0.000	0.002	0.033	-0.633	0.000	-0.003	0.005	0.002	0.000	0.003
	Wine	Low	0.005	-0.003	-0.001	-0.001	-0.002	0.012	0.000	-0.004	-0.031	0.012	-0.380	0.000	-0.002	-0.007	0.003	0.005
		Hi	0.010	0.005	0.002	0.012	0.003	0.005	0.000	0.001	0.015	-0.004	0.000	-0.411	-0.003	-0.005	0.001	0.003
	Spirit	Low	0.018	0.019	-0.002	0.004	-0.001	-0.004	0.000	0.000	0.015	0.013	-0.001	0.028	-3.722	0.023	-0.002	-0.014
		Hi	0.007	0.002	0.006	0.018	-0.001	-0.002	0.000	-0.003	-0.005	-0.018	0.000	-0.002	-0.001	-0.286	0.000	-0.004
	RTDs	Low	0.005	0.004	-0.005	0.004	-0.005	0.005	0.000	0.001	0.006	0.012	0.005	0.002	0.068	-0.030	-0.393	0.014
		Hi	0.002	0.000	0.005	0.010	0.002	-0.002	0.000	0.000	0.015	0.002	0.001	0.009	0.002	-0.005	0.001	-0.419

Appendix 4 – Summary of purchase changes at off-licences and on-licences by beverage type

SUMMARY TOTAL	Mean annual purchases per drinker (units)															
		Off-licence								On-licence							
Pricing option	% change in purchases (all beverages)	Beer low price	Beer high price	Wine low price	Wine high price	Spirits low price	Spirits high price	RTDs low price	RTDs high price	Beer low price	Beer high price	Wine low price	Wine high price	Spirits low price	Spirits high price	RTDs low price	RTDs high price
Minimum price of $1.00	-2.4	-0.3	0.3	-6.3	0.4	-9.8	0.1	-1.1	0.1	0.6	0.6	0.0	0.0	0.0	0.1	0.0	0.1
Minimum price of $1.10	-3.4	-0.6	0.5	-9.1	0.6	-13.3	0.2	-2.1	0.1	0.9	0.9	0.0	0.1	0.0	0.2	0.0	0.1
Minimum price of $1.20	-4.7	-1.0	0.6	-12.5	0.9	-18.3	0.2	-3.5	0.1	1.2	1.3	0.0	0.1	0.0	0.3	0.0	0.1
Excise increase of 82%	-12.2	-9.7	-5.9	-12.6	-5.6	-36.5	-18.6	-10.3	-6.4	-7.5	2.3	-14.7	0.9	-100.0	0.1	-10.4	-3.1
Excise increase of 107%	-19.5	-15.9	-9.6	-20.5	-9.1	-59.3	-30.4	-16.7	-10.4	-11.8	3.5	-18.6	2.6	-100.0	0.3	-17.0	-5.1
Excise increase of 133%	-11.9	-9.4	-5.2	-12.6	-5.3	-36.6	-18.7	-10.6	-6.4	-6.9	2.6	-14.7	2.0	-100.0	1.0	-10.5	-3.5

Source: Estimated by the Ministry of Justice based on University of Sheffield elasticity estimates

Appendix 5 – Impact of the pricing policies on alcohol-related harm

Table 49: Impact on alcohol-related harm costs for a minimum price of $1.00 per standard drink

Areas of harm				Male					Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+ year olds	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+ year olds
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-12	-2	-2	-2	-2	-1	-1	0	-1	-1	0
		Total	-13	-2	-2	-2	-2	-1	-1	0	-1	-1	0
	Admissions (number of people)	Chronic	2	0	0	0	0	1	0	0	0	0	0
		Acute	-305	-56	-40	-32	-31	-27	-32	-25	-24	-29	-9
		Total	-302	-56	-40	-32	-30	-26	-32	-25	-24	-29	-8
	Change in cost ($000)	Chronic (admissions)	24	0.01	0.1	0.7	4.5	11.8	0.1	0.1	0.2	1.1	5.7
		Acute (admissions)	-2,180	-331	-252	-219	-270	-346	-151	-132	-159	-211	-111
		ACC	-7,575	-1,181	-1,351	-1,340	-829	-142	-611	-675	-748	-665	-33
		Pharmaceuticals	-18										
		Specialist	-1,401										
		Total	-11,151	-1,513	-1,603	-1,558	-1,094	-476	-761	-807	-906	-875	-137
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-1,078	-46	-67	-84	-387	-83	-29	-44	-65	-168	-104
		Acute (admissions)	-16,428	-2,426	-1,933	-1,543	-1,996	-2,862	-1,115	-971	-1,106	-1,577	-900
		ACC	-54,898	-8,560	-9,792	-9,712	-6,007	-1,027	-4,428	-4,895	-5,420	-4,821	-237
		Pharmaceuticals	-133										
		Specialist	-10,153										
		Total	-82,690	-11,033	-11,792	-11,338	-8,390	-3,972	-5,572	-5,910	-6,590	-6,566	-1,240
Crime changes per annum	Volume	Violence incl threats	6,189	1,176	1,178	906	1,502	0	334	381	349	364	0
		Burglary/theft	933	381	190	84	131	0	52	38	34	24	0
		Property damage	5,144	1,739	1,010	544	741	0	288	293	260	269	0
		Driving offences	586	133	93	65	133	0	44	40	34	44	0
		Other incl robbery, fraud	1,041	348	203	89	203	0	50	61	37	49	0
		Total	13,892	3,776	2,673	1,689	2,709	0	769	813	713	749	0
	Change in cost ($000)	Violence	-26,508	-5,537	-4,621	-3,675	-7,078	0	-1,304	-1,663	-1,287	-1,343	0
		Burglary/theft	-2,641	-1,077	-549	-246	-367	0	-140	-103	-94	-65	0
		Property damage	-2,682	-907	-527	-284	-386	0	-150	-153	-135	-141	0
		Driving offences	-9,953	-2,475	-1,773	-1,180	-2,434	0	-631	-633	-302	-523	0
		Other	-3,342	-1,150	-702	-215	-605	0	-207	-234	-109	-120	0
		Total	-45,126	-11,146	-8,172	-5,599	-10,869	0	-2,433	-2,786	-1,928	-2,192	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-8.4	-1.6	-1.6	-1.6	-1.8	0	-0.4	-0.3	-0.4	-0.6	0
		Unemployment (people)	-451	-64	-90	-82	-119	0	-34	-18	-15	-29	0
		Absenteeism (days)	-7.0	-2.8	-3.3	-0.3	-0.2	0	-0.3	-0.1	-0.1	0.0	0
		Impaired productivity (days)	-9.1	-2.3	-3.9	-0.3	-0.8	0	-0.5	-0.6	-0.5	-0.2	0
	Change in cost ($000)	Mortality	-76	-10	-15	-19	-19	0	-2	-2	-3	-5	0
		Unemployment	-7,498	-701	-1,489	-1,739	-2,286	0	-323	-256	-241	-463	0
		Absenteeism	-757	-243	-403	-43	-22	0	-19	-10	-15	-2	0
		Impaired productivity	-1,010	-200	-476	-48	-114	0	-33	-62	-51	-24	0
		Total	-9,341	-1,155	-2,383	-1,850	-2,442	0	-378	-331	-310	-493	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-11,151	-1,513	-1,603	-1,558	-1,094	-476	-761	-807	-906	-875	-137
	Crime costs ($000)		-45,126	-11,146	-8,172	-5,599	-10,869	0	-2,433	-2,786	-1,928	-2,192	0
	Workplace productivity costs ($000)		-9,341	-1,155	-2,383	-1,850	-2,442	0	-378	-331	-310	-493	0
	Total societal costs ($000)		-65,618	-13,813	-12,158	-9,007	-14,405	-476	-3,572	-3,924	-3,144	-3,561	-137
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-82,690	-11,033	-11,792	-11,338	-8,390	-3,972	-5,572	-5,910	-6,590	-6,566	-1,240
	Crime costs ($000)		-323,515	-79,436	-62,861	-37,022	-77,907	0	-16,938	-20,661	-12,731	-15,959	0
	Workplace productivity costs ($000)		-69,761	-8,561	-19,117	-12,710	-18,219	0	-2,733	-2,554	-2,128	-3,738	0
	Total cumulative costs ($000)		-475,966	-99,030	-93,770	-61,070	-104,516	-3,972	-25,244	-29,126	-21,450	-26,263	-1,240

Table 50: Impact on alcohol-related harm costs for a minimum price of $1.10 per standard drink

Areas of harm				Male					Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+ year olds	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+ year olds
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-18	-4	-3	-3	-3	-2	-1	-1	-1	-1	0
		Total	-18	-4	-3	-3	-3	-2	-1	-1	-1	-1	-1
	Admissions (number of people)	Chronic	3	0	0	0	1	2	0	0	0	0	1
		Acute	-445	-82	-58	-46	-45	-40	-47	-36	-35	-43	-12
		Total	-441	-82	-58	-46	-44	-38	-47	-36	-35	-43	-12
	Change in cost ($000)	Chronic (admissions)	34.3	0.01	0.1	1.0	6.4	16.7	0.1	0.2	0.3	1.5	8.0
		Acute (admissions)	-3,182	-485	-368	-319	-393	-505	-220	-192	-231	-308	-161
		ACC	-11,058	-1,728	-1,974	-1,955	-1,209	-207	-893	-985	-1,089	-970	-48
		Pharmaceuticals	-26										
		Specialist	-1,999										
		Total	-16,231	-2,213	-2,342	-2,273	-1,596	-695	-1,113	-1,177	-1,320	-1,276	-200
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-1,546	-66	-96	-120	-552	-124	-42	-63	-93	-240	-150
		Acute (admissions)	-23,973	-3,550	-2,824	-2,250	-2,910	-4,173	-1,629	-1,417	-1,611	-2,300	-1,309
		ACC	-80,135	-12,525	-14,308	-14,165	-8,759	-1,497	-6,470	-7,141	-7,895	-7,031	-344
		Pharmaceuticals	-190										
		Specialist	-14,485										
		Total	-120,329	-16,141	-17,228	-16,535	-12,221	-5,794	-8,141	-8,621	-9,599	-9,571	-1,803
Crime changes per annum	Volume	Violence incl threats	9,087	1,726	1,730	1,330	2,205	0	490	559	513	535	0
		Burglary/theft	1,370	560	278	124	192	0	76	55	49	35	0
		Property damage	7,553	2,553	1,483	799	1,088	0	423	430	382	395	0
		Driving offences	860	195	136	96	195	0	65	59	50	64	0
		Other incl robbery, fraud	1,528	511	298	131	299	0	74	90	54	72	0
		Total	20,397	5,545	3,925	2,480	3,978	0	1,129	1,194	1,048	1,100	0
	Change in cost ($000)	Violence	-38,796	-8,129	-6,785	-5,270	-10,392	0	-1,915	-2,442	-1,890	-1,972	0
		Burglary/theft	-3,877	-1,581	-806	-361	-538	0	-206	-151	-138	-96	0
		Property damage	-3,939	-1,332	-773	-417	-566	0	-220	-225	-199	-206	0
		Driving offences	-14,614	-3,635	-2,604	-1,733	-3,574	0	-926	-930	-444	-768	0
		Other	-4,907	-1,689	-1,031	-315	-888	0	-304	-343	-160	-177	0
		Total	-66,132	-16,366	-11,999	-8,096	-15,959	0	-3,572	-4,091	-2,831	-3,219	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-12.2	-2.3	-2.4	-2.4	-2.7	0	-0.6	-0.4	-0.6	-0.9	0
		Unemployment (people)	-645.4	-91.5	-129.4	-117.1	-170.3	0	-49.1	-26.4	-20.8	-40.8	0
		Absenteeism (days)	-10.3	-4.1	-4.8	-0.4	-0.2	0	-0.4	-0.1	-0.2	0.0	0
		Impaired productivity (days)	-13.4	-3.3	-5.7	-0.5	-1.2	0	-0.8	-0.9	-0.7	-0.4	0
	Change in cost ($000)	Mortality	-110	-15	-22	-28	-28	0	-3	-3	-5	-7	0
		Unemployment	-10,736	-1,004	-2,132	-2,490	-3,273	0	-463	-366	-346	-662	0
		Absenteeism	-1,112	-358	-593	-63	-32	0	-28	-15	-21	-3	0
		Impaired productivity	-1,480	-295	-700	-70	-166	0	-49	-92	-74	-35	0
		Total	-13,439	-1,670	-3,446	-2,652	-3,500	0	-542	-476	-446	-707	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-16,231	-2,213	-2,342	-2,273	-1,596	-695	-1,113	-1,177	-1,320	-1,276	-200
	Crime costs ($000)		-66,132	-16,366	-11,999	-8,096	-15,959	0	-3,572	-4,091	-2,831	-3,219	0
	Workplace productivity costs ($000)		-13,439	-1,670	-3,446	-2,652	-3,500	0	-542	-476	-446	-707	0
	Total societal costs ($000)		-95,802	-20,249	-17,787	-13,021	-21,054	-695	-5,227	-5,744	-4,597	-5,203	-200
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-120,329	-16,141	-17,228	-16,535	-12,221	-5,794	-8,141	-8,621	-9,599	-9,571	-1,803
	Crime costs ($000)		-474,188	-116,636	-92,299	-53,530	-114,391	0	-24,870	-30,336	-18,693	-23,433	0
	Workplace productivity costs ($000)		-100,384	-12,386	-27,642	-18,223	-26,111	0	-3,925	-3,677	-3,061	-5,360	0
	Total cumulative costs ($000)		-694,900	-145,163	-137,168	-88,288	-152,723	-5,794	-36,937	-42,633	-31,353	-38,363	-1,803

Table 51: Impact on alcohol-related harm costs for a minimum price of $1.20 per standard drink

Areas of harm			Male						Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-26	-5	-4	-4	-5	-3	-1	-1	-1	-2	-1
		Total	-26	-5	-4	-4	-4	-3	-1	-1	-1	-2	-1
	Admissions (number of people)	Chronic	4	0	0	0	1	2	0	0	0	0	1
		Acute	-629	-117	-82	-65	-64	-57	-66	-51	-49	-60	-18
		Total	-625	-117	-82	-65	-63	-55	-66	-51	-49	-60	-17
	Change in cost ($000)	Chronic (admissions)	47	0.02	0.1	1.4	8.8	23.1	0.1	0.2	0.4	2.2	11.1
		Acute (admissions)	-4,502	-689	-522	-451	-558	-716	-312	-271	-325	-430	-228
		ACC	-15,640	-2,456	-2,805	-2,761	-1,714	-293	-1,265	-1,390	-1,531	-1,357	-67
		Pharmaceuticals	-37										
		Specialist	-2,783										
		Total	-22,914	-3,145	-3,327	-3,211	-2,263	-986	-1,577	-1,661	-1,856	-1,785	-284
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-2,155	-93	-135	-167	-770	-176	-59	-87	-129	-332	-209
		Acute (admissions)	-33,920	-5,045	-4,011	-3,179	-4,126	-5,917	-2,310	-1,999	-2,264	-3,217	-1,852
		ACC	-113,342	-17,801	-20,324	-20,012	-12,420	-2,123	-9,171	-10,076	-11,097	-9,832	-487
		Pharmaceuticals	-265										
		Specialist	-20,171										
		Total	-169,853	-22,938	-24,470	-23,358	-17,316	-8,216	-11,539	-12,162	-13,490	-13,380	-2,548
Crime changes per annum	Volume	Violence incl threats	12,960	2,462	2,467	1,896	3,145	0	699	797	731	763	0
		Burglary/theft	1,953	798	397	176	274	0	109	79	70	49	0
		Property damage	10,772	3,641	2,115	1,140	1,551	0	604	614	544	563	0
		Driving offences	1,227	278	194	137	278	0	92	85	72	91	0
		Other incl robbery, fraud	2,180	729	425	187	426	0	105	128	77	103	0
		Total	29,092	7,908	5,598	3,537	5,674	0	1,610	1,703	1,494	1,569	0
	Change in cost ($000)	Violence	-55,220	-11,595	-9,677	-7,403	-14,823	0	-2,731	-3,482	-2,695	-2,813	0
		Burglary/theft	-5,530	-2,255	-1,149	-515	-768	0	-294	-216	-197	-137	0
		Property damage	-5,617	-1,899	-1,103	-595	-808	0	-314	-321	-284	-294	0
		Driving offences	-20,844	-5,184	-3,714	-2,471	-5,098	0	-1,321	-1,327	-633	-1,096	0
		Other	-6,998	-2,409	-1,471	-449	-1,266	0	-434	-489	-229	-252	0
		Total	-94,210	-23,342	-17,114	-11,433	-22,762	0	-5,095	-5,835	-4,037	-4,591	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-17.3	-3.3	-3.4	-3.4	-3.8	0	-0.8	-0.6	-0.8	-1.2	0
		Unemployment (people)	-909.0	-128.9	-182.3	-164.9	-239.9	0	-69.2	-37.2	-29.3	-57.5	0
		Absenteeism (days)	-14.8	-5.8	-6.9	-0.6	-0.3	0	-0.6	-0.2	-0.3	0.0	0
		Impaired productivity (days)	-19.1	-4.8	-8.1	-0.7	-1.7	0	-1.1	-1.2	-1.0	-0.5	0
	Change in cost ($000)	Mortality	-156	-21	-32	-39	-40	0	-4	-5	-7	-9	0
		Unemployment	-15,121	-1,413	-3,002	-3,507	-4,610	0	-652	-516	-487	-933	0
		Absenteeism	-1,590	-512	-848	-90	-46	0	-39	-21	-30	-5	0
		Impaired productivity	-2,113	-421	-1,001	-100	-234	0	-70	-131	-106	-50	0
		Total	-18,980	-2,367	-4,882	-3,737	-4,931	0	-765	-672	-630	-997	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-22,914	-3,145	-3,327	-3,211	-2,263	-986	-1,577	-1,661	-1,856	-1,785	-284
	Crime costs ($000)		-94,210	-23,342	-17,114	-11,433	-22,762	0	-5,095	-5,835	-4,037	-4,591	0
	Workplace productivity costs ($000)		-18,980	-2,367	-4,882	-3,737	-4,931	0	-765	-672	-630	-997	0
	Total societal costs ($000)		-136,104	-28,855	-25,323	-18,382	-29,955	-986	-7,437	-8,168	-6,522	-7,373	-284
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-169,853	-22,938	-24,470	-23,358	-17,316	-8,216	-11,539	-12,162	-13,490	-13,380	-2,548
	Crime costs ($000)		-675,573	-166,356	-131,644	-75,595	-163,154	0	-35,472	-43,268	-26,662	-33,422	0
	Workplace productivity costs ($000)		-141,783	-17,552	-39,158	-25,683	-36,786	0	-5,537	-5,193	-4,320	-7,553	0
	Total cumulative costs ($000)		-987,208	-206,846	-195,273	-124,636	-217,255	-8,216	-52,548	-60,623	-44,472	-54,356	-2,548

Table 52: Impact on alcohol-related harm costs for an excise increase of 82%

Areas of harm				Male					Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-97	-19	-15	-14	-17	-11	-5	-3	-4	-6	-3
		Total	-97	-19	-15	-14	-17	-11	-5	-3	-4	-6	-3
	Admissions (number of people)	Chronic	11	0	0	0	2	6	0	0	0	1	2
		Acute	-2370	-430	-305	-248	-243	-216	-247	-193	-190	-229	-68
		Total	-2360	-430	-305	-248	-241	-210	-247	-193	-190	-229	-66
	Change in cost ($000)	Chronic (admissions)	109	0.04	0.3	3	20	57	0.2	0.5	0.6	4.6	22
		Acute (admissions)	-17,005	-2,527	-1,943	-1,715	-2,120	-2,721	-1,161	-1,030	-1,254	-1,649	-885
		ACC	-58,927	-9,008	-10,430	-10,493	-6,515	-1,114	-4,711	-5,281	-5,913	-5,200	-262
		Pharmaceuticals	-97										
		Specialist	-7,375										
		Total	-83,295	-11,536	-12,372	-12,205	-8,615	-3,778	-5,872	-6,310	-7,167	-6,844	-1,125
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-5,950	-259	-375	-460	-2,084	-570	-155	-227	-338	-840	-643
		Acute (admissions)	-128,174	-18,505	-14,921	-12,082	-15,687	-22,502	-8,599	-7,594	-8,743	-12,330	-7,211
		ACC	-427,035	-65,282	-75,585	-76,042	-47,213	-8,071	-34,141	-38,268	-42,854	-37,682	-1,897
		Pharmaceuticals	-701										
		Specialist	-53,447										
		Total	-615,307	-84,046	-90,882	-88,584	-64,985	-31,142	-42,895	-46,088	-51,935	-50,853	-9,751
Crime changes per annum	Volume	Violence incl threats	45,759	8,693	8,710	6,695	11,105	0	2,468	2,814	2,581	2,693	0
		Burglary/theft	6,897	2,818	1,402	623	967	0	385	279	248	174	0
		Property damage	38,035	12,856	7,468	4,024	5,477	0	2,132	2,168	1,921	1,988	0
		Driving offences	4,331	982	685	483	980	0	326	299	253	322	0
		Other incl robbery, fraud	7,697	2,573	1,499	661	1,505	0	372	454	272	362	0
		Total	102,719	27,922	19,764	12,487	20,033	0	5,683	6,014	5,275	5,540	0
	Change in cost ($000)	Violence	-194,291	-40,939	-34,169	-25,461	-52,335	0	-9,644	-12,295	-9,517	-9,930	0
		Burglary/theft	-19,526	-7,962	-4,059	-1,818	-2,711	0	-1,039	-761	-695	-482	0
		Property damage	-19,834	-6,706	-3,894	-2,099	-2,851	0	-1,110	-1,133	-1,001	-1,039	0
		Driving offences	-73,594	-18,304	-13,112	-8,726	-17,999	0	-4,666	-4,684	-2,235	-3,870	0
		Other	-24,710	-8,505	-5,193	-1,586	-4,470	0	-1,532	-1,727	-807	-889	0
		Total	-331,955	-82,416	-60,427	-39,691	-80,366	0	-17,990	-20,601	-14,255	-16,211	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-65.1	-12.1	-12.5	-12.9	-14.4	0	-3.0	-2.3	-3.3	-4.6	0
		Unemployment (people)	-2740.8	-388.5	-549.5	-497.3	-723.3	0	-208.5	-112.0	-88.3	-173.3	0
		Absenteeism (days)	-53.9	-21.1	-25.0	-2.2	-1.2	0	-2.3	-0.7	-1.1	-0.2	0
		Impaired productivity (days)	-70.9	-17.3	-29.5	-2.5	-7.1	0	-4.2	-4.6	-3.9	-1.9	0
	Change in cost ($000)	Mortality	-589	-76	-118	-149	-153	0	-15	-18	-26	-35	0
		Unemployment	-45,591	-4,262	-9,052	-10,576	-13,901	0	-1,965	-1,556	-1,468	-2,812	0
		Absenteeism	-5,795	-1,853	-3,077	-331	-171	0	-150	-79	-117	-17	0
		Impaired productivity	-7,870	-1,522	-3,624	-382	-991	0	-269	-489	-409	-185	0
		Total	-59,845	-7,713	-15,871	-11,437	-15,216	0	-2,398	-2,142	-2,019	-3,050	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-83,295	-11,536	-12,372	-12,205	-8,615	-3,778	-5,872	-6,310	-7,167	-6,844	-1,125
	Crime costs ($000)		-331,955	-82,416	-60,427	-39,691	-80,366	0	-17,990	-20,601	-14,255	-16,211	0
	Workplace productivity costs ($000)		-59,845	-7,713	-15,871	-11,437	-15,216	0	-2,398	-2,142	-2,019	-3,050	0
	Total societal costs ($000)		-475,096	-101,664	-88,670	-63,332	-104,197	-3,778	-26,260	-29,053	-23,440	-26,106	-1,125
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-615,307	-84,046	-90,882	-88,584	-64,985	-31,142	-42,895	-46,088	-51,935	-50,853	-9,751
	Crime costs ($000)		-2,380,815	-587,365	-464,806	-262,430	-576,059	0	-125,244	-152,769	-94,137	-118,005	0
	Workplace productivity costs ($000)		-447,484	-57,190	-127,291	-78,595	-113,521	0	-17,362	-16,549	-13,857	-23,120	0
	Total cumulative costs ($000)		-3,443,607	-728,601	-682,979	-429,609	-754,564	-31,142	-185,500	-215,406	-159,928	-191,978	-9,751

Table 53: Impact on alcohol-related harm costs for an excise increase of 107%

Areas of harm				Male					Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-121	-24	-18	-18	-22	-13	-5	-4	-6	-8	-3
		Total	-121	-24	-18	-18	-22	-14	-5	-4	-6	-8	-3
	Admissions (number of people)	Chronic	15	0	0	0	4	7	0	0	0	1	3
		Acute	-2863	-543	-385	-307	-306	-273	-194	-243	-239	-286	-86
		Total	-2848	-543	-385	-307	-303	-266	-194	-243	-238	-285	-83
	Change in cost ($000)	Chronic (admissions)	163	0.1	0.4	4	46	73	0.3	0.6	0.7	6.7	31
		Acute (admissions)	-20,888	-3,191	-2,454	-2,126	-2,676	-3,436	-961	-1,295	-1,573	-2,059	-1,117
		ACC	-74,007	-11,375	-13,173	-13,010	-8,225	-1,406	-5,940	-6,639	-7,417	-6,491	-330
		Pharmaceuticals	-126										
		Specialist	-9,573										
		Total	-104,430	-14,566	-15,627	-15,131	-10,856	-4,769	-6,901	-7,933	-8,990	-8,544	-1,417
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-7,418	-337	-489	-593	-2,381	-773	-214	-295	-442	-1,081	-813
		Acute (admissions)	-157,540	-23,368	-18,847	-14,981	-19,806	-28,410	-7,122	-9,547	-10,967	-15,393	-9,100
		ACC	-536,319	-82,432	-95,467	-94,280	-59,607	-10,189	-43,044	-48,111	-53,753	-47,042	-2,394
		Pharmaceuticals	-910										
		Specialist	-69,372										
		Total	-771,559	-106,137	-114,803	-109,853	-81,795	-39,373	-50,380	-57,953	-65,162	-63,516	-12,306
Crime changes per annum	Volume	Violence incl threats	57,855	10,991	11,012	8,465	14,040	0	3,120	3,557	3,264	3,405	0
		Burglary/theft	8,720	3,563	1,773	788	1,222	0	487	353	314	220	0
		Property damage	48,088	16,254	9,442	5,088	6,924	0	2,696	2,741	2,429	2,514	0
		Driving offences	5,475	1,242	866	611	1,240	0	412	378	320	408	0
		Other incl robbery, fraud	9,732	3,253	1,895	836	1,902	0	470	574	344	458	0
		Total	129,870	35,303	24,988	15,787	25,329	0	7,185	7,603	6,670	7,005	0
	Change in cost ($000)	Violence	-245,575	-51,760	-43,201	-32,121	-66,169	0	-12,193	-15,545	-12,032	-12,555	0
		Burglary/theft	-24,687	-10,067	-5,131	-2,299	-3,427	0	-1,313	-962	-879	-610	0
		Property damage	-25,076	-8,479	-4,923	-2,654	-3,605	0	-1,403	-1,433	-1,266	-1,314	0
		Driving offences	-93,047	-23,142	-16,578	-11,032	-22,756	0	-5,899	-5,922	-2,825	-4,893	0
		Other	-31,241	-10,753	-6,566	-2,006	-5,652	0	-1,937	-2,184	-1,020	-1,124	0
		Total	-419,628	-104,200	-76,399	-50,111	-101,608	0	-22,745	-26,047	-18,022	-20,496	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-81.8	-15.3	-15.8	-16.0	-18.2	0	-3.7	-2.9	-4.1	-5.7	0
		Unemployment (people)	-3,558	-504	-713	-646	-939	0	-271	-145	-115	-225	0
		Absenteeism (days)	-68	-27	-32	-2.8	-1.5	0	-3.0	-0.9	-1.4	-0.2	0
		Impaired productivity (days)	-90	-22	-37	-3.2	-9	0	-5	-6	-5.0	-2.4	0
	Change in cost ($000)	Mortality	-740	-96	-149	-185	-193	0	-18	-23	-32	-44	0
		Unemployment	-59,188	-5,533	-11,751	-13,729	-18,046	0	-2,551	-2,020	-1,905	-3,651	0
		Absenteeism	-7,334	-2,346	-3,895	-419	-216	0	-189	-100	-148	-22	0
		Impaired productivity	-9,956	-1,927	-4,588	-483	-1,250	0	-340	-618	-517	-235	0
		Total	-77,218	-9,901	-20,383	-14,815	-19,705	0	-3,099	-2,761	-2,602	-3,952	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-104,430	-14,566	-15,627	-15,131	-10,856	-4,769	-6,901	-7,933	-8,990	-8,544	-1,417
	Crime costs ($000)		-419,628	-104,200	-76,399	-50,111	-101,608	0	-22,745	-26,047	-18,022	-20,496	0
	Workplace productivity costs ($000)		-77,218	-9,901	-20,383	-14,815	-19,705	0	-3,099	-2,761	-2,602	-3,952	0
	Total societal costs ($000)		-601,276	-128,668	-112,408	-80,058	-132,169	-4,769	-32,744	-36,740	-29,614	-32,991	-1,417
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-771,559	-106,137	-114,803	-109,853	-81,795	-39,373	-50,380	-57,953	-65,162	-63,516	-12,306
	Crime costs ($000)		-3,009,648	-742,619	-587,665	-331,328	-728,324	0	-158,349	-193,149	-119,019	-149,197	0
	Workplace productivity costs ($000)		-577,300	-73,417	-163,481	-101,812	-147,018	0	-22,432	-21,332	-17,857	-29,951	0
	Total cumulative costs ($000)		-4,358,507	-922,172	-865,949	-542,994	-957,137	-39,373	-231,160	-272,433	-202,038	-242,663	-12,306

Table 54: Impact on alcohol-related harm costs for an excise increase of 133%

Areas of harm				Male					Female				
Absolute change			NZ total	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+	18-24 year olds	25-34 year olds	35-44 year olds	45-64 year olds	65+
Health total in Year 1	Deaths (number of people)	Chronic	0	0	0	0	0	0	0	0	0	0	0
		Acute	-150	-29	-23	-22	-27	-17	-8	-5	-7	-10	-4
		Total	-150	-29	-23	-22	-27	-17	-8	-5	-7	-10	-4
	Admissions (number of people)	Chronic	20	0	0	1	6	9	0	0	0	1	3
		Acute	-3661	-668	-474	-371	-377	-336	-384	-299	-294	-352	-106
		Total	-3641	-668	-474	-370	-371	-327	-384	-299	-294	-351	-103
	Change in cost ($000)	Chronic (admissions)	216	0.1	0.6	5.5	71	89	0.4	0.7	0.9	9.0	39
		Acute (admissions)	-26,275	-3,927	-3,019	-2,565	-3,294	-4,228	-1,801	-1,593	-1,936	-2,535	-1,375
		ACC	-90,770	-13,998	-16,211	-15,696	-10,122	-1,730	-7,310	-8,172	-9,131	-7,993	-406
		Pharmaceuticals	-155										
		Specialist	-11,820										
		Total	-128,804	-17,925	-19,230	-18,256	-13,345	-5,870	-9,111	-9,764	-11,067	-10,519	-1,743
Cumulative health totals over 10 years	Change in costs ($000) discounted at 8%	Chronic (admissions)	-8,927	-416	-607	-727	-2,710	-999	-249	-365	-545	-1,327	-983
		Acute (admissions)	-198,116	-28,757	-23,194	-18,076	-24,375	-34,965	-13,343	-11,751	-13,501	-18,955	-11,200
		ACC	-657,799	-101,439	-117,479	-113,749	-73,355	-12,539	-52,973	-59,219	-66,174	-57,926	-2,946
		Pharmaceuticals	-1,124										
		Specialist	-85,660										
		Total	-951,627	-130,612	-141,280	-132,552	-100,440	-48,503	-66,565	-71,335	-80,221	-78,208	-15,128
Crime changes per annum	Volume	Violence incl threats	71,186	13,524	13,549	10,416	17,276	0	3,839	4,377	4,016	4,190	0
		Burglary/theft	10,730	4,384	2,182	969	1,504	0	599	435	386	271	0
		Property damage	59,169	20,000	11,618	6,260	8,520	0	3,317	3,372	2,989	3,093	0
		Driving offences	6,737	1,528	1,065	752	1,525	0	507	466	393	501	0
		Other incl robbery, fraud	11,974	4,002	2,332	1,029	2,341	0	579	706	423	563	0
		Total	159,795	43,437	30,746	19,425	31,165	0	8,841	9,355	8,207	8,619	0
	Change in cost ($000)	Violence	-302,100	-63,686	-53,155	-39,460	-81,416	0	-15,002	-19,127	-14,805	-15,448	0
		Burglary/theft	-30,376	-12,386	-6,314	-2,828	-4,217	0	-1,616	-1,184	-1,081	-750	0
		Property damage	-30,855	-10,433	-6,057	-3,266	-4,435	0	-1,727	-1,763	-1,558	-1,616	0
		Driving offences	-114,487	-28,475	-20,398	-13,574	-27,999	0	-7,258	-7,286	-3,476	-6,020	0
		Other	-38,440	-13,231	-8,078	-2,468	-6,954	0	-2,383	-2,687	-1,255	-1,384	0
		Total	-516,258	-128,211	-94,003	-61,596	-125,021	0	-27,986	-32,048	-22,175	-25,218	0
Workplace productivity changes per annum	Volume	Pre-mature mortality (people)	-100.3	-18.9	-19.4	-19.3	-22.4	0	-4.6	-3.6	-5.0	-7.1	0
		Unemployment (people)	-4,394	-623	-881	-797	-1,160	0	-334	-180	-142	-278	0
		Absenteeism (days)	-84	-33	-39	-3.4	-1.9	0	-3.6	-1.2	-1.7	-0.3	0
		Impaired productivity (days)	-110	-27	-46	-3.9	-11	0	-7	-7	-6.1	-2.9	0
	Change in cost ($000)	Mortality	-906	-118	-183	-223	-237	0	-23	-28	-40	-54	0
		Unemployment	-73,098	-6,833	-14,513	-16,956	-22,287	0	-3,151	-2,495	-2,353	-4,509	0
		Absenteeism	-9,026	-2,887	-4,793	-515	-266	0	-233	-123	-182	-27	0
		Impaired productivity	-12,251	-2,371	-5,646	-594	-1,538	0	-418	-761	-636	-289	0
		Total	-95,281	-12,209	-25,135	-18,288	-24,329	0	-3,824	-3,407	-3,210	-4,879	0
Summary financial value of harm reduction Year 1	Health costs ($000)		-128,804	-17,925	-19,230	-18,256	-13,345	-5,870	-9,111	-9,764	-11,067	-10,519	-1,743
	Crime costs ($000)		-516,258	-128,211	-94,003	-61,596	-125,021	0	-27,986	-32,048	-22,175	-25,218	0
	Workplace productivity costs ($000)		-95,281	-12,209	-25,135	-18,288	-24,329	0	-3,824	-3,407	-3,210	-4,879	0
	Total societal costs ($000)		-740,344	-158,344	-138,368	-98,140	-162,695	-5,870	-40,921	-45,219	-36,452	-40,617	-1,743
Cumulative 10 year summary financial value of harm reduction (discounted at 8%)	Health costs ($000)		-951,627	-130,612	-141,280	-132,552	-100,440	-48,503	-66,565	-71,335	-80,221	-78,208	-15,128
	Crime costs ($000)		-3,702,737	-913,736	-723,077	-407,267	-896,147	0	-194,836	-237,655	-146,444	-183,575	0
	Workplace productivity costs ($000)		-712,334	-90,530	-201,599	-125,676	-181,512	0	-27,686	-26,320	-22,032	-36,980	0
	Total cumulative costs ($000)		-5,366,697	-1,134,877	-1,065,956	-665,495	-1,178,099	-48,503	-289,087	-335,310	-248,697	-298,762	-15,128

Appendix 6 –Comparison of Euromonitor sales proportions and AC Nielsen and the SHORE and Whariki Research Centre's consumption data

2011	Volume (Litres M)					
Wine	Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Vol	% Diff Vol
On	18.4	19%	14.3	15%	-4.1	-22%
Off	79.3	81%	80.9	85%	1.6	2%
Total	97.7		95.2		-2.5	-3%

	Sales ($ M)					
Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Sales	% Diff Sales
697.6	36%	689.6	40%	-8	-1%
1246.6	64%	1043.4	60%	-203.2	-16%
1944.2		1733		-211.2	-11%

2011	Volume (Litres M)					
Beer	Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Vol	% Diff Vol
On	79.5	27%	88.6	30%	9.1	11%
Off	231.6	79%	206.7	70%	-24.9	-11%
Total	311.1		295.3		-15.8	-5%

	Sales ($ M)					
Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Sales	% Diff Sales
1212.7	49%	1399.5	59%	186.8	15%
1268.3	51%	983	41%	-285.3	-22%
2481.0		2382.5		-98.5	-4%

2011	Volume (Litres M)					
Spirits	Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Vol	% Diff Vol
On	4.14	40%	2.66	32%	-1.48	-36%
Off	6.14	60%	5.65	68%	-0.49	-8%
Total	10.28		8.31		-1.97	-19%

	Sales ($ M)					
Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Sales	% Diff Sales
890.3	68%	542.3	71%	-348	-39%
417.7	32%	218.2	29%	-199.5	-48%
1308.0		760.5		-547.5	-42%

2011	Volume (Litres M)					
RTDs	Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Vol	% Diff Vol
On	22.2	35%	6.24	18%	-15.96	-72%
Off	36.8	55%	28.43	82%	-8.37	-23%
Total	59		34.67		-24.33	-41%

	Sales ($ M)					
Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Sales	% Diff Sales
643.4	59%	159.3	45%	-484.1	-75%
447.3	41%	198.6	55%	-248.7	-56%
1090.6		357.9		-732.7	-67%

2011	Volume (Litres M)					
Total Alcohol	Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Vol	% Diff Vol
Total	478.08		433.48		-44.6	-9%

	Sales ($ M)					
Euromonitor	Proportion	AC Neilson/Shore	Proportion	Diff Sales	% Diff Sales
6823.8		5233.9		-1589.9	-23%

Appendix 7 – Adjusting the demand curve for irrational consumption

A standard assumption made in traditional economic theory is that consumers behave rationally when making decisions. "In the sort of liberal economies of which New Zealand is an example, it is generally assumed that individuals know their best interests – or that no other person or agency knows the individual's interests better" (Easton, 2002, p.42).

However, alcohol is unlike most other commodities or products and is associated with short run and long run irrational behaviour. "Alcohol's status as a licit drug with the potential to cause dependency and to impose significant costs on others, marks it out in a number of important ways from other consumer goods and markets" (The Law Commission, 2010, p. 294). Low risk and increased risk drinker types are likely to consider the costs of alcohol consumption such as hangovers and negative impacts on work performance and health, while harmful drinkers may not. Therefore the benefits of alcohol consumption for harmful drinkers may actually be very small or in some cases zero or negative as such consumption is considered irrational.

Irrational behaviour may result from:

- a lack of information about the risks of harmful alcohol consumption, resulting in uninformed decision making, particularly among young drinkers. Furthermore, advertising can mask these risks by focusing only on the perceived positive benefits of alcohol consumption.
- a change in consumption patterns with age, leading to a fall in consumption. For example, 57% of 18 to 24 year old males and 35% of 18 to 24 year old females drink 6+ drinks on a typical drinking occasion at least once a week, compared to 23% of 45 to 64 year olds males and 8% of 45 to 64 year old females.[50] This indicates that alcohol consumers may become more rational as they get older, as they learn the physiological impacts of alcohol consumption, and how to handle social situations involving alcohol (Easton, 2002 p.42) "Young people frequently engage in risky drinking patterns, along with other risky behaviour, because they underestimate, or do not fully comprehend, the negative consequences of their actions." (The Law Commission, 2010, p. 294)
- peer group pressure, which influences drinking behaviours and preferences (Marsden Jacob Associates, 2009, p. 15).

Irrational consumption[51]

The consumers' surplus model outlined in Section 8.3 assumes that all consumers behave rationally and consider the benefits and costs of alcohol consumption before purchasing and consuming alcohol. Therefore irrational behaviour is not considered in the development of the model. Figure 36 depicts the demand curve adjusted for irrational consumption. Assuming consumers would have a lower willingness to pay for alcohol if they were rational and aware of the full costs of their consumption, the demand curve shifts from D1 to D2. The impacts of adjusting the demand curve for irrational consumption are that:

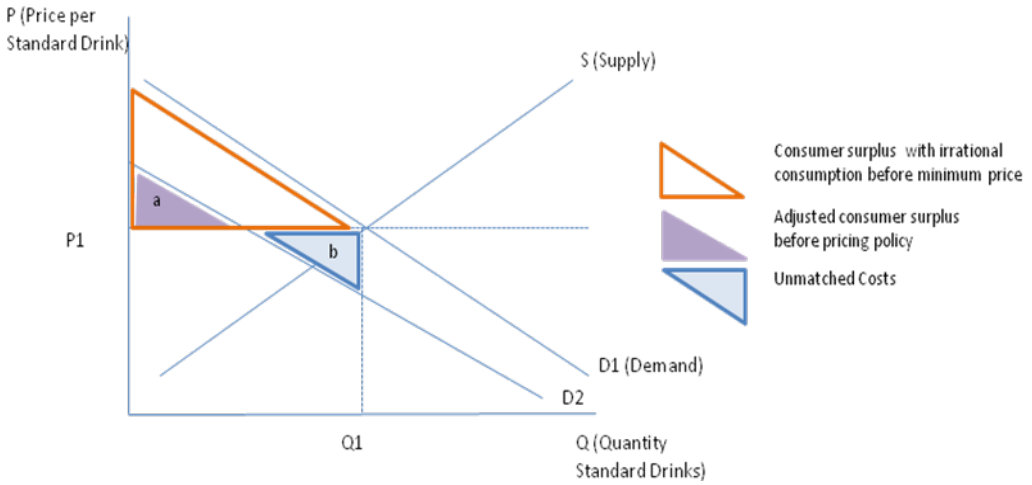
- the consumers' surplus is estimated to be much lower (it reduces from the orange triangle to the purple triangle).

[50] Based on data provided by the SHORE and Whariki Research Centre from the *International Alcohol Control Survey 2011.*

[51] The analysis presented here is based on a report by Marsden Jacobs Associates for the Law Commission in 2009 entitled "The benefits, costs and taxation of alcohol: towards an analytical framework."

- There is a range of alcohol consumption over which the price of alcohol exceeds the true willingness to pay for alcohol by consumers (based on the adjusted demand curve), meaning there are costs to consumers that are unmatched by benefits (triangle b in Figure 36).

Figure 36: Adjusting the demand curve for irrational consumption

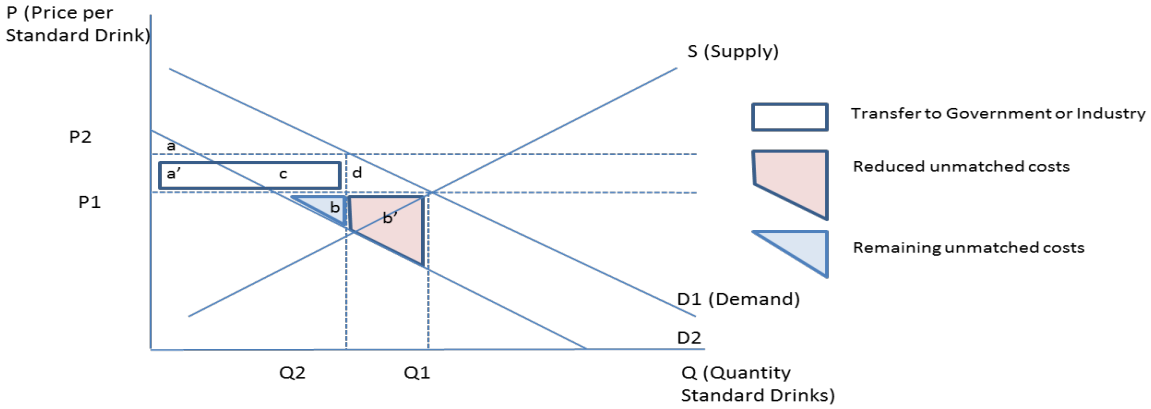


Impact of a pricing policy

If irrational demand is assumed and the demand curve needs correcting, the welfare implications of a minimum price or excise increase are different from the case of a normal good.

Figure 37 illustrates how a minimum price or increase in excise tax rates cause consumption to contract to Q2. This results in a reduction in unmatched costs of b' and an increase in excise tax revenue of a' + c. There is also a reduction in consumers' surplus of a'. The net benefit of the pricing policy is a transfer to the Government or alcohol industry minus the fall in consumers' surplus, plus the reduction in unmatched costs, i.e. ((a'+c) – a') + b'. The net benefit is c+b'.

Figure 37: Impact of a pricing policy if irrational demand is assumed



Adjusting the demand curve for irrational consumption illustrates that the true consumers' surplus and the loss of consumers' surplus due to a price increase is more than offset by the gain in revenue for the Government or alcohol industry. There are also significant costs of consumption that are unmatched by consumer surplus benefits, and these costs can be reduced through a minimum price or alcohol excise increase.

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